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The use of IT in life and health insurance product  
development

Master's thesis in the International  
Information and Knowledge Management

Master's Programme

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Åbo Akademi University

Åbo 2020

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Subject: Master's thesis in the International Information and Knowledge Management	
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Title: The use of IT in life and health insurance product development	
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<p>Abstract:</p> <p>With the rapid development of big data, AI and other information technologies, enterprises have begun to focus on their own information construction, while customers' demands and requirements for related services are also increasing. The insurance industry is purely information-based and information-oriented, therefore efficient gathering, processing, analyzing, and using a vast amount of information is essential for business operations in this area. The use and development of IT is crucial. All activities between insurance companies and customers occur around information and information technologies mediate the relationships throughout the whole life cycle of insurance products. Therefore, in contrast to other industries, the modern insurance industry has a natural dependence on IT. Information technology is of vital importance to insurance companies and effective use of information and IT is a primary competitive advantage for insurance companies.</p> <p>As one of the most influential insurance company in China, Ping An applies information technologies in multiple fields extensively and aims to become a world-leading fintech company on the basis of core information technologies. This study describes how information technologies are used in the development of life and health insurance product development in the company, with particular focus on and what kinds of data and information are used in product development.</p> <p>This thesis is based on interviews within the company and it aims to investigate the use of information and IT in data analysis in life and health insurance product development. To reach the aim of the thesis two research questions are set and 10 interviews were conducted with senior manager, technicians in information and actuarial departments, and sales managers to collect information and answer these questions. The interview materials provide an overview of the full cycle of insurance product development process. The results show in the context of big data, the insurance product development is changed into a better way.</p>	
Keywords: insurance product development, IT solutions, big data, BI, AI, data mining.	
Date: 12.3.2020	Number of pages: 73

# 1 INTRODUCTION

## 1.1 Area of research

Information and IT has become increasingly important in many areas, including the insurance industry. As in other sectors of the economy, the insurance industry has experienced many changes in IT over the years. Information affects the insurance industry in various aspects. In this thesis, I attempt to explore how public information and statistics on health, death, traffic and market influence life and health insurance product development and how big data analysis and other analytical techniques and tools are used in this process.

The market competition of insurance in China is increasingly fierce and intense. In order to enhance competitiveness, Chinese insurance companies have to provide high-quality products and services to maximise consumer satisfaction. The premise of developing a high-quality insurance product requires an in-depth study of the consumers' demands, and choosing-purchase behaviours, and IT has brought effective tools which help to gather and process data and information effectively about customers' needs and behaviours (Annual Report, 2017) Thus, the necessity of research about information and information technology used in the insurance industry to understand consumer's needs and develop new products is apparent.

The purpose of this thesis is to build a comprehensive understanding of information use and IT applications in insurance product development. Life and health insurance products, and their development process, are analysed to reach the aim. The reason for choosing life and health insurance is that they are the main products of the insurer.

## 1.2 Research question

Considering the overall research purpose, the research questions for the thesis are the following:

- What kind of information is required for life and health insurance product development?
- What IT solutions are used to manage the required data for life and health insurance product development?

### 1.3 Structure

The structure of this thesis is as follows. Chapter 2 focus on the theoretical background, product development, and information technologies used in product development are introduced. Chapter 3 describes the research methods used in this thesis and describes the interview process. Chapter 4 describes the Ping An insurance company and its structure, market and customers. In Chapter 5, the main insurance products are introduced, and the data analysis process is discussed in detail. Chapter 6 describes what information and IT tools are required in the process. Chapter 7 presents the conclusion of the thesis, the limitations of the current study and suggestions for the future research are explained.



## 2 THEORETICAL BACKGROUND

In this chapter, the fundamental concepts of life and health insurance and IT methods which are applied in life and health insurance product development are introduced

### 2.1 Presentation of insurance business, life and health insurance

#### 2.1.1 Insurance and Insurance development

Insurance is a contract in which a policy holder applies for financial protection from an insurer. The policy holder pays the insurance premium to the insurer according to the contract. The insurer takes the liability for compensation insurance for the property loss or other insurance term condition (Wei & Lin, 2008), The essence of insurance is risk transferring. Policyholders pay premiums to insurers then insurers undertake the insured's risks. When risks occur, they are transferred from the insureds to insurers. Thomas and McSharry (2015) explain that risk is the quantitation or measurement of uncertainty. Commercial insurance can be roughly divided into property insurance, life insurance, health insurance, liability insurance, credit insurance, and marine insurance.

An insurance policy is a financial agreement between the insurer and the policyholder. For instance, an insurer agrees to pay some benefits, if the insured meet the condition of term of the insurance, while the policyholder agrees to pay premiums to the insurance company to secure these benefits. The premiums will also need to reimburse the insurance company for the expense associated with the policy(Dickson, Hardy & Waters, 2009). Policy holder is an individual who contracts with an insurance company and has the obligation to pay insurance premiums in accordance with the insurance contract. Insurer, or insurance company which contracts with the policyholder, is liable for compensation or payment of the insurance. The insured is the protected target of the insurance contract. The beneficiary is the individual who is designated by the insured or the policy holder that has the right to claim insurance benefits (Wei & Lin, 2008).

Insurance business represents commercial activities which are profit-driven as the objective of the organization. The success of insurance business is the amount of premium (Rubin, 2000). In China, the main profit of local giant insurers comes from life and health insurance premiums.

The origin of the insurance business can be traced back to ancient Roman times. The Romans invented marine insurance to reduce the risks of shipping. With the development of society, prototypes of fire, property and other insurances successively emerged in Europe (Liu, 2008). In contrast to other types of insurance, the emergence of life insurance came relatively late. Edmond Hally, the British astronomer, geophysicist, mathematician, meteorologist and physicist created the first annuity table based on mortality data collected from historical record, and this is viewed as the major leap forward for life assurance (Kopf, 1927).

The development of the China's insurance industry is later than that in Europe. The first Chinese insurance company was opened by British in Guangzhou in 1805. After 1805 until the establishment of People's Republic of China, many insurance companies are formed. After the establishment of People's Republic of China, only one insurance company was founded, the company was domestics and operated by the government. Until 1980s, private Chinese insurance companies were permitted to found, and China's insurance industry began its development. The development of Chinese insurance industry is difficult, due to large population, regional disparity, low insurance awareness, and low income which are the impediment of development. However, with the growth of economy and the policy support from government, the prosperity of the industry has flourished (Liu, 2008). The late development of Chinese insurance means that the gap with foreign insurance industry is big. To minimise the gap and penetrate deeper of the native market, a great effort must be made.

### 2.1.2 Life insurance

Life insurance is a contract between an insurer and an insurance policyholder. Life insurance is also an investment and family property planning, it is also a type of

income after retirement. It is a form of protection in which a policyholder makes regular payments to an insurer. In return, a sum of money will be paid to the beneficiary after a fixed period of time, or after the death of the insured (Wei & Lin, 2008). The death of the insureds is regarded as a risk to the insurer. The risk will transfer from the insured to the insurer in life insurance if the insured is underwritten. Shang (2006) illustrates that in life and health insurance, risks are predictable if historical data is analysed and understood well, and even different types of mathematical models can be built to quantify the possibilities of risks. According to the past data, such as death rate, insurers can realise an acceptable range of risk rate, and design appropriate products with precise premium rates to avoid losses. Based on the characteristics of life insurance, it helps to prevent insurance beneficiaries from falling into financial difficulties caused by the death of insureds. Insurance compensation can be used to cover funeral and other death expenses, and it can be regarded as the replacement of the earning of insureds.

Common types of life insurance include term life insurance, permanent life insurance and endowment insurance. Life insurance covers a specific time period. If the insured dies during the period of coverage, the beneficiary has the right to claim the compensation. After the period expires, the insurer is no longer guaranteed the benefit of the insured and policyholder (Wei & Lin, 2008). Permanent life insurance is an insurance that covers the remaining lifetime of the insured. The validity of the contract ends upon the death of the insured. Due to the prolonged duration of permanent life insurance, its premium is inevitably higher than life insurance (Wei & Lin, 2008). Endowment policy is an insurance contract which pays an accumulated sum after a certain time or of death. Meaning the insured receives the value of the policy if the individual survives the endowment period. In contrast to other types of life insurance, this policy functions similarly to a long-term investment, thus the premium can be expensive (Wei & Lin, 2008).

### 2.1.3 Health insurance

Health insurance covers the losses caused by health problems. It also covers part or all the medical costs of the insured. It includes insurance for losses from accident,

medical expense, disability, and accidental death and dismemberment (Marcinko & Hetiko, 2006). The essence of health insurance is to transfer the health risks from insurees to insurers. Health insurance includes medical insurance, disability income insurance and long-term care. Of which, medical insurance can be further divided into illness medical insurance and accident insurance.

Marcinko and Hetiko (2006) defined underwriting as signing and accepting an insurance policy thus guaranteeing payment in case loss or damage occurs. The main risks of health insurance are generally illnesses and accidents. Therefore, the terms and conditions of health insurance are generally stricter than those of life insurance. Hoyweghen (2007) demonstrated that the translation of an individual into an insurance risk is not a strict technical-arithmetical conversion of the individual's health characteristics into a statistical risk category. The insurers must inspect the latest actual situation of every single customer before underwriting. The feasibility of underwriting relies on both the calculation and inspection result (Sun & Lan, 2010). Before underwriting, insureds must be evaluated strictly on their state of health, the career, working and living environment and other factors. Moreover, the insureds should tell the insurers about their medical history. It is necessary for insureds to submit their physical examination results. If the health status of insureds do not meet the requirement of the terms, they need to pay higher premium or accept the term of exclusions in a specific condition. The observation period refers to a period of time the insurer is entitled to observe insureds' overall health status before making a judgment on their qualification of a certain policy. The observation period of some Chinese health insurance products, for example, is 90 days; the insurance policy becomes effective after the observation period, given full qualification of the insured. The insurance company would not pay any benefits if the insured does not meet the health standard during any time of the observation period.

Rationed payment medical insurance, reimbursement medical insurance and subsidy or allowance type medical insurance are the most common health insurance. (Sun & Lan, 2010). In rationed payment medical insurance, the insurance

amount is fixed. As long as the insured suffers from any of the diseases listed in the clauses of the insurance, regardless of whether or how much medical expenses have occurred, the insurance company will pay the insurance benefits in a lump sum according to the amount in the contract (Sun & Lan, 2010). Reimbursement medical insurance is the policy in which the insured pay losses and costs for medical first and then apply reimbursement for covered loss from the insurer (Sun & Lan, 2010). The costs are reimbursed according to the proportion agreed in the insurance contract. In allowance type medical insurance, the insurance company pays the insurance benefit according to the actual number of days which the insured spend in the hospital.

## 2.2 Insurance product development

Insurance product development is the process to create new products, and it aims to meet the needs of the insurance market. It not only refers to design a brand-new insurance product, but also includes the improvement and combination of existing products (Purushotham et al., 2017),

### 2.2.1 Insurance product development process

Both clients and insurers' core benefits must be considered in insurance product development. The core benefit of clients is the value of term or content in the insurances. For instance, in life insurance, core benefits of clients are the needs of pension, health care and medical, and insurers must fulfil those demands to retain clients. Therefore, the term, content and coverage are key parts in insurance product development. For insurer, they need to make enough profit from their clients to stay in business. Hence, premium design is another key part in insurance product development (Purushotham et al., 2017).

Purushotham et al. (2017) illustrate that there are several types of new insurance product development, the most common types are: brand new product development, revision and repricing. Development of a brand-new product requires information on strategy, premium pricing, management, and the budget.

Brand new product involves bringing to the market significantly new different product features or functions. A new product would require a unique system identifier or would be filed as a new product.

