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INNOVATION PATH OF INTERNET OF VEHICLES INSURANCE MODEL DRIVEN BY BIG DATA

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Abstract

In recent years, the Chinese government has successively introduced supporting policies and regulations to support the development of related industries such as the Internet of Vehicles. In the new era, with the rapid development of big data, mobile Internet and Internet of Vehicles technology, my country's motor vehicle insurance market is undergoing an unprecedented transformation. If big data technology, Internet of Vehicles technology, etc. can be applied to auto insurance products, it will inevitably break the actuarial requirement that traditional motor vehicle insurance can only be based on the data of past accidents. The change is far more than that. Since auto insurance companies can collect, obtain, and analyze and process personal information in real time through connected devices related to the Internet of Vehicles, auto insurance companies can control the risk of their targets in real time. Through the analysis of these data, auto insurance companies can also provide users with a personalized auto insurance experience that suits them all. It is also possible to promptly remind users to change bad driving styles through Internet of Vehicles-related equipment when it is found that user risks are increasing. At the same time, it can also be paid when the accident is completed in time after the accident, which has already interacted with users. It also brings the possibility for auto insurance companies to supervise policyholders to avoid falling into bad driving habits and increase the risk of accidents, thereby increasing the cost of auto insurance business. This is because auto insurance companies can record drivers' behaviors through Internet of Vehicles hardware, such as cameras, and promptly remind drivers when they find bad driving behaviors, to manage risks before they occur. Review the related theoretical research on the Internet of Vehicles and the integrated development of Internet of Vehicles and auto insurance and analyze the advantages of Internet of Vehicles auto insurance products launched by auto insurance companies in developed countries. Combining with the overall situation of my country's economic development, analysis and demonstration draw the fact that there is still huge room

for development in my country's auto insurance market. But in fact, most of my country's auto insurance companies are at a loss. Analyze the probable reasons and explain that the integrated development of the Internet of Vehicles and auto insurance will most likely break the profit dilemma of my country's auto insurance market. First, analyze and summarize the definitions of four variables, including profit model, pricing model, big data, and technological innovation, and previous research. And get their respective impact factors.Through the analysis of these data, auto insurance companies can also provide users with a personalized auto insurance experience that suits them all. It can also be found that when the user's risk is increasing, the Internet of Vehicles-related equipment is used to promptly remind users to change bad driving habits.

Keywords: Profit Model; Pricing Model; Driving Habits; Technological Innovation

Introduction

With the advent of the Internet age, the ability of humans to generate data is increasing exponentially. In recent years, a large amount of data and information have been generated from all aspects of people's lives, social interactions, and work, but this does not mean that it is a 100% good thing. Although the comprehensive application of Internet of Vehicles technology has brought a lot of data and information to the auto insurance industry, if people cannot effectively use these large amounts of data and information, it will not be of any effective help to the development of Internet of Vehicles insurance. And it is likely to hinder the future development of Internet of Vehicles insurance. Therefore, in order to effectively utilize these massive amounts of data information, the Internet of Vehicles insurance industry must have efficient analysis capabilities and the ability to tap high-tech in terms of data analysis as a basis, and fully consider the future development trend of Internet of Vehicles insurance.(Tang and Kang 2019; Xu 2018; Zhou et al. 2018)

With the advent of economic globalization, my country's economy and technology have also developed rapidly. Under the opportunity driven by big data, the Internet of Vehicles insurance model has also encountered unprecedented problems, that is, the challenge of effective innovation of Internet of Vehicles insurance. In this article, based on the preliminary research on Internet of Vehicles insurance driven by big data, it mainly defines four variables: profit model as the dependent variable, pricing model and big data as the independent variable, and technological innovation as the intermediary variable. And the positive correlation between the four variables is tested by linear regression analysis and correlation analysis.

The profit model refers to the division of the company's income structure, cost structure, and corresponding target profit according to stakeholders. Profit model is one of the important research objects of management. The profit model is to identify and manage the value of business elements and find profit opportunities in the

business elements. That is, a systematic method to explore the sources of corporate profits, production processes and output methods.