Revision and enhancement mean to change, modify, add or delete the condition and terms in current products. Purushotham et al. (2017) believe revision and enhancement cover the spectrum of changes between a rate change and a new product because many new insurance products are design based on the old products. Repricing and rate change refer to the premium adjustment of products, the policies are remained (Purushotham et al. 2017).

To provide for consistency in responses across participating companies, the key product development process has been defined. The steps are the following: (Purushotham et al. 2017).

- Idea Generation: Ideas for new products. Views are discussed and selected for further formal analysis.
- Product Concept and High-Level Feasibility: Study and research about the feasibility of selected view and idea. Selected ideas are projectised and funded.
- Product planning and design: Clause and content of products are designed.
- Establish Underwriting Guidelines: Establish underwriting rules and processes.
- Product Pricing: Actuarial pricing that includes setting the rates, reserves,
- Product Launch: Product development complete.
- Tracking of Results: Feedback from market and clients, compare and measure the business results.

### 2.2.2 Traditional insurance product development

Data analysis has begun to influence the insurance industry since the emergence of actuarial science. (Franklin, 2001) Actuarial science is the pillar of life and health insurance product development. The actuarial methods link to probability calculation and risk evaluation. The methods are applied to calculate premiums,

reserves, and dividends for participating policies, and develop products. (Rubin, 2000) Actuaries used modern mathematical and statistical methods to predict the uncertainties of the business and evaluate the risks. Actuarial science is developed based on mortality data and analysis, demographics and probability research. Actuaries adjust calculation according to those historical data. However, the insurance market became more complicated by the progress of society, and actuaries need to involve more uncertain factors into their calculation to achieve an accurate result. Relying only on traditional statistics methods does not seem sufficient in today's era. A more stringent requirement of data is necessary to meet the current need of the actuarial science. As the quantity and quality of data improve, it will be impossible to calculate increasingly accurate estimates based directly on the information with old-fashioned data analysis methods. (Thomas & McSharry, 2015) Thus, modern IT methods are used to support a more comprehensive data collection as well as an accurate data analysis process.

Solutions like big data analytics and artificial intelligence not only satisfied the needs of insurers but also redefine the roles of insurance. These methods enable insurers to obtain information about customers' habits and behaviours and to analyse the information. High-quality data analysis results show precise risk rates. By understanding the risk rates, the role of insurance is no longer only to protect risk or compensate for loss but also to predict and prevent risks. (Swan, 2015)

IT impacts today's insurance industry positively, it not only changes the role of insurance but also change the aim of insurance. Traditional insurance product development means that new products, based on market surveys, and customers analysis have been developed unilaterally. Economic benefits have been the only purpose of the product development and customers' needs have not been adequately considered. Low customization forces customer to accept insurance products which may not fully satisfy their needs. However, with the advance of internet and IT, insurers realised that the centre of business is not products but customers. Customization product is generated, customers' experience and needs became the reference of product development (Johne,1993).

## 2.3 Data management and IT solutions

Hislop (2005) defines data as raw material such as numbers, images or words which result from observation or measurement. The value of raw data is limited if no data processing is implemented. Unprocessed data cannot be used to enhance decision-making. To extract evidence for decision-making, data is organised into a meaningful pattern, and the meaningful pattern is referred to information (Hislop, 2005). Data management is the way to organise data. It provides the interpretation of qualitative empirical materials (Huberman & Miles, 1994). Data management is the process to acquire, store and process data, and it requires the use of both hardware and software.

The emerge of e-commerce 20 years ago, influences modern business and generates a new business model, and it triggers the rapid increase of social data volume. Then with the growing popularity of smartphones, search engines, and big data, a socio-technical phenomenon is defined and spread. The phenomenon generates both the volume and variety of data more than ever, and the data management became more challenging. Therefore, advanced methods are needed to process data characterised by high volume and diversity (Krishnan, 2013).

### 2.3.1 Big data and big data solutions

Big data is high-volume, high-velocity and high-variety information assets that require high efficiency and accuracy of information processing for enhanced decision-making and perception (Swan, 2015). Volume is the amount of stored data. It differs from traditional data, in the way that the size of big data is massive. Terms like terabytes, petabytes and even exabytes are used to describe the volume of big data. The volume of data is also used to measure if the data can be considered as big data or not (Hilbert, 2016). The size of data in the insurance industry is even more massive than other industries due to the fact that both variety and amount of data is required to make accurate predictions. Traditional data processing methods are not able to process all available data, therefore big data techniques have been applied. Variety refers to the type and characteristics of data. The data type in big data is not only in text form, the data type includes images, audio, and video. The diversity of



data helps insurance companies understand the market, customers and the environment entirely (Katal, Wazid & Goudar, 2013). Velocity is the speed at which the data is generated and processed to meet the demands and challenges that lie in the path of growth and development. Big data is often available in real-time. To remain competitive, insurance companies need to focus on the changes in market and environment, then insurance companies make a quick response to the changes. New product development and products upgrade are methods of immediate response to the demand (Katal, Wazid & Goudar, 2013). Term veracity was added later to describe the characteristics of big data later. It refers to the data quality of gathered data, it relates closely with the accuracy of data analysis and predicts (Habart & Janssen, 2017).

The quality is also the most crucial factor in big data. Quality of data includes completeness, accuracy and appropriateness (Olson, 2012). The completeness of big data means data include sufficient historical information to assess the characteristics of the underlying risks and identify trends in these risks. The accuracy refers to the data which is recorded regularly and coherently and without material errors. Suitability is the consistency of data and the data is consistent with the assumptions underlying the actuarial and statistical techniques applied to them in the calculation of technical provisions.

The insurance industry was one of the first to take advantage of IT solutions. Insurers adopted new methods to deal with the challenges of big data era when it emerged. One of the most innovative moves is the creating of a big data platform for individuals with specific insurance needs. By the platform, insurers can collect those individuals' information and negotiate highly customised contracts for them. The platform allows insurers to extract deep knowledge of the individuals by analysing customers' data. Through the data analysis results, the insurer can precisely locate customers who have the possibility to underwrite. In addition, by understanding those customers' needs, insurers are able to design the high-customised insurance product to them. Big data also provides easy access to some of the information necessary for pricing and will gradually reduce the use of the traditional paper questionnaires. Hence, it allows faster decision-making (Habart & Janssen, 2017).

In the context of big data, a vast amount of information is available to gather from different channels. In addition, different formats of data can be processed to provide useful information for insurers. Big data solutions provide ways to collect, store and analyse a high volume of data efficiently. Analytical solutions for big data provide precise and high-quality results that reveal specific needs and associated risks of individuals. These solutions also ensure the quality and accuracy of data. To some extents, the role of insurance is transferred from understanding and protecting risks to predicting and avoiding risks in the era of big data (Benno, 2018).

The challenges of big data processing are the high volume and complexity. Unstructured data is data that is not organised in a pre-defined manner, the type of unstructured data is various, and it accounted the vast majority data volume in a company. Big data tools like Hadoop, Hive and NoSQL are used to deal with unstructured data (Krishnan, 2013). Big data and other IT solutions such are utilised to support decision making are used to transfer data into meaningful information. However, these solutions differ from each other due to their purposes, characteristics, and targets are different. Big data solutions have capacity to deal with larger amount of data than other IT solutions, and the solutions are able to process real-time data. Big data solutions apply parallel processing method which enhances the efficiency of processing the data by assigning multiple tasks into several implementation processes, and thus it makes analysing the large volumes faster.

### 2.3.2 Artificial intelligence

Artificial Intelligence is a branch of Computer Science dealing with the simulation of intelligent behaviour in computers. Machine learning is a core application of AI, which support systems with a self-learning ability. Machine learning start with observations of data, then it accesses and searches for the patterns of data. The ultimate aim of the machine learning is allowing the computers learns automatically thereby the computer can make better decision based on the historical data (Benno, 2018).

Rajendra and Srinivas (2016) state that artificial intelligence has been emphasizing and applying in the insurance industry. The machine learning algorithms help insurance companies to understand the characteristics and needs of customers; it improves the accuracy of premium pricing. AI helps insurance company in product development. It provides content recommendation to customer and enhance risk control. Advanced insurers have established comprehensive scenarios of AI applications such as smart perception, prediction, risk management, and services to ensure the quality of data and accuracies of data analysis results. Besides, through voice and image recognition, machine learning, natural language processing and other technologies, customer service has been simplified.

Machine learning is an efficient tool which process vast amounts of real-time big data in succession. Systems established on machine learning algorithms use large amounts of real-time data and data analytics results to conduct its unceasing study and improvement (Schanz & Sommerrock, 2016). Insurers take reference from machine learning results when a new product plan is set. Through the continuous observation and analysis of relevant data, risks in the new product is calculated and the results are reported to insurers. According to the result, insurers will define the acceptable limitation of risks. The high-risk terms will reveal from the results, insurers are warned thereby loss is prevented. High risks probably cause losses to insurers, to prevent the situation, insurers may set high premium or decide not to take the risks. Insurance product development is labour-consuming process, machine learning can enhance the research and development efficiency and reduce research and development costs (Schanz & Sommerrock, 2016).

Many actors in society are concerned about over-using of personal data in many industries. The concerns are probably to become more prominent in the era of big data and artificial intelligence, and the situation may cause a new challenge. In insurance industry, customers' data is a critical information asset, and through analysis, detailed customers' personal information is known by insurers. Although data protection regulations were issued to control the collection and use of personal data by insurers in most countries (Benno, 2018). However, customers must

provide key personal information in underwriting. Therefore, take value from customers' personal data while protect customers' privacy is a problem insurer must take seriously.

### 2.3.3 Business intelligence

Business intelligence is an ability which uses the information assets of firms intelligently to support better decision-making. It is a concept and method for enhancing the decision-making operation ability. It aims to transfer the data and information that companies store into core competence (Xu, Zhang & Jiang, 2005). It involves collecting massive amounts of raw data regarding all aspects of the business, from productivity to profits and losses, and transforming it into actionable insights.

Data analysis is a complicated process, multiple types of data are involved and interacted. In the insurance industry, data of finance, actuarial, marketing, customers, sales, human resources management, and production management are core data relates to decision making. The data can be organised, or non-organised, different data stored in different forms. In this condition, it is not conducive to data management and analysis if data is not integrated. Therefore, a comprehensive system is built to integrate, classify, store and analyse multiple types of data in one data warehouse. This called the business intelligence system. BI systems allow the data analysis based on classification, forecasting and simulation methods, which enables gathering new and useful business information. The approach to integrate data for BI named business intelligence solution. As an integration tool, business intelligence solution enables access to different dispersed data from sources of different structures and formats (O'Brien & Markas, 2010).

The data warehouse is an essential part of business intelligence, it is established to centralise, store and partition data. The functions of data a warehouse are data analysis and reporting (Nedim & Clare, 2016). It is defined as a collection of integrated databases established to support the decision support system function. Data warehouse receives data sources from multiple different systems. Data from

systems is extracted in a unified format, then data is cleansed, transformed, integrated, and finally loaded into the data warehouse. Data warehousing emphasise the data gathering from diverse sources for query and analysis. The operational system is the main information source of data warehouse. Multiple operational systems are built in different departments to gather data from various aspects. Those systems are independent of each other, and the data is stored separately in each system. To facilitate data analysis, data should be stored centrally. Hence, raw data extracted from each operational system is integrated later to combine data from disparate sources into meaningful and valuable information. Data warehouse differs from a database. It organises the stored data for data analysis and decision support, but the main purpose of the database is to store and query data for the operational system. The main purpose of data integration is to deal with unprocessed data. Data without processing is called unprocessed data. Unprocessed data is generally incomplete and inconsistent, and it cannot be analysed directly. Analysing without pre-processing is difficult to use further.

Online analytical processing (OLAP) is a tool to conduct multidimensional data analysis, it is an important part of business intelligence and it has become a driving engine in data warehouse industry. The functions of online analytical processing include business reporting for sales, marketing, management reporting, business process management budgeting and forecasting, financial reporting, etc. The essence of online analytical processing is linking disparate databases and then analysing data concentratedly in multiple dimensions. A dimension can be regarded as an aspect of thinking or analysis such as time and place. OLAP is used to analyse current customers' data, the data is integrated and classified for further use (Xu, Zhang & Jiang, 2005).

Big insurance companies in China have developed at least for a decade, vast volumes of data, and they have invested and upgraded in hardware to meet the vast volume of data. Few giant insurers have already achieved data integration, which provides the feasibility of organise, store, query and in-depth analysis of data. Chinese insurers realised that the core element that influence the insurance industry is transferred from products to customers, satisfy customers' needs is the key to the

fierce competition. The way to satisfy customers' needs is keeping close relationship with customers and understand their instant demand by advanced IT tools. Insurers can categorise the data of customers who contribute the major benefit to the insurer, then analyse the attributes of the data and develop specific insurance products to these customers. Risk evaluation is the premise of insurance product development. Planning of insurance term and setting of premiums that have high requirement of risk evaluation impact insurers' profit and business. The balance between a competitive premium and low risk coverage is the success of an insurance product. Insurers need to know if the new product can generate profit, and, which term may cause losses. For example, through the report, an insurer realised that main claim submitters are insureds with liver cancers. Thus, the insurer has to re-evaluate the risk of liver cancer and re-set reasonable premium for the insurance (Xu, Zhang & Jiang, 2005).

Insurers face challenges in business intelligence, and one of the biggest challenges is that the cost is high and professional technicians are required to implement BI solutions (Xu, Zhang & Jiang, 2005). The function of BI can't be fully used due to some insurers lack of skilful technicians, thus, only the reporting function of BI is emphasised by some insurers.

#### 2.3.4 Data mining

Data mining can be defined as the process of selecting, exploring, and modelling large amounts of data to uncover previously unknown patterns. It is the process of revealing unexpected relationships in data (Ratner, 2011). The two main tasks of data mining are classification and clustering. A class is a set of data samples with similar feature or relationship, data in a class distinguished from other classes. A cluster is a process of grouping similar objects into a class. The cluster is used to classify objects in a meaningful way (Wang & Fu, 2005). Through the classification, data and objects are organised and modelled, and future trends are predicted based on the models. Through the specific result of data mining, decision-maker can answer crucial business questions with greater accuracy. However, the premise of taking full advantage of data mining in the insurance industry is managed, analysed,

and exploited data of the customer properly. Customer data is unique and a valuable corporate asset. Data mining can track customers' activities and predict their future behaviour. It provides answers like who is a loyal customer and who will not purchase our products anymore, and those answers influence the product development (Berry & Linoff, 2004).

The insurance industry is an information-based industry. During the development of insurers, enormous amount of business and customer data is accumulated. It's imperative to apply an effective method to discover and use the potential knowledge from the accumulated data (Wang, Geng & Chen, 2008). So far, powerful Chinese insurers have built their own data warehouse for data mining. The aim is to enhance the efficiency of transfer vast amount of raw data into useful knowledge that better decision-making. The main purposes of data mining in insurance industry are risks accessing and customer classifying. It can dig out detailed information as consumption structure of the market, consumption habit, social status and influence, and even this information of customers' families' members can be collected by insurers.

Data mining also play a key role in insurance product development by providing reference for decision-making. Data mining reveals useful knowledge which indicate success or failure, profit or loss to new products. Data mining search for potential knowledge and relationship of risks. It digs out elements that cause risk thereby insurers can prevent and control in product development stage (Wang, Geng & Chen, 2008). The use of data mining in life and health insurance industry mainly includes set premium, retain old customers, attract new customers and detect insurance fraud. Processing customer data is another use of data mining, it supports the analysis of customers' state, predicts the customer's purchasing behaviours, and digs out the key elements that affect the customer maintaining. The methods for dealing with customers' data is categorizing, customers are categorised by key index such as the possibility of purchase insurance products or the possibility of renewal. Throughout the data mining, customers that with the high possibility to purchased insurance are located and their needs are also determined (Wang, Geng & Chen, 2008).

### 2.3.5 Multiple IT solutions

Solutions that deal with data is shifted in the era of big data. A single IT solution is not able to meet the information needs of modern insurers. Today, insurers use multiple IT solutions to achieve different information goals. The importance of data has become more vital in insurance industry, since the good decisions only can be made by extracting key information from correct analysed data. Big data, BI, data mining and AI solutions help insurers to analyse data to get the insights needed. The relationship of those solution is neither opposite nor overlapping, they need to be synchronised to achieve the information goal together. The solutions are not the same, but they share a lot of features. The ultimate goal of those solutions is to help insurers to enhance their decision-making. However, the purposes and using of those solutions differ from each other. For instance, in data analysis, big data solutions focus on data processing, BI solutions focus on the relationship of data while data mining focus on details and patterns of data (Wang, Geng & Chen, 2008).

IT solutions share many similarities, but also differ at some key points, for instance, BI and big data solutions. Big data solutions focus on data analysis and provide high-quality result to support decision-making while BI solutions aim to enhance the decision-making in a strategic way (Habart & Janssen, 2017). In data analysis, the object data of big data and BI is distinct. Big data solutions can analyse semi-structured data and structured data while BI majorly deal with structured data. In data collection, big data is collected from a variety of sources while BI utilises data from a single and specific source. The big data channel is comprehensive, it can be acquired from social media and other sources, whereas BI's main data sources are database and flat files. In the analysis, big data solutions can process the historical data and also data coming from real-time sources, whereas in BI, it processes the historical data sets (Krishnan, 2013).



### 3 INTRODUCTION OF COMPANY

Ping An Insurance (Group) Company of China, Ltd, or Ping An Insurance is the first joint-stock-insurance company in China. It was established in 1988, and its headquarters is located in Shenzhen. Due to the business expansion and rapid development of 30 years, currently, Ping An is a holding company which deals with insurance, banking, and financial service.

Ping An Insurance is now the world's largest and most valuable insurer with a premium revenue was \$97 billion in the 2017. In 2018, Ping An rose to No. 10 on the Forbes Global 2000 list.

#### 3.1 Business scope

The main business of Ping An includes life and health insurance, property insurance, banking, wealth management, loan, fund, trusts, and health care. The main and most profitable business is life and health insurance.

Table 1. Business income composition of Ping An 2018 (Annual Report, 2017)

Business income Composition (Unit/ Million RMB)							
Business types	Proportion	Income	Year-on-year change	Cost	Gross margin	Year-on-year change	
Life and Health Insurance	62.09%	342327	15.05%	296241	13.46%	2.61%	
Property Insurance	19.83%	109332	17.41%	99304	9.17%	-0.11%	
Asset Management	3.99%	21988	70.46%	14086	35.94%	-0.78%	
Banking	10.38%	57241	5.86%	39839	30.40%	-0.05%	
Stock	0.87%	4792	12.49%	3636	24.12%	-9.07%	
Trusts	0.49%	2683	-24.95%	509	81.03%	0.02%	
<b>Total income</b>							534814 ¥

Table 2 shows the business income composition of Ping An in the first half year of 2018. It indicates that the main income of Ping An comes from the insurance business. Although Ping An dedicates to expand its financial business in the past few years, insurance is still the core business of the company (Annual Report, 2017).

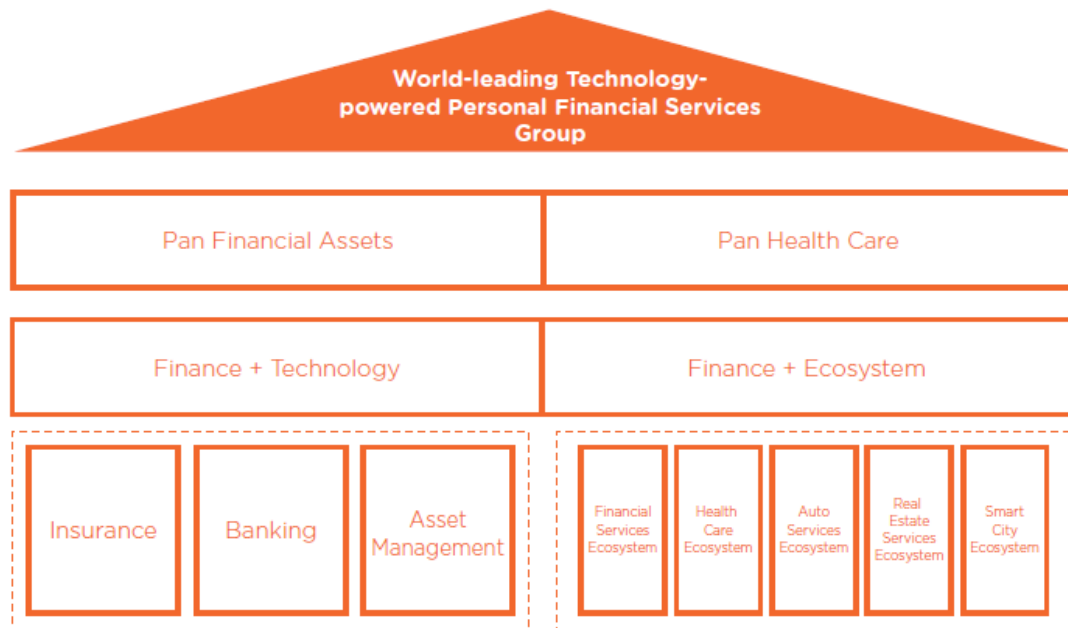


Figure 1. Business Scope of Ping An (Annual Report, 2017)

To expand multiple businesses, branches and subsidiaries are established for managing the expanded business. For instance, Ping An Life and Health Insurance Company and Ping An Property Insurance company are two main subsidiaries which operations cover with insurance products of Ping An. Ping An Bank and other subsidiaries are established to develop banking, investment and other financial products and services (Annual Report, 2017). Ping An Life and Health insurance company is the main research target in the thesis.

### 3.2 Market and customers

Ping An seizes the biggest life and health insurance market in China. Retail customers are a major income source to the company, the number of retail customers reached 166 million at the end of 2017.

According to the annual report of Ping An, net profit from the Group's retail business grew by 44.4% year on year to RMB 58,975 million, accounting for 66.2% of the group's net profit attributable to shareholders of the parent company. From the beginning of 2017, retail customers grew 26.4% to 166 million and contracts per customer rose 5.0%. Profit per customer grew 14.2% year on year. New customers increased 20.5% year on year to 46.30 million, 40.4% of whom were the Group's internet users (Annual Report, 2017).

### 3.3 Company structure

Ping An Life and Health Company is a joint-stock limited company, the capital of a limited company is raised in the form of stock purchases by shareholders. Shareholders are liable to the company for the shares they hold, and their profits come from the dividends or bonuses of the company. Therefore, the shareholder meeting is on the top of the company structure. The board of directors and board of supervisors are under the authority of shareholder meeting. The board of directors' main responsibility is company administration; the board of supervisors' responsibility is supervising the operation and management of the company. A general manager is appointed by the board of directors, the general manager is responsible to the board of directors, and the general manager has responsibility for profit and loss of the company.