The pricing model of the Internet of Vehicles insurance is based on the current vehicle and human-related factors to query the corresponding basic risk rate and basic premium from a given rate table. Through the risk assessment of driving behavior, the driving score model is used to obtain the driving score. And manage the score and the rate adjustment coefficient to calculate the rate adjustment coefficient part. Finally, the basic rate is affected by the rate adjustment coefficient, and finally the premium price is discounted for drivers with good driving behavior, and the price is increased for drivers with poor driving behavior.(Zhou et al. 2018)

The concept of big data is developed with the development of practice, and the understanding of big data is also constantly developing. The emergence of big data has become another disruptive technological change in the IT industry after cloud computing and the Internet of Things.

Technological innovation refers to the innovation of production technology, including the development of new technologies or the application of existing technologies. Science is the source of technology, and technology is the source of industry. Technological innovation is based on the discovery of scientific principles, while industrial innovation is mainly based on technological innovation.(Tang and Kang 2019) This study first puts forward the research questions and research goal, defines the four variables and collects and sorts out the relevant preliminary research results. And collect and sort out the literature as the theoretical basis of this article. Based on the effective analysis results, it summarized and put forward effective suggestions.

Problem Statement

With the rapid development of network technology, it is easier for some young people born in the 80s and 90s to use Internet of Vehicles insurance for open personal privacy than middle-aged and elderly people. The Internet of Vehicles insurance involves the collection of some private information such as vehicle driving behavior, and middle-aged and elderly people will have varying degrees of resistance. For the Internet of Vehicles insurance to be better promoted, the key to all private car owners is to provide relatively substantial premium discounts so that private car owners can better accept Internet of Vehicles insurance. But even so, there are still many problems in pricing models, big data collection and processing, and the Internet of Vehicles industry chain.(Xu 2018)

LITERATURE REVIEW

Definition

The profit model refers to the income structure, cost structure and corresponding target profit of an enterprise divided by stakeholders. In management, the profit model

is one of the important research objects. The profit model is to identify and manage the value of the business elements of a company, and to find profit opportunities in the business elements, that is, a systematic method to explore the sources of corporate profits, production processes and output methods. There is also a view that it is an organizational mechanism and business model structure that realizes value creation, value acquisition, and benefit distribution formed by the integration of the resources of enterprises and related stakeholders. (Alam et al 2015)

In this article, the profit model is the dependent variable, the pricing model and big data are the independent variables, and technological innovation is the intermediate variable. Design a questionnaire survey around these four variables and sort out the results of the questionnaire survey. Use SPSS data analysis software to study the positive correlation between these four variables. There are three influencing factors in the profit model. Due to the different influencing factors, the positive correlation is also different.

Previous research

In the Internet of Vehicles business model, since Internet of Vehicles services are still in the early stage of development in my country, most of the profit models are based on the practices of foreign OEM car manufacturers and are spontaneously summarized through practice. At present, most of the Internet of Vehicles services have a period of free B2B service. Generally, depending on the OEM car manufacturer, the end user is given a free service period of 4-6 years. During this period, users can enjoy a longer period of free service if they do not change their vehicle and mobile phone numbers. After the B2B service free period expires, if the user still wants to continue to use the Internet of Vehicles service, the end user needs to sign a service renewal contract with the original Internet of Vehicles service operator and need to pay a certain service fee. This period is called the B2C service charging period. These service fees usually consist of six parts. That is, vehicle communication module communication traffic fee, system usage fee, service operation fee, content resource usage fee, and the manpower, material and financial resources invested by other service providers and OEM car manufacturers to continuously improve products and services. Today, profitable entities include traditional dealers, OEM car manufacturers, Internet of Vehicles service operators, car terminal manufacturers, content providers, and other beneficiaries.

Based on studying foreign advanced research concepts, domestic scholars have developed the theory of the components of the profit model based on my country's national conditions. Guo Jinlong and Lin Wenlong (2005) pointed out that the profit model consists of three elements, namely the profit generation process, the profit source path and the profit output form. The enterprise finally makes profits through coordination and matching of the three elements. Xiang Guopeng et al. (2011) further proposed that the research on profit model should clarify the source, generation process and output form of the company's profit, and there should be an updated

mechanism. Zhou Li (2014) believes that the profit model is the basis for companies to maintain profitability and corporate development. Its constituent elements must not only reflect the main behavior and core elements of the enterprise, but also be easy to implement, universal and adaptable. According to this principle, companies usually choose profit sources, profit leverage, profit barriers and profit objects as the basis for analyzing profit models.