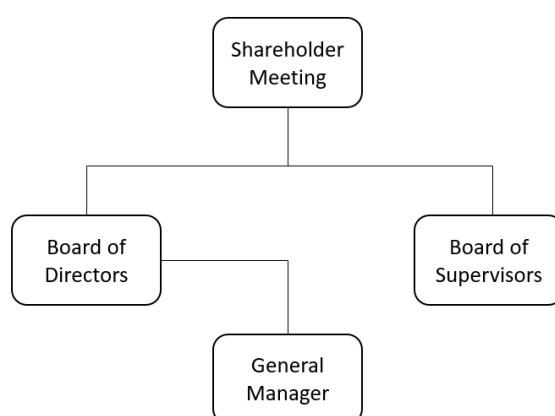


Figure 2. Top management structure of the company

The main departments and offices under the general manager office are the financial and administration centre, the actuarial and system department, the compensation department, the retail customer service centre and the group customer service centre. The departments that participate in new product development are the actuarial department and the financial centre. The product development is authorised by the general manager, the aim of new product development is to gain benefits to the board and company.

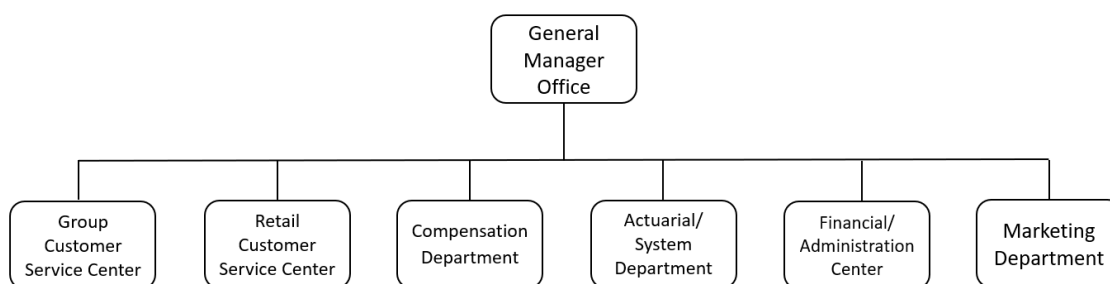


Figure 3. Main Department of the Company

### 3.4 Departments participating in insurance product development

The information for this section was collected from during the interviews with supervisor and one of the interviewees, an actuary. Supervisor introduced the product development process and the departments which are involved in product development. The actuary also provides the information in the interview to describe the necessity of actuarial in product development. New insurance product development is a time-consuming and human resource-consuming process in which and multiple core departments are involved. The whole process starts from the idea or intention to generate a new product, First, the idea is approved if it reaches the goals and meets the needs of the insurers. Then the idea is transferred into an executable plan. After that, a business analysis is conducted to verify its accessibilities to market and determine the new product’s costs and profits. Once the plan is confirmed, the actuarial department begins the policy design and premium pricing. Finally, the new product is officially issued.

#### 3.4.1 Actuarial department

The actuarial department plays a core role in insurance product development. The product department is responsible for product design, provide support to the strategy of the company. The department defines the feasibility and form of new products, it also defines the demands of the customer. The department guides the development processes, reviews the blueprint of new products. The department also researches insurance products from other companies and takes part in promotion and track of products. The responsibilities of the pricing department are pricing and adjusting the premium and interest rate of products. Professional actuaries are recruited in the department to conduct the complicated calculation and to build complex mathematical models to achieve the goal of pricing. Also, actuaries need to analyse premium and interest rates of products from competitors to ensure the accuracy and correctness of the company's strategy. The evaluation office's responsibilities are to review the results of compensation capacity and reserve the amount which are calculated by actuaries, review the data and its resource, evaluate and predict the profit, risks and reinsurance, assess the result of cost analysis, and competitive intelligence which provided by product department and other departments, assess actuarial terms, and review the requirement of China Insurance Regulatory Commission. In addition, the office is responsible for internal and external communication and coordination about report and auditing. Main responsibilities of the marketing department are the market survey, promotion planning and administration, build and maintain the positive brand image.

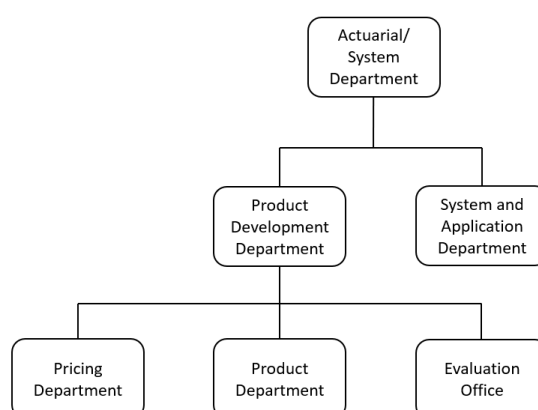


Figure 4. Actuarial Department Structure

### 3.4.2 Financial and administration centre

The structure of the company was modified in 2014, when the financial and administration departments were combined into a financial and administration centre. The functions of the centre include administration and finance. Departments and offices under the management of financial and administration centre include planning department, finance department, reinsurance department, human resource department, administration office, train department and supervision and audit department. Among them, the planning and the finance department participate in product development. (Interview with Li, 25.6.2018)

The planning and finance department are subordinate departments of financial and administration centre which involved in product development and information communication and application. The main jobs of the planning department are product development, product strategy and making development plans making. The department research business strategy of health and life insurance and provide solutions and advice on product strategy. Industrial data and information collection, data analysis are the responsibilities of the department also. In addition, the department is responsible for environment and market analysis

The finance department consists of financial management office, financial accounting office and reinsurance settlement office. The department's responsibilities include design and maintain the financial system, build and review budget plan, asset management and supervision, accounting and auditing, cost control and financial report. Due to the development, promotion and operation of new insurance products require R&D expense, the R&D expense is authorised and calculated by the financial management office. (Interview with Li, 25.6.2018)

## 4 METHODOLOGY

In this chapter, the methodological framework is discussed. The research purpose, the research approach, questionnaire design, and information collection are described and evaluated as applied in this research.

### 4.1 Research purpose

The purpose of the thesis is to understand how the insurer uses information and relevant technologies in life and health insurance product development. In order to conduct the research, a 2-months internship was carried out in a Chinese insurance company named Ping An. Ping An emphasises the importance of applications of information and information technology, and the need for a comprehensive, and functional information systems to support the data and information analysis and meet the information need of the company (Annual Report, 2017). Based on the insurer's experience of IT use and product development, required information is acquired. The company provides valuable and relevant information, accurate data and other resources to author supporting the research. Through the study, interviews and observations were conducted to study how, the life and health insurance product development processes and promotion methods of Ping An are realised. Relevant information and data were collected, recorded, organised and used to answer the research questions.

### 4.2 Research approach

The research is conducted to understand and describe the process of developing health and life insurance and to obtain the answers to the research question. Seidman (2006) and Creswell (2007) argue that qualitative methods should be adopted if the research has no links with establishing mathematical models or set hypotheses to illustrate a phenomenon. Corbin and Strauss (2008) illustrate that qualitative research methodology is considered to be suitable when the researcher either investigates a new field of study or intends to ascertain and theorise prominent issues. Thus, a qualitative research method is appropriate. To answer the research question, in-depth and extensive understanding of the issues is required,

therefore the most appropriate qualitative methods to collect data is interview, and the form of data is textual and non-numerical.

Interview is one of the most common methods used in social sciences, Kvale and Brinkman (2008) emphasise there are multiple types of interview and of those existing approaches, structured, semi-structured and unstructured are used most frequently. The interview method used in this thesis is semi-structured. The reason is to collect more unexpected relevant data and generate new ideas from interview. (Kvale & Brinkman, 2008).

Moreover, case study research is a qualitative approach in which an investigator explores a case, through detailed, in-depth data collection involving multiple sources of information (Creswell, 2007). It is another qualitative method used in this research. The case study approach is familiar to social scientists because of its popularity in medicine, law and political science. Health care and law elements are involved in insurance industry; thus, the case study method seems to be an appropriate approach and it will be used in the thesis to collect key information.

The specific and detailed data is collected using the semi-structured interviews. Interviewees who agreed to participate in the interview provided useful data as much as possible to support the research and the quality of interviews are ensured. Moreover, the structure of the interviews is flexible, interviewees are allowed to provide any relevant data in the interviews and communication after interviews, consequently, new ideas are inspired and generated from interviews and communications to support the research. One difficulty in the interview was that the interviewees could not provide many internal data of the company due to the confidentiality of the company which is fully understandable.

Three types of interview formulas were designed to collect different data and information from various aspects. Questions for senior supervisor were designed to gather information about the product development process, and decision making in product development. Questions for the information technicians were designed to understand how data is gathered and processed and then turned into information,



what type of data is required to be gathered and processed. Questions designed for sales managers to understand the information on life and health insurance. Besides, multiple questions were set to the actuary to understand the importance of actuarial in product development. The main life and health insurance products are studied as the case to explain the product development process.

### 4.3 Research design

Qualitative methods are used for information collection. The collected information is organised to provide a clear research result. Interview questions are designed for multiple interviewees to collect data and answer the core research questions; supplementary information was collected by observation.

Table 2. Research Design

Research Design	
Information collection methods	Interview
Interview target	Senior supervisor, technicians, sales managers, actuary
Interview Objective	Process of product development and data analysis process
Observation Objective	Information and clauses of life and health insurance
Number of interviewees	6
Time of interview	1 to 2 hours (supplementary question time is not included)
Observation Period	2 months
Location of interviews and observation	Branch Company of Ping An Life and Health Insurance Company

Two interviewees labelled as “Q” and “W” are sales managers in Ping An. Their main business is selling life insurance products. In the interviews, they introduced the basic information of Ping An’s life and insurances, such as type, content, the clause of products. The interviews were all conducted in 2018. An interviewee denoted as “J” is sales managers too. Data about specific products was collected during the

interview with J. A detailed product analysis was conducted with the help with J also. The interview date was 16.7.2018.

In the interview with the senior supervisor Li, data about the basic state of the company, structure of the company, basic information about insurance product development was collected.

Interviewee denoted as “C” is a professional technician who works in the information department. He provided all IT information of the company, which includes the methods, tools and process of data collection and analysis. Several interviews were held with C.

Interviewee denoted as “D” is an actuary in Ping An, and useful data of life and health insurance product development was provided during the interview. The data includes process, content, required data and information in life and health product development.

The interviewees also provided relevant data after the interviews to help and guide the research.

#### 4.4 Data analysis method

Content analysis methods is used in this research to analyse data. Qualitative content analysis is one of the research methods that were used to analyse text data. Text data might be in verbal, print, or electronic form, and it is collected from narrative responses, open-ended survey questions, interviews and observations, (Kondracki & Wellman, 2002). The research data is mainly collected from interviews. The aim of data analysis is to understand the use of IT in life and insurance product development in the said company.

The main objective of this thesis is to understand the life and health insurance development process. Throughout the analysis, how IT solutions are used in the process is understood. The interview data is categorised into three main aspects; data of life and

health insurance products, data of life and health insurance product development and IT used in product development. To conduct the analysis, a sample of life insurance bundle is selected, categorised data is analysed separately. The data is analysed by studying an insurance product and its development process. Based on the collected information, the required data in product development is learned and key types of data are selected to answer the research question, i.e., “what kind of data is required for life and health insurance product development”?

The features of the data are determined by analysing, and generally, the sizes of those types of data are huge, which require advanced IT solutions to deal with. Multiple solutions are applied to collect, store, organise, classify and process data. Through the discussion and interviews with the technician, the solutions and their roles are introduced, and their functions in the different stages in the development process are analysed.

## 5 INSURANCE PRODUCT AND DEVELOPMENT PROCESS

Information of the insurance product and its development is acquired from the interview with supervisor Li, two sales managers and one the actuary employees. The detailed content and process of development of the main life and health insurance product is introduced in this chapter.