Liu Hong et al. (2014) proposed that from the perspective of the profit process, the profit model is mainly composed of four elements: customers, content, platform, and profit. Pei Zhengbing (2015) added two new elements of "profit environment" and "customer value" based on the "four elements" view of the previous profit model. Form a profit model element system centered on customer value, profit environment, profit point, profit leverage, profit barrier, profit maker and profit source. Nie Qiaona (2016) believes that the profit model has five elements, including profit point (customer value), profit source (revenue source), profit leverage (value chain), profit barrier (core competitiveness) and profit target (target customer).

Sun Xiaoyang et al. (2017) believe that the profit model, also known as the business model, is a profit structure gradually formed during the growth of a company. By analyzing the five elements of profit source, profit object, profit lever, profit barrier and profit point, we can explore the unique profit formation and output process of an industry. Li Chengjia et al. (2018) believed that the profit model contains four basic components: profit point, profit lever, profit barrier and profit source based on the comprehensive theory of existing profit model.

The Internet of Vehicles is the application of the Internet of Things technology in the intelligent transportation system, which has attracted the attention of relevant research institutions at home and abroad. Some scholars have also begun to conduct a series of studies on the Internet of Vehicles. Wang Jianqiang, Li Shiwei and Zeng Junwei (2011) explored the development model of the Internet of Vehicles. They believe that the industry alliance will be the core business model of the Internet of Vehicles, and the key to the industry alliance based on the industry chain is openness, cooperation, and win-win. Wang Jie and Jiang Yin (2012) conducted a strategic analysis of the IoV industry chain and operator cooperation and analyzed the important role and technical requirements of operators in IoV services. Rao Yu, Dai Cuiqin, and Huang Qiong (2013) studied the key technologies and connectivity of the Internet of Vehicles and analyzed the connectivity of vehicle-to-vehicle communication in various situations.

At present, most domestic researches are mainly focused on the Internet of Vehicles system architecture and Internet of Vehicles industry planning, and there is even less research on Internet of Vehicles services (Pei 2018). The reason may be that the industry still believes that the Internet of Vehicles is a traditional component system of automobiles. In fact, the Internet of Vehicles not only collects, processes, and analyzes various in-vehicle equipment and sensor information, but also uses this information for service applications to satisfy various safety, entertainment, and

convenient services for car owners. The development of the Internet of Vehicles in China requires research on the back-end application model and profit model. According to the current development situation, such research is very necessary and urgent.

Wang Yingluo (2010) based on the impact of the financial crisis on Chinese industries and the traditional Chinese manufacturing development model of high energy consumption, high pollution, low added value, and low labor efficiency, proposed a service-oriented manufacturing model that integrates manufacturing and service industries. Li Gang, Sun Linyan and Li Jian (2009) studied the origin of service-oriented manufacturing, the concept of service-oriented manufacturing and the mechanism of value creation. Yang Shuanghui (2010) believes that the current auto value chain is fragmented, manufacturing and sales and after-sales services are disconnected, the service system is not sound, and value-added services are not playing their due value. Jin Ningyun and Liu Chaoming (2009) believe that in the entire automobile industry, the value-added capacity and potential of automobile services are much higher than those of automobile manufacturing. The value-added capability of automobile services is mainly manifested in that the value-added chain can extend unlimitedly according to the needs of customers.

There are fewer researches on the profit model of related auto value-added services. In the Internet field, Li Chen (2011) studied the business model of Internet enterprise basic platform plus value-added services. It is believed that in the bilateral market, the business models of Internet companies are the same, that is, they all adopt business models based on value-added services. It provides a reference for the development of automobile value-added services, but, the research on value-added services of self-owned brand automobiles is still in the initial stage of exploration. In summary, the industry has little research on value-added services for connected car services and profit models. This article combines the two areas of delivery to conduct comprehensive research and discusses the Internet of Vehicles as an important part of value-added services. Studying its profit model, helping automakers transform into service providers, increasing core competitiveness for auto factories, and maintaining long-term customer stickiness will play a significant role in marketing (Xu 2018).

METHODOLOGY

Research Design

In the field of vehicle insurance, there are two main bodies, the target insurance company and the insurance customer. In this mutual relationship, it should be said that the insurance company occupies a leading position. The adoption of new technologies, the design and launch of new products, the transformation of new insurance services and operating models should all be led by insurance companies. In the auto insurance market, it is a very important factor in motor vehicle insurance. Although it is the

opposite side of the product, the identity of the consumer's insurance customer is very important.

From a certain perspective, even if insurance companies introduce various tricks, how novel and innovative business models, assuming that such products are not recognized and accepted by most customers, they will often only result in futile results. Therefore, in the process of introducing UBI products and services, it is necessary for us to clarify their understanding and attitudes and the most direct customer survey information on the questionnaire survey of insurance practitioners and Internet of Vehicles insurance. Deduct the acceptance and enthusiasm of insurance companies and the entire insurance industry for connected car insurance products, to further understand their various views on UBI products. And make certain judgments on the positioning and development of various value-added services of Internet of Vehicles insurance products, and then provide data support. Analyze such a question: Does the domestic vehicle networking insurance have enough existence possibility and development space. The accuracy of the information provided by the overly complicated questionnaire is actually relatively low. In addition, as a new thing, the Internet of Vehicles insurance is still a blank in China, and even professionals know less about it. The main purpose of our survey is to clarify the target population’s macroscopic view and acceptance of connected car insurance products, so our questionnaire design for this survey is relatively simple. It mainly involves the respondents' understanding, acceptance and recognition of connected car insurance products.

Population / Sampling / Unit of Analysis

A very targeted questionnaire survey was conducted among relevant personnel of major domestic insurance companies, insurance-related financial institutions and Internet of Vehicles companies, and insurance customers.

In this survey, we selected middle-level managers and insurance users of major domestic insurance companies as the main survey subjects. Including middle-level managers at the head office level of each insurance company, senior executives and middle-level managers at the branch level, and insurance customers. We believe that the actual collection of effective questionnaires can basically and truly reflect the views and attitudes of the current major domestic insurance companies' management personnel and insurance users on the issues we care about.

FINDINGS & DISCUSSIONS

Profile of Respondents

The respondents participating in the survey are distributed in 11 provinces, basically covering most of the cities where Internet of Vehicles insurance is distributed.

Table 4-1 Distribution of survey respondents by province

Province	Subtotal	Scale
Guizhou	25	8.3%
Beijing	15	5%
Zhejiang	26	8.7%
Liaoning	22	7.3%
Shanxi	15	5%
Shanghai	23	7.7%
Shaanxi	31	10.3%
Sichuan	17	5.7%
Guangdong	35	11.7%
Jiangxi	40	13.3%
Chongqing	12	4%
Hainan	15	5%
Tianjin	24	8%
Number of valid entries in this question	300	100%

The survey questionnaires are distributed according to the provinces of the respondents: Guizhou Province 25 accounts for 8.3%, Beijing 15 accounts for 5%, Zhejiang 26 accounts for 8.7%, Liaoning 22 accounts for 7.3%, and Shaanxi 15 Shares accounted for 5% of the proportion, 23 from Shanghai 7.7%, 31 from Shaanxi 10.3%, 17 from Sichuan 5.7%, 35 from Guangdong 11.7%, and 40 from Jiangxi 13.3%, Chongqing 12 accounts for 4%, Hainan 15 accounts for 5%, and Tianjin 24 accounts for 8%. Judging from the distribution of the questionnaire according to the province where the respondents are located, this questionnaire is representative.

4.1.2 Companies distribution of respondents

There are 7 insurance companies participating in this survey, which basically cover the major companies involved in Internet of Vehicles insurance. The questionnaire is representative. See the table below for details:

Table 4-2 Sources companies of questionnaire

Company Name	Subtotal
China Life Insurance	45
Ping An Life	50
China Life Insurance	65
Xinhua Insurance	30
Pacific Life	35
Taikang Life	35
Sunshine Life	40

The survey questionnaires are distributed according to the source of the company as follows: China Life 45 accounts for 15%, Ping An Life 50 accounts for 16.7%, China Life Insurance 65 accounts for 21.7%, and Xinhua Insurance 30 accounts for 10%, Life Insurance 35 accounts for 11.6%, Taikang Life 35 accounted for 11.6%, and Sunshine Life 40 accounted for 13.3%. Judging from the distribution of questionnaires by enterprises, this questionnaire is representative.