### 5.1 Content of insurance product development

According to the Chinese Insurance Law, (Insurance Law, 1995) new insurance products must be filed and review by the China Insurance Regulatory Commission, and the commission stipulates that insurance products and contracts must include:

- The basic information of the insures: Name, gender, and contact information, address.
- The basic information of policyholders, insureds, and beneficiaries: Name, gender, and contact information, address.
- Insurance subject: Targets of insurance, properties, health and life are the primary insurance subject. It is the premise of product design because the demands of clients can be met only if their needs are clearly defined. Insurance subject is the needs of customers.
- Insurance liability and liability exemption: Scope of liability and the exemption refers to the term and condition out of scope liability.
- Insurance period and Insurance liability start time: The valid period of insurance. The start and end time of the insurance and liability period are consistent.
- Insured Value: The value of insurance subject, measured in monetary value
- Insurance Amount: the maximum amount an insurance company will pay if an insured asset is deemed a total loss.
- Premium: Cost policyholders need to pay to insures to validate the insurance contract.
- Insurance compensation and payment method.

## 5.2 Main life and health insurance product

The product development process is confidential of the company, thus the specific information about it is uncollectable. However, the supervisor indicates that Ping An developed products based on the standard development process. In the interview, the senior supervisor elaborated on a few key processes in basic life and health insurance product development by introducing how the main insurance product of the company is developed. Due to the product is well-designed, the sales manager also suggests that the main insurance product should be used to analyse the process of product development. The sales manager and the senior supervisor provide the specific product material and help to analyse what data and information used in product development.

Ping An Luck is one of the most profitable comprehensive life and health insurance product of the company. The product is upgraded annually to fit the changing demand of markets. The 2018 edition of the product named Ping An Luck 18, and the last version is Ping An Luck 17. As the main insurance of Ping An, it is prevailing in the native life and health insurance market. The company promotes the insurance vigorously by its powerful marketing network, consequently, it contributes to occupy the market share firmly.

Ping An Luck 2018 is an insurance bundle product, the main part of the product is life insurance. The bundle includes additional critical illness insurance with early payment term, additional malignant tumour insurance, additional long-term accidents injury insurance, additional critical illness exemption, additional minor exemption, and additional accidental medical treatment. Life insurance, critical illness insurance, accident insurance, and critical illness exemption are compulsory and must be selected by customers. Other terms are optional, customer can select depends on their own needs. In addition, the insurance amount of each term can be customised based on customers' demands, and the premium of each term varies according to the insurance amount customer set by themselves. If insurance amount of each term is confirmed by the customer, the premium of each term and total

premium are calculated by the system immediately, then the customer can decide the payment period, pay in 10 years, 20 years and 30 years is the basic selection.

As the main part of the combination, life insurance is the most profitable term. The content of this life insurance product is when the insured dies or reaches the age specified in the insurance contract, the insurer pays the insurance premium. The payment of insurance amount can be one-time payment, or it can be paid in instalments in accordance with the contract to protect the beneficiary's life in the future, usually after retirement. The compulsory term of the life insurance is the insurance amount of life insurance must be higher than other products in the combination. The reason is the compensation amount of critical illness linked with the insurance amount of the main insurance. When a customer receives an amount of critical illness compensation, the equal amount of insurance amount is reduced from the main life insurance.

### 5.3 Other products in bundle

Critical illness insurance, malignant tumour and Long-term accident injury insurance are other insurances in the bundle. The coverage of critical illness insurance in the bundle covers more types of illness than other illness insurances. 80 types of heavy critical illness and 20 types of minor critical illness are included, which made it prevailed in the market.

Malignant tumour is one important term in the critical illness coverage. The company sets malignant tumour insurance as an independent insurance in the combination is to prevent the recurrence and metastasis in future. The term provides continue protection to customer after cure of cancer. The content of the insurance is if customer suffer malignant tumour which is specific in the critical illness insurance, and recovered at last, then after five years, if the insured suffer malignant tumour again, the customer can claim for compensation again for cancer cure.

The content of long-term accident injury insurance is insureds encounter accident when drive a private car, and take public transportation, insurers will pay the

compensation to the beneficiaries. The compensation condition is death or disability of insureds in accidents. If insured injured survives in an accident and without being disabled, the claim is invalid. The advantage of the insurance is high insurance amount and compensation, insured can claim double insurance amount for compensation. For instance, a customer set the insurance amount of accident insurance 500000 RMB, if the insured dies in an accident, his beneficiaries can claim for 1 million RMB in total, and they can receive the insurance amount of main insurance due to the insured dies.

## 5.4 Key process of developing the main product

### 5.4.1 Originating of product

Idea originating is the beginning of insurance product development. Insurance product development includes new product development, enhancement or revision of current products, and repricing or rate changing of existing products. As mentioned, Ping An Luck 18 is an enhanced edition of the life and health product in the past year. Compares to the previous edition, the premium and insurance amount are higher, and more insurance subjects and illnesses are added in the insurance coverage, besides, exemption condition of the current edition was changed also. Although no significantly brand-new features and function were added, it is still a new product. The idea of updating the main bundle product annually comes from the understanding of the fluctuating of market. Market and needs float constantly, to respond to the floating, periodical business or product plans must be delivered and executed. However, superficial understanding and experience of the market are insufficient to transfer a raw idea or concept into a performable plan. To achieve the plan, one who generates the idea must refer to the corresponding professional data to determine if the idea is practicable (Interview with Q, 11.7.2018).

Data guides idea generation. Market survey and national illness data reflect that both critical illness incidence and critical illness types have increased from 2017 to 2018. To cope with the situation, the company decided to add corresponding types of critical illnesses into the bundle's coverage thereby satisfy the needs of the

market. Another instance is that Ping An issued a new health product which was designed specifically for cancers which name is Cancer Defender 2018. It is not a brand-new product with different and new added functions or characteristics, it was upgraded and enhanced from the previous cancer insurance. The motivation of enhancement and revision to the previous product is that the decision-makers noticed that data indicates that the cancer population grew rapidly in past years. Thus, the idea to develop a corresponding is reasonable and feasible. (Interview with Q, 11.7.2018) The data from International agency for Research on Cancer shows the number of new cancer cases occurred in China in 2018 is 4285033 (see Table 3), and the number of prevalent cases, in the last 5-years is 7827961 (Globocan 2018).

Table 3. Cancer population fact sheets of China 2018

Summary statistic 2018			
	Males	Females	Both sexes
Population	732 906 984	690 200 262	1 423 107 240
Number of new cancer cases	2 366 010	1 919 023	4 285 033
Age-standardized incidence rate (World)	223.0	182.6	201.7
Risk of developing cancer before the age of 75 years (%)	23.00	18.29	20.64
Number of cancer deaths	1 791 805	1 073 369	2 865 174
Age-standardized mortality rate (World)	166.6	95.2	130.1
Risk of dying from cancer before the age of 75 years (%)	17.26	10.03	13.70
5-year prevalent cases	3 611 702	4 216 259	7 827 961
Top 5 most frequent cancers excluding non-melanoma skin cancer (ranked by cases)	Lung Stomach Colorectum Liver Oesophagus	Breast Lung Colorectum Thyroid Stomach	Lung Colorectum Stomach Liver Breast

Given that the increase of the cancer population is steep, the obvious changing in data was impossible to be neglected by the company. On the other aspect, the old cancer product cannot meet the increasing needs of the market. Thus, the necessity to generate ideas and draw up plans for a new cancer insurance development was confirmed.

Data which lead to idea generation can be raw. The raw data will be processed in the product development for further use. However, data is not the only factor which brings about idea generation, personal knowledge and experience can also generate



idea. Experienced managers might be sensitive about the changing and trend of market and environment, hence they probably work out a plan and implement in advance. In this situation, personal knowledge creates ideas, then relevant data is needed to review the feasibility of the idea (Interview with Q, 11.7.2018),

Ideas of a new product might be generated by the general manager because the individual knows the needs of both company and market, the most important point is that, the individual has the right and sufficient resources to generate an idea and achieve it. Through the data provided by core departments, such as marketing and actuarial department, the idea will be shaped and transferred into a plan.

#### 5.4.2 Feasibility assessing

If the ideas of new products are accepted by the general manager, a review of the feasibility of development is required. In this phase, more types of data are needed and involved. Raw data is processed, classified and analysed for decision making.

Compared to an enhanced and repriced product, the feasibility review and product concept generation of a brand-new product consumes more time and resources. Additional data and information are also required. A product which is updated from a previous version has generated concept and feasibility review from the original version as reference. The method of review for upgrading existing products only involves assessing and testing the content of previous terms using current data and information. The main bundle product Ping An Luck is an appropriate example here. The main content of feasibility check for the bundle are re-setting premium according to the analysed data and adding critical illness types to the insurance's coverage. However, a tremendous amount of work has been done to access the feasibility when the company determined to design and launch bundle as the main product. The primal feasibility assess requires to determine which types of insurances are needed by the market, then design and develop determined insurances respectively. Then actuaries built up primary mathematical models and provide a premium scope. In addition, prerequisite like a long-term overall market survey is imperative (Interview with Q, 11.7.2018).

Another example to explain the feasibility assessing is the cancer insurance mentioned above. The motivation of developing new cancer insurance is that the needs from the customers were increased while the old product can no longer meet current demand because the premium of the old cancer insurance was high, and the insurance amount was not enough to cover medical expenses of cancer curing. Therefore, the feasibility of new cancer insurance development is reducing the premium and increasing the insurance amount. According to the feasibility, actuaries re-calculated new premium and new insurance amount (Interview with Q, 11.7.2018).

If the result of data analysis shows the feasibility of development, the development process will move to the next stage, product planning and design. If the feasibility is low or null, the development plan will be ceased or delayed.

#### 5.4.3 Product planning formation

Product plan formation is the process to design insurance policies. Product development department takes the main responsibility to conduct the planning work. Due to the fact that specific types of data and information are required, the department needs to communicate and cooperate with the marketing department, actuarial departments and other subsidiaries for data exchange and collection. For instance, market survey reports from the market department indicate that the demands of the customer are fluctuating, results of actuarial calculation suggest that the premiums of current products are above the average prices, therefore, adjusting of premiums is urgent. Necessary data and information are depended on the type of product. For instance, the illness population amount, types of illness and other environmental or social data is required in health insurance of the bundle, and mortality table is critical in life insurance of the bundle. Marketing data is needed in all types of product development because it reflects the demand of customer and some business state of the industry and competitors. In old product upgrading and enhancement, all data of old products is required to review for a redesign. Once data

is processed completely, a report will be made and submitted to the general manager, then general manager decides if to approve and implement it.

#### 5.4.4 Product development

Insurance terms design, underwriting design, and actuary are the main content of product development. The whole development process is managed as a project. Different departments work and coordinate together to execute the plan until the project is completed. In brief, the insurance term design is the process to determine content and coverage. The critical illness insurance in the bundle product is used to illustrate how this process works.

The motivation to design critical illness insurance is to meet the market need by covering the type of critical illness as much as possible. Taking all critical illness types into the insurance's coverage is inadvisable because both research and development expenditure and compensation will be costly. The aim of developing a new product is profit gaining, thus, only illness with high prevalence are taken into the coverage. Through the relevant data and information about illness, the product development confirmed that dozens of illnesses are applicable in the coverage. The types of heavy critical illness are malignant tumour, malignant mole, liver failure, serious brain injury, serious motor neuron illness and other illnesses. The types of minor critical illness include early malignant lesions, carcinoma in situ, skin cancer, single limb loss, moderate coma, cerebral haemangioma, visual impairment, hearing loss. Moreover, the illness insurance also provides compensation to major surgery as heart valve surgery, aortic surgery, craniotomy, coronary artery bypass surgery, and other few types of surgeries (Interview with Q, 11.7.2018).

Compensation terms and condition design is another key content in insurance product development because they define detail of compensation. In the interview with Li, the compensation content of life insurance in the bundle is introduced. The table below is an insurance payment plan for a 30-year-old male white collar, he sets insurance amount of every term by his individual choice. The insurance amount of life insurance is 310000 RMB, this means his beneficiary will receive 310000 RMB

as compensation if he dies. As mentioned, insurance amount of the critical illness insurance must be lower than that the life insurance, hence the insurance amount of critical illness can be set as any amount which is under 310000 RMB.

If the customer suffers from critical illness in the future, and he receives 100% of the critical illness compensation, which is 300000 RMB, then the life insurance amount is reduced to 10000 RMB because the compensation is taken from life insurance amount. This means, that when he dies, the beneficiary will only receive 10000 RMB. However, the remained insurance amount can still provide protection to the customer, because malignant tumour insurance, accident insurance and accidental medical treatment insurance in the combination are still valid. If the insurance amount of life insurance is equal to the critical illness insurance, when the customer receives full amount of compensation, the same amount of insurance amount is removed from life insurance. It means the insurance amount of the main insurance is reduced to 0. Then the insurance contract ends, and the customer loose protection from other insurances in the combination (Interview with Li, 16.8.2018).

Table 4. Ping An luck 2018 payment plan example

Product Types	Insurance Amount/RMB	Insurance valid Period/Year	Payment for the First Year	Payment Period/Year
Ping An Luck 2018 Life Insurance	¥ 310,000.00	Lifelong	¥ 5,642.00	20
Critical illness insurance	¥ 300,000.00	Lifelong	¥ 3,750.00	20
Malignant tumour insurance	¥ 300,000.00	Lifelong	¥ 1,440.00	20
Long-term accidents injury insurance	¥ 500,000.00	70-year-old	¥ 2,500.00	20
Critical illness exemption		Lifelong	¥ 82.66	19
Minor exemption		Lifelong	¥ 144.79	19
Accidental medical treatment	¥ 50,000.00	1 year	¥ 318.00	1
			¥ 13,877.45	

A favourable compensation condition to the customer stimulates their desire to purchase the product. Given that, beneficial terms to a customer are designed in critical illness insurance in the bundle. A beneficiary can claim for minor critical illness three times, and the compensation amount is 20% of critical insurance amount each time the insured suffers a specific minor illness in the coverage. Therefore, the beneficiary can receive 60% of critical insurance amount in total, and the compensation of minor illness is not linked with the main insurance amount. For instance, the insurance amount of critical illness insurance is 300000 RMB, a customer can receive 180000 RMB in total for minor critical illness, and the beneficiary can still receive 300000 RMB if the insured suffers a heavy critical illness. Moreover, unlike heavy critical illness, the compensation of minor illness is not taken from the main insurance amount.

Another beneficial term to the customer is an exemption. It is a common term in life and health insurance, the term provides a huge advantage to insureds and policyholders. The exemption target can be both insureds and policyholders, it is based on the requirement of insurance condition. The condition exemption term in the bundle is that if insureds suffer from a heavy or minor critical illness for the first time, the policyholder need no longer to pay the premium in the remaining payment period, and other terms of the insurance remain valid until the end of the contract. If a payment period of a customer is 20 year, and the insured suffer a critical illness in the first year after sign the contract, the policyholder no longer need to pay for the premium in the next 19 years, and the insured can still claim for compensation of other insurance terms in the bundle.

There are some terms set to ensure the benefit of the company also, such as deductible amount setting. Deductible amount is stipulated by the company in some health insurance products. Deductible means the minimum amount of the insurance benefits; the insurance company will not pay if the medical cost of insureds is lower than the minimum amount of the insurance benefits. (Interview with W 4.7.2018)

#### 5.4.5 Underwriting condition design

Underwriting condition design is associated directly with the risks, appropriate underwriting condition prevent possible loss of the company. It sets limitation to the customer with high risks. In the different types of insurance products, the underwriting conditions are different (Interview with Q, 11.7.2018). Required information and data in underwriting condition design are risk rates such as death rate in every age, risk rate in various occupations, risk of illness, risks in different region, environment, etc. Data of risk rate and risk are gathered from channels of big data and statistic. Then actuaries calculate the premiums in different risk condition based on the risk rates.

Common underwriting limitations in life and health insurance are age, profession and health state. Age is a critical underwriting condition. Age limitation is set in all life insurance and premium of life insurance increase with age. A customer can't be underwritten if age dose not match with the age requirement of insurance. For instance, the upper age limitation of the bundle is 55 for both male and female, and the premium increase with the age of the insureds. Table 4 shows that an insured 31 years-old male's yearly payment is 13,877.45 RMB if the individual decides that the insurance amount of the bundle is 310000 RMB. One shares the same state with the insured but older persons need to pay more than the yearly payment. People who are over 55 is not allowed to underwrite and purchase the bundle. According to the actuary calculation result, people over 55 years old have high risks. The high risk probably causes loss of the product (Interview with Q, 11.7.2018).

Profession and health state are also essential factors which influence underwriting. Customers with high risks professions and poor health state can also be underwritten, but they need to pay an extra premium and submit specific certificates which insurers required to ensure that they are qualified to underwrite.

Overall, the price of the premium depends on the risk of the customer. The premium gap between the customer with high risk and low risk is enormous, in some condition, customers with high risks need to pay several times of premium than low-

risk customers. Hence, underwriting condition is not only limitation but also an advantage to the customer with less risk.

#### 5.4.6 Actuary

In the interview, the actuary indicates that actuarial is a work to analyse, evaluate, and manage future risks in various economic activities based on the basic principles of economics, using various scientific and effective methods such as modern mathematics, statistics, finance, and law. It is the foundation of the contemporary insurance industry, and it is applied in finance and investment field also (Interview with Li, 16.8.2018).

Risk control is the primary responsibility of the actuary. One of the most important methods to control risk is pricing reasonable premium to insurance. Sufficient premium from the customer can ensure the profitability of insurance companies and help to reduce risk to some extent. In addition to calculating the premium for insurance products, actuaries also take responsibilities for many aspects, like researching the insurance laws for insurance accidents, the distribution law of insurance accident losses, the average loss of insurance insurers and their distribution rules, insurance rates and liability reserves, insurance company solvency and other insurance specific issues. Actuaries need to calculate the basic risk rate and extra risk rate. For example, an individual might not be underwritten by paying a standard premium because his or her risks are relatively higher than common. To be underwritten, the individual must pay a higher premium than the standard. Therefore, extra rates and premiums needed to be calculated (Dickson, Hardy & Waters, 2009).

The actuaries' take responsibilities for assessing, quantifying, managing and monitoring the risks inherent in insurance products, pension schemes and other financial transactions that provide benefits contingent on uncertain future financial events. In order to do this, they need to be able to build, test, implement and interpret models to project and evaluate the future asset and liability cash flows

under a range of possible assumptions for the coming experience. In the insurance industry, actuaries participate in product development and financial management.

In product development, actuaries design new insurance clauses based on the demand of the market. Premium pricing and insurance rate calculation is a core part of insurance product development, it is also the major job of actuaries. Actuaries need to use past life statistics, current bank interest rates and expense rates, to determine the price of the policy. Also, they need to calculate the reserve of new product and cash value of insurance policy. Insurance reserves are the fund insurance company prepare for future compensation. In order to ensure insurance company will perform insurance compensation or payment obligations as promised, a certain number of funds must be prepared to correspond to the legal liability or business-specific needs. The reserves are drawn from premium income or surplus. (Interview with Li, 16.8.2018).

In addition to developing new products, actuaries also audit and evaluate existing products and their clauses. The purpose is to determine whether the existing clauses can still satisfy and meet the demand of customer. If the answer is negative, then premium and coverage must be adjusted to remain competitiveness of the products.

Data analysts and actuaries are similar, and both are involved in data analysis processes. Data analysts and actuaries share the same skill sets and work content, they use mathematical and statistical techniques to process data and report the result. However, they differ in the work content. The data processed by data analysts are in a wide scope, the types of data are various, while actuaries only need to analyse data which relate to insurance policies, risks and possible losses associated with accidents. In addition, actuaries require the analysis results to set premium price.

Actuaries are in charge of financial management as review the company's annual financial report; evaluate the company's investments to ensure the safety and profitability of the investment; participate in the company's development plan, provide effective data support and professional advice for the company's future



economic decisions. This means actuaries know clearly how many profits the insurer needs to maintain business. Hence, another main job of actuaries is premium setting. Premium is variable in most life and health insurance product. In premium pricing, actuaries calculate not a fixed price but a list of prices instead. The reason is that every customer is unique, and the condition of every customer is unique also. The factors used to distinguish the difference of customer include age, career, health condition, living place. In insurance, these elements are risks, and the premium varies according to risks. Age is the main risk factor in insurance. For example, although a 30-year old male has the same health condition, job and accommodation environment as a 55-year old male, if they select the same health insurance product, the 55-year old male need to pay extra premium than the 30-year old male because he has higher accident and disease risk than the 30-year old male. If the premium is fixed, customers with low risks need to pay more, they probably chose to give up the product; or customers with higher risks can pay less, insurance companies transfer all risks from them, the consequence is the cost increasing (Interview with D, 3.8.2018). To gain profits and decrease costs, actuaries must set premium accurately, or predict the risks accurately. Modern data mining technology is applied in the company to improve predictive accuracy. Ping An has partitioned the databases into small groups according to the characteristics of the data. The data of each group can be queried, analysed and modelled. Database partition is conducted by using variables associated with risk factors, profits, or behaviours. Partition based on the variables can provide apparent relationship and contrast of data analysis. Consequently, the risks are easier to predict, as well as the possibility of claim (Interview with D, 3.8.2018).

#### 5.4.7 Feedback from the market

Results tracking is the most direct and effective way to receive feedback from customer. In order to collect the feedback information, service personnel will contact customer through telephone after underwriting to conduct satisfaction survey. In addition, sales agent is able to contact with customer to collect and record more specific feedback information. The feedback result is analysed later to verify the quality of products. The result is also a critical reference to product upgrade.

Important data required to upgrade the Ping An Luck 18 is collected from the feedback of its previous version.

## 6 REQUIRED DATA AND IT TOOLS IN LIFE AND HEALTH INSURANCE DEVELOPMENT

Through the analysis of the product bundle and interviews, main data and information needed in life and insurance product development are determined.

### 6.1 Required data and information

#### 6.1.1 Market survey

Market demand is the motivation for product development. In a mature insurance market, financial insurance is commonly the most profitable product to insurers. However, native insurance market in China is immature, life and health insurance are source of revenue for the Chinese insurers. Hence, Ping An and other large Chinese insurers focus on the sales and development of life and health insurance.

There is a wide variety of life and health insurance products, multiple insurances should be purchased if customer need a comprehensive protection. Ping An's market survey indicates that: life insurance is the best-selling product in the Chinese market; in recent years, with the increasing incidence rate of critical illness, such as cancer and tumour, health insurance has grown in popularity. Meanwhile, the increase of private cars in China lead more traffic accidents in recent years, hence the sales of accident insurance have arisen. (Interview with J, 16.7.2018)

Through the survey, the company realised that life, health and accident insurances will prevail in the market steadily and customers prefer to purchase comprehensive insurance bundle instead of purchase multiple insurance products separately. The reason for this preference is defined, which is customer believe that being underwritten and evaluated for every single insurance before purchasing is time-consuming and complex. However, customer only need to be underwritten and evaluated for only one time if they purchase bundle products, and the premium of bundle is relatively low when contrast to multiple independent insurance products.

Market survey gives key information in product development, it gives the direction to a company's business. Market survey not only collect information from market, but also from competitors. By understanding competitors' products, the company can identify the market niche and fill the gap by provide unprecedented product into the market.