4.1.3 Educational background distribution of respondents

Table 4-3 Educational background of respondents

Options	Subtotal	Scale
PhD	43	14.3%
Master's degree	98	32.7%
Undergraduate	159	53%
Number of valid entries in this question	300	100%

The questionnaire is distributed according to the educational background of the respondents: doctors 43 accounted for 14.3%, masters 98 accounted for 32.7%, and undergraduates 159 accounted for 53%. Judging from the distribution of the questionnaire according to the educational background of the respondents, this questionnaire is representative.

4.1.4 Gender distribution of respondents

Table 4-4 Gender of respondents

Options	Subtotal	Scale
Male	187	62.3%
Female	113	37.7%
Number of valid entries in this question	300	100%

The questionnaire is distributed according to the gender of the respondents as follows: males 187 accounts for 62.3%, and females 113 accounts for 37.7%. Judging from the distribution of the questionnaire according to the educational background of the respondents, this questionnaire is representative.

4.1.5 Position level distribution of respondents

Table 4-5 Position level of respondents in the questionnaire

Options	Subtotal	Scale
Senior management	33	11%
Middle manager	57	19%
Grassroots managers	75	25%
Grassroots staff	135	55%
Number of valid entries in this question	300	100%

The questionnaire is distributed according to the job level of the interviewees as follows: senior managers 33 accounting for 11%, middle managers 57 accounting for 19%, grassroots managers 75 accounting for 25%, grassroots staff 135 accounting for 55%. Judging from the distribution of the questionnaire according to the job level of the respondents, this questionnaire is representative.

Age distribution of respondents

Table 4-6 Age distribution of respondents in the questionnaire

Options	Subtotal	Scale

25～35	96	32%
36～45	153	51%
46～55	51	17%
Number of valid entries in this question	300	100%

The questionnaires are distributed according to the age of the respondents as follows: 96 customers from 25 to 35 years old account for 32%, 153 customers from 36 to 45 years old account for 51%, and 51 customers from 46 to 55 years old account for 17%. From the perspective of the age distribution of the respondents in the questionnaire, this questionnaire is representative.

The Relationship between Pricing Model and Technological Innovation

Analysis

Correlative analysis of the questionnaire data on pricing models and technological innovation:

Pearson related-standard format					
	Mileage and time	Speeding times	Number of rapid acceleration and deceleration	Number of sharp turns	Number of violations
Product innovation ability	0.122	0.071	0.137	0.182	0.127
Information data ability	0.655**	0.291	0.377	0.574**	0.389
Digital innovation capability	0.538*	0.628**	0.572**	0.640**	0.511*
Market innovation environment	0.33	0.386	0.602**	0.33	0.499*
* $p<0.05$ ** $p<0.01$					

Correlation analysis is used to study the relationship between quantitative data, whether there is a relationship, and how close the relationship is.

First: specifically analyze the relationship between each Y and each X, whether there is a significant relationship between Y and X.

Second: Then analyze whether the correlation is positive or negative. The size of the correlation coefficient can also be used to indicate the closeness of the relationship.

Third: summarize the analysis.

Before correlation analysis, scatter plots can be used to observe and display the relationship between data. You can also use normal graphs to observe and display the normal distribution of data.

As can be seen from the above table, the use of relevant analysis to study the mileage and time, the number of speeding, the number of rapid accelerations and decelerations, the number of sharp turns, and the number of violations are combined with product innovation capabilities, information data capabilities, digital innovation capabilities, and market innovation environments. The correlation between the 4 items. Use Pearson correlation coefficient to indicate the strength of the correlation. Specific analysis shows that:

The mileage and time, the information digitization capability, and the digital innovation capability are all significant. The correlation coefficient values are 0.655 and 0.538, all of which are greater than 0. It means that there is a positive correlation between driving mileage and time, information digitization capability and digital innovation capability.