### 6.1.2 Public statistics and data

Development of life and health insurance requires professional data in actuarial. The most critical data in life insurance development is the life table. The table shows the probability a person of that age will die before his or her next birthday. The table fully reflects the law of life and death of a certain group of people from birth to death. (Interview with C, 30.7.2018) Statistics can be calculated and derived by applying the probability and statistical formula, such as life expectancy at different ages, proportion of people in specific age which still alive, longevity possibility of people in a specific age.

In order to price insurance products and ensure that insurance companies retain sufficient reserve to maintain solvency, actuaries must predict future insured events such as death, illness and disability. To do this, the actuary developed a mathematical model for the cause, amount, and timing of these events. By studying the incidence and severity of events in the past, actuaries expect to understand the causes and law of these events over time, and based on the law, actuaries can calculate the when these events occur again in future, and how many times these events will occur. For instance, current life expectancy increased continuously, and based on the situation, actuaries need to know whether life expectancy will continue to increase in the future. The possibility or expectation are usually represented in percentage. It shows the number of events that occur in a specific population based on age or other relevant demographic characteristics. (Interview with C, 30.7.2018)

According to the life table and relevant statistics, actuaries calculate the risk rates in each age. Basically, higher age means higher risk. Actuaries of the company calculated that Ping An Luck 18 is profitable if consumer' age range is from 18 to 55.

Teenage, children under 18 years old and adult over 55 years old have high risks which can cause direct loss to company because more capitals must be prepared to ensure the solvency and more claims may occur.

### 6.1.3 Disease data

The coverage of the last edition of critical illness insurance includes 80 types of illness, and current critical illness insurance cover 100 types of illness. The coverage range has increased due to the data shows incidence rates of some illnesses grown during past years. In addition, record and data of other Ping An's illness insurances reflect that claims number for some illnesses were not in the coverage in old Ping An Luck has increased last year. Therefore, more illnesses were added into the coverage of the critical illness insurance.

Disease database is a data management and analysis system which classifies diseases by type. Data are normalised and stored in the system for research use. The company corporates with an official institution and some companies which provide relevant public disease data. Through the disease analysis statistical database, all cases accumulated in the for past many years can be analysed to obtain a statistical result. The profession database technology and scientific classification methods are used to summarise the disease knowledge system, thus the qualities of collected data, research resources and calculated statistical results are high. The results and data provided by these systems can reflect the regional and national disease situation in time realistically, and the result is a critical factor which influences the design of health insurance (Interview with C, 30.7.2018).

The type of disease is various, in order to manage the disease data, case of different kinds of illnesses are recorded and classified. Partition is used in a disease database system to build minor database to store specific illness cases. The common disease databases are liver cancer database, diabetes database, gallbladder cancer database, thyroid disease database, pancreatic cancer database, heart surgery database, tumour chemotherapy database, and respiratory disease database. Through those databases, the actual situation of each disease can be understood. The data shows

the number of real cases, the growth rate of disease and other critical information which are used in product development. However, the data in disease databases is not only the amount of case, but also specific data as age gender and other basic information of patients. The most important is data about the treatment and relevant costs can be gathered. Based on it, the average cost in a specific disease can be calculated, and results are very useful to actuaries. Actuaries can reference the average cost in premium and insurance amount pricing. (Interview with C, 30.7.2018)

#### 6.1.4 Traffic accident rate

The traffic accident rate is a core index in accident insurance development. The rate is the relative relationship between the number of traffic accidents in the country or a certain region (the number of casualties and deaths) and the number of people in the country in a period. The relevant statistics are accounted, record and issued by official institutions. In addition, relevant data can be gathered from historical claims and sales records. The car insurance of Ping An seized Chinese market stably for years, the sales volume is huge. Through the information of customer and claim record, the company can obtain information like a significant difference in driving behaviour between male and female drivers. Female drivers cause fewer accidents, hence the premium is relatively lower than male drivers. The data also shows that education and age influence driving behaviour greatly. Moreover, a detailed result like risks of driver in different age and gender can be calculated. Based on the result, actuaries can price accurate and reasonable premium for drivers in a different situation (Interview with D, 3.8.2018).

The sales and claim data show both death and casualty rates have grown in past years due to the claim number increased. The claims record shows the costs that the customers spend on treatment after an accident. The cost consists of treatment cost, nursing expenses, compensation for lost income, rehabilitation cost. Ping An realised that the cost had increased, and the original insurance amount of accident insurance can no longer meet the demand and cover the costs of treatment. Thus, the insurance amount was recalculated in the new edition of accident insurance.

### 6.1.5 Other data

Apart from the 4 types of data above, insurers need data like customer data, sales data, operation data, product data, finance data and other data from both internal and external. However, all the data insurers need in developing new product has huge volume, and the forms of these types of data differ from each other. Thus, professional tools like big data analysis, data mining, AI are used to process the data analysis to obtain accurate and correct results for decision-making.

## 6.2 IT used in in life and health insurance product development

### 6.2.1 Big data solutions

The company has applied big data solutions for years, and up until now, the company established one of the largest big data platforms among Chinese financial institutions. In the interview, C introduced that in 2017, over 900 million credit inquiries were processed, and compares to other insurers, this volume is really huge and stupendous (Interview with C, 30.7.2018). On the big data platform, the company has built a strong network of ecosystems and applied the big data technology to areas such as financial services, health care, auto services. One of the most important functions of the platform is to collect customers' information from different information channels. With the upgrade of the platform, functions like synchronisation service and real-time data gathering are achieved to provide efficiency. Through the platform and services, customers' information can be uploaded immediately (Interview with C, 30.7.2018).

In the development of the insurance company, massive data is accumulated and gathered. In the past years, the company's insurance business has grown stably, and the number of new customers has increased rapidly. As a consequent of it, the volume of data increased, and extra data storage space was required. Therefore, Ping An applied big data solution to store and manage data systematically. The company realised also that with the expansion of business, more data about the society, market and other industries are required for the analysis to make the right decisions to remain competitive, and the most important is that the type of the data is different (Interview with C, 30.7.2018). For that reason, the insurer needs a

powerful data storage platform that provides by big data technics to store and process any type of data it collects for the use of product development.

Insurers are required to implement internal processes and procedures to ensure the suitability, completeness and accuracy of the data used within this framework. To ensure the quality of data which is upload from operational systems, the primary source of the data is refined and catalogued. Incorrect, inaccurate, and other types of bad data can cause serious problems in data analysis. Bad data affect the accuracy of data analysis result, and data analysis result is the crucial basis of decision making. Therefore, data should be made available and accurate for use by managers and other business professionals for data mining, online analytical processing, market research and decision support (O'Brien & Markas, 2010). The quality of data associates directly with data report and decision-making, and some data analysis result is the basic of insurance product development and decision-making.

#### 6.2.2 Artificial intelligence

The company has established comprehensive scenarios of AI applications such as smart perception, prediction, risk management, and services to ensure the accuracies of data analysis results. The company's AI and deep learning technologies have reached world-leading levels. In disease forecasting, the company has achieved precision rates of over 90% for influenza and hand, foot and mouth disease and 92% for chronic obstructive pulmonary disease respectively. The medical image reading technology ranked first in lung nodule detection and false positive reduction with precision rates of 95.1% and 96.8% respectively according to test results of Lung Nodule Analysis (LUNA), an international authoritative assessment in the medical imaging field (Annual Report, 2017). With the exception of forecasting, another major function of AI used in the company is making premium pricing accurate.

At present, scientific and effective differentiated pricing methods are required by Chinese insurers. The reason is some Chinese insurers adopt follow-up strategy in product pricing and conduct virulent price competition. Hence, premium pricing is one of the bottlenecks which restrict the development of the Chinese insurance industry. To break the bottlenecks, the company applied the AI technics to make



premium pricing. The company combines the necessary information of customers' living habits, age, insurance experience and other essential information to explore the insurance preferences of policyholders with AI technologies as machine learning algorithm. In data analysis, the data is used to build mathematical models, through the models, critical results like risk rates, possible compensation amount, death or accident rates are calculated. Then the calculated results will be used in machine learning algorithms to forecast the future risks, consequently, the accurateness of premium pricing is increased (Interview with C, 31.7.2018). With AI and actuary technologies, the company can calculate the differentiated price and recommend appropriate insurance products to every single customer after analysis. Differentiated pricing means that companies provide products and services to customer with different price. Customers can adjust the insurance amount and premium which calculated according to their economic situation. Therefore, both customers who require products with full protection with higher price and customers who need only basic protection can be satisfied at the same time.

The insurer also applies machine learning solution to learn from historical business data over the years as a training process. Through the learning, the system can analyse and acquire the information in different business scenario. It is possible by machine learning algorithms that review every single customer's data and provide high-customised insurance products to them after analysis.

### 6.2.3 Business intelligence

The company applies business intelligence mainly for multidimensional data analysis and data integration. Operational systems were installed in the core departments in Ping An such sales, marketing, or customer relationship management department, and separated systems are built for each (Interview with C 31.7.2018). However, data is stored or distributed in different data systems and partition within the company, and the data can't be processed without integration. In this situation, business intelligence methods are used to seek the valuable data from the systems and partition, then integrate the data with different form or structure (Interview with C, 3.8.2018). For instance, customers' data is stored in an

independent partition according to the category. Valuable customers are located, and their data is stored in a unique partition for analysing (Wang and Fu, 2005).

Data integration combines data from multiple data sources and stores them in a unified form. The process of building a data warehouse is called data integration. Several data integration methods are used by the company in data pre-processing to get a more accurate analysis of the results. Data grouping, statistics calculation, basic statistical graphs drawing, data value conversion, and data normalisation is the necessary steps in data pre-processing. Those help the insurer to master the distribution characteristics of data, which is the basis for further analysis and modelling. In addition, a large amount of historical data was accumulated and stored separately within different traditional information systems, and it affected the efficiency of data utilisation because the data forms are not uniform and old data analysis system does not support data integration. The development of BI is based on data integration, which requires a certain volume of data. The disadvantage of traditional information systems emerged with the increasing of both volume and type of data in life and health insurance industry. The traditional information and business systems are designed for dealing with separate transaction process, multi-level analysis and statistics is beyond the ability of the systems. Business intelligence can obtain various types of customers' data and business data from traditional business systems, thereby establishing a multi-level analysis system, and translate it into commercially meaningful knowledge for insurer (Xu, Zhang & Jiang, 2005). Integrated and structured data is analysed using the OLAP solution. Through the analysis, the value of data is revealed and used as a reference for decision-making. The insurance product development requires comprehensive information from different aspects. Using the OLAP solution, data in multiple dimension is analysed, which means it reveals relationships between different dimensions. For instance, the insurer retrieves the sales status of a life insurance product in Beijing last year. In this situation, dimension includes time and location, if one dimension is missing, such as location, the insurer receives the sales status of whole country, and the retrieval result is not accurate enough for decision-making (Interview with C, 3.8.2018).

#### 6.2.4 Data mining

Markets change over time, as well as the products which customers need. It is critical that insurers identify and monitor the change of customer's demands, prospect and trend of insurance and the adjustment of policies. Data mining supports the monitoring of the change of data, and the change of data always reflects a shift in reality. Through data mining, demand change of the customer can be realised in a short time. The company attaches importance to the change of market and customer, it responds quickly to the changes. The company focuses on modifying old products and designing new products to meet the changing demand of customer as soon as possible (Interview with D, 3.8.2018).

Insurance companies need to know what policies are profitable in the future to cope with the changes in demand and market. For example, elevator accidents frequently happened in China in the past few years. Not like other accidents, elevator accident was out of compensation scope of accident insurance products. The elevator accidents triggered the concerns of customers, through data mining, the company realised the concerns of customers and added the elevator accident into compensation term in its main accident insurance before its competitors in 2018. Then the new clause attracted the attention of consumer, and it is the unique selling proposition of the product.

Data mining does not only provide the answers to questions such as what the change in the market is, what is the most profitable product and policy currently, but it also generates new questions for analysts and decision-makers. The questions are, after data analysis of potential products, which product is the most profitable? Which has the lowest risk or highest risk rate in market? Which will seize the most prominent market? With further analysis, all questions will be answered, the most optimised decision will be made, and the most profitable product will be selected. (Interview with D, 3.8.2018) However, parts of data relate to personal and private information, confidential, legal and ethical issues may cause (Sapsford & Jupp, 2017). The company tries to avoid the issues in data collection and data mining and respect for

underrepresented social groups and attempts made to avoid their further social exclusion.

#### 6.2.5 Mobile application and data collection

The company focuses on the application of artificial intelligence as well as big data. AI is applied in data analysis, and it is also developed for customer data collection and for customer self-service. The company developed a mobile application for its users, through the application, users can purchase about more than 80% of products from the company by using the application. The whole process of underwriting can be implemented by users without the help by salespersons (Interview with C, 31.7.2018). If a user has purchased any products and uploaded personal information in the past, his or her historical data is recorded. The historical data include personal information and transaction record. The important information in transaction record includes the amount of premium and types of products. The amount of premium and types of products purchased reflect the demand and positioning of customers. Moreover, before underwriting, the illness history and current health state are required to upload, in this condition, illness data of customers are collected for disease forecasting. To reach the qualification of underwriting, users must upload personal information and the information is stored for future use.

## 7 DISCUSSION

The rapid development of the Internet led to IT expanding by insurers. Insurers realised the importance of data and started to collect and analysis data with advanced and sophisticated IT solutions since 1980 (Clark & Libarikian, 2014). Insurers can understand more from data analysis results using the advance analytical techniques, thus decision-making can be enhanced. However, the role of insurance is still understanding the risk and compensating for policy holders' losses. Today, by applying advanced IT solutions, more types of data can be collected and analysed. For instance, insurers can only collect limited information about customers' habits and lifestyles, such as basic income situation, personal level of consumption, working place. Now, in the era of digitalisation and big data, insurers can predict accurate market trends and find the questions and answers that insurers did not know before.

### 7.1 Information required in life and health insurance product development.

Through the interviews and analysis of the main product, the information that are require and used in the product development is introduced. The source of data insurers need mainly comes from market survey, public statistics and other data that links with customers, market and business. In life and health insurance product development, data that reflect the regional or national health status is crucial. There are two types of data which can indicate the health status. The first type is data as disease rate that reflects the health state directly. The second type of data that gives information of health status indirectly as living and purchasing habits, marital status, or even food consumption of customers and market. The data is gathered from both internal and external. Internal data can be queried directly from the databases of the company. External data consists of public datasets and online data. Open data from scientific research institutions, enterprises, and governments is available to the company. Besides, the insurer also gathers free online data or purchase data from cooperating data providers.

### 7.2 IT solution used in life and health insurance product development

The IT solutions play a major role in life and health insurance product development from data collection to data analysis. It contributes to generate key information or knowledge which is the important basis that guides the decision-making through the whole development process. Based on the data collected from the interviewees and the analysis of the content, interviewees introduce that big data, BI, AI and data mining are the main IT solution Ping An used in insurance product development. Insurance product development requires knowledge and information as reference, which are extracted from relevant data analysis. The IT solutions impact insurance industry in many aspects. On the rapid development of both hardware and software of IT and internet, insurer realised that to remain competitive, a bold change must be made. Insurers used to focus more on products instead of customers, customers' demands were not fully considered, and customers were not highly involved in product development. To solve the problem, IT solutions were used to build a better understanding of customers and their needs.

Finding 1. The IT solutions lead a better understanding to customers and affect insurance product development.

Johne (1993) argues that the competition is then to be more aggressive in future. Insures must revise the traditional way of the product development to give a distinct competitive advantage. Providing high-customised insurance product is a main trend in the insurance industry. Because of the emergence of customised products, customers are no longer forced to accept the insurance term that provide no benefit. The change brought benefit to both insurers and customers, the insurance business was expanded, and customers' benefits were protected. Ping An works on developing customised product for years. Through IT solutions as BI and data mining, the company can locate and attract valuable customers. The valuable customers are located and are partitioned in a group. Data in the group is integrated and analysed to understand the specific demand and expectation. After that customised product is designed according to customers' needs. Ping An emphasis on information as customers' education, jobs or social position, due to the

information tells the financial states of them. Then actuaries set reasonable premium based on the states.

Finding 2. In the big data context, the way to collect customers' information is changed.

IT brings benefit to insurer, in the context of big data, information channel of the company has become more extensive. Habart and Janssen (2017) explain that big data platform is one of the most innovative creation in the big data era. Ping An built one of the largest big data platform in Chinese insurance industry. The platform links with the company's information system and applications. The platform is used by both the company and customers, and it also allows the interaction between the company and its customers. Customers can purchase insurances, claim, and request services from the platform. When customers purchase and underwrite insurance on the platform, their personal information is uploaded into the platform. Thus, it is one of the most efficient way to collect customers' information for Ping An. AI techniques are also used in the platform to enhance the user experience and satisfaction. The AI analyses customers' needs and recommend appropriate insurance products to customers. Then AI calculates premium according to customers' states. Due to individual differences, customers have different health state and risks. Therefore, the premium must be calculated independently for every single customer by AI.

Finding 3. Multiple IT solutions are used to meet different information needs.

Throughout the study of how IT solutions work in product development, a conclusion is reached. That is the solution used by the company share many common grounds. They all contribute to decision-making, and own abilities to process data, and they all conduce to the design of high-customised products. However, the use of them are different. Data analysis of BI solution data analysis not only enables decision-making but also involves an active part in the development of strategies and methods that make sure the success of organisations, whereas big

data solution focus on more about data and data processing, and data mining solution focus pattern analysis of data. BI solution can only process structured and historical data while big data solutions can deal with both structured and unstructured, and real-time data. Therefore, those IT solutions needs to be synchronised and work together to satisfy multiple information needs of insurers.

#### Finding 4. Challenges of IT solution.

The interviewee “C” illustrated that development of China’s insurance industry and IT started relatively late than Western countries. One of the biggest gaps between Chinese and Western insurers is the IT application in insurance business. Western insurers are more experienced in informatisation, to catch up with them, Chinese insurers have to invest more on both software and hardware. Big data, BI, AI and data mining solutions require a huge cost, and more costs is needed to maintain the system (Interview with C, 30.7.2018). Although the benefit of applying those solutions is huge, but insurers need to consider the cost-efficiency, the cost is one critical challenge of using IT solutions. Professionalism is another challenge of IT solution. All those solutions require professionals to implement, BI requires tools as OLAP and warehousing, Big data solution requires tools like Hadoop and Hive, hence insurers needs professional with different IT skills. Although the machine learning can help to reduce the labour-intensive in IT, but machine learning algorithm is one of the most complicated work that needs high-skilful technicians and experts (Xu, Zhang & Jiang, 2005). Thus, insurers must consider how to recruit, cultivate or retain the professionals. Complexity of data analysis is the third challenge that insurers facing. The volume of data will remain increasing, which create more difficulties in data mining and extracting since not all data can make value for decision-making. With the increasing of data volume, the data analysis will be more labour-consuming or time-consuming. Customers privacy is also the challenge of IT, it causes many concerns to customer. Customer is pleased with AI since, it improves customers’ buying experience through high-customised products after data analysing of their personal data. However, almost customers are displeased with violation of personal privacy. With the development of IT solutions,



more customers information is acquired by insurers (Benno, 2018). Although collecting information from customers is the rights of insurer in underwriting, but they need to keep the balance between customers' privacy and the benefit from customers' information.

## 8 LIMITATIONS AND FUTURE RESEARCH

The thesis presents the data analysis process in insurance product development and the explains required information needed in the product development with the focus on the big data analytics. The development process of Ping An life and insurance company is analysed to provide the results. As one of the largest insurance company in China, Ping An shows its advantage and expertise in its business capability. The whole process of product development is professional and standardised in Chinese insurance industry. Thus, the research result can be referenced by other Chinese insurance companies to review their information using and information technology application in product development.

However, the limitation of the research is obvious. The author of this thesis believes the research can only be applied to Chinese life and insurance company. On the one hand, the difference in medical and insurance system between China and other countries is huge, thus, the gap in product design is huge also. On the other hand, the Chinese insurance industry had started late compares to the Western insurance industry. As such, Chinese market shows its immaturity when compares to Western insurance market; and the need of consumers are different also. Therefore, the difference in product development is existing between Chinese and foreign countries.

Product development is one of the most critical and confidential processes in the insurance industry. It influences risk, profit and loss of insurance company. Therefore, the information and data related to product development provided by interviewees are limited. Core data and information in product development is confidential which is not allowed to be revealed and used. If more information and data are permitted, more detailed research results may achieve.

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## APPENDIX

I am conducting a research of how information and data influence new product design and promotion. The purposes of the interview include understand: the types of data and information which are required for new product development; how the data and information needed for new product development is collected, analysed and used; how information of the new product communicate within the company; how sales personnel communicate with customer.

According to the purposes of interview, interview targets include supervisor, actuary, technical personnel and sales manager. Questions are set for different groups; thus, interviewees only need to answer the corresponding questions and common questions.

All responses and answers will be kept anonymous and all information that you give will be treated in confidence. Your identity will not be connected to your answers in any way.

### Common Question

**1. Can you describe your routine working content?**

- Describe briefly of your daily job and how long have you been doing it?

**2. Is communication an important part in your job?**

- Describe your main communication targets
- How you communicate with them?

**3. Do you think data, information and knowledge management involved with your jobs?**

Questions for information technicians

**What specific types of information are required to support product development?**

- Do decision makers indicate the data and information they need in decision making?
- Or you collect and upload necessary data and information to decision makers, and then they decide what should take into consideration?

**4. Which types of data or information are more important in new product development?**

- What kind of data and information are used frequently in previous product development?
- Type of required data are always changing or remaining?

**5. How data and information are collected?**

- Is data and information collected by information system?
- Or collected by salesperson? Service department.

**6. How to analysis data and information?**

- What programming languages or applications are used to analyze data

**7. How you communicate or report with decision makers about the processed data?**

Questions for Actuaries

**8. What is Actuaries and Actural Science?**

**9. How actuaries works in product developement?**

- What information is required by actuaries in product development?

**10. How actural department communicate with other department in product development?**

## Questions for supervisor

### **11.What is the structure of the company?**

- What is the business of the company?
- What are the main departments of the company?

### **12.How the company develops life and health insurance products?**

- What departments are involved in the company?
- What are the processes of product development?

### **13.How to make decision by using collected data and information?**

- What factors should be taken into consideration?
- Processed data is more important than previous experience?
- What are decisive factors in decision selection?

### **14.How the decision be understood and communicated downstream to basic employees?**

- How to introduce the new product to salespersons, by holding meets?
- Or specific electronic or paper form introduction send by e-mail?
- How do you know employees understand the new product or decision and work toward it?
- Any issues happened about misunderstanding about the new product and decision due to lack of communication and explanation?
- New product development and decision are made due to some reasons and purposes, is it necessary to ensure that employees understand purposes and reasons?

## Questions for sales managers



**15. What is the main product on the current market?**

- What is the content of the product?

**16. How do you understand new products?**

- Do you know the why new products are developed?
- How do you promote the new product?

**17. How do you communicate within the company, with other colleagues, managers, customers?**

- How to communicate within the company?
- How do you communicate with customers or potential customer?
- How do you handle the relationships with customers?