All the items between the number of speeding and digital innovation ability are significant, the correlation coefficient values are 0.628, and all are greater than 0. It means that there is a positive correlation between the number of speeding and digital innovation ability.

The number of rapid accelerations and decelerations, digital innovation capability, and market innovation environment are all significant. The correlation coefficient values are 0.572 and 0.602, all of which are greater than 0. It means that there is a positive correlation between the number of rapid accelerations and decelerations, digital innovation capabilities and market innovation environment.

The number of sharp turns, the ability of information digitization, and the ability of digital innovation are all significant. The correlation coefficient values are 0.574 and 0.640 respectively, all of which are greater than 0. It means that there is a positive correlation between the number of sharp turns and the ability of information data and digital innovation.

The number of violations, digital innovation capability, and market innovation environment are all significant. The correlation coefficient values are 0.511 and 0.499 respectively, all of which are greater than zero. It means that there is a positive correlation between the number of violations, digital innovation capability and market innovation environment. (Alam et al. 2015)

Conclusion

Research and discussion of current domestic and foreign scholars mainly focus on the research status of the marketization of auto insurance rates, the determination of auto insurance rates and the integrated development of Internet of Vehicles insurance, and the application status of the integrated development of "Internet of Vehicles + car insurance". Foreign scholars pointed out that the traditional auto insurance rate pricing model tends to make insurance companies in a passive position (Tang and Kang 2019). In the face of various risks, it is necessary to maintain a uniform rate, which makes the problems of adverse selection and moral hazard very prominent, and the operating conditions of auto insurance companies are very severe (Li, 2018). On this basis, the domestic and foreign insurance markets have successively begun market-oriented reforms of auto insurance rates to study more scientific and reasonable rates (Pei 2018). Scholars at home and abroad have done a lot of research and found that the risk loss of different ages, genders, and environments is different. The study also concluded that traditional car insurance rates did not reflect the external costs of accidents, making the calculation of insurance premiums lacking actuarial fairness, and that all risk factors should be considered. Including drivers, vehicles and driving environment should be included in the rate calculation system.

Domestic scholars are also actively studying how to make auto insurance rates more scientific and reasonable. The study believes that four categories of factors should be considered in car insurance rates, namely people, cars, geography, and other factors. It is also believed that the "human factor" of these four elements is especially important, and the main risk factors of "human factor" should be subdivided. It is concluded that factors such as drivers' driving habits and driver's eyesight should be introduced into the calculation system of car insurance rates. At the same time, domestic scholars also explored the opportunities brought by the development of the Internet of Vehicles technology to auto insurance by studying the business status of domestic and foreign commercial auto insurance and the problems and opportunities they are facing. In the car insurance market, we innovate the service methods of insurance companies and reduce the adverse selection and moral hazard in the car insurance market.

The Internet of Vehicles insurance collects the driving behavior of drivers by using Internet of Vehicles technology. Using big data mining technology, different driving behaviors, driving habits and driving environments can be scored. The risk level is obtained according to the driving score, the safety level is determined according to the risk level, the rate adjustment coefficient is further determined, and the insurance premium is calculated according to the coefficient. Internet of Vehicles insurance can effectively identify different driving behaviors through premium pricing. This is the innovative manifestation of Internet of Vehicles insurance compared to traditional insurance, and it is also a manifestation of the scientific, fair, and accurate pricing of car insurance.

The Internet of Vehicles insurance is the auto insurance product in the Internet era. Its main idea is based on the actual driving time, driving habits, and driving behavior of the vehicle. The determination of this differentiated premium rate is based on the detection of consumer behavior. This shifts the premium price from the previous focus on vehicle data to vehicle data and driving behavior data, making auto insurance pricing more fair, reasonable, scientific and precise. This article is mainly under the influence of the vehicle insurance thought in the era of the Internet of Vehicles, using the related technologies of the Internet of Vehicles to collect vehicle attributes and status information of the owner during the driving process, and analyze the driving behavior of the driver on this basis (alam et al 2015). The safety level of driving behavior is scored through related algorithms, which lays the foundation for the differentiation of the UBI rate of the Internet of Vehicles insurance and the personalization of services (Abe 2018; Zhou et al. 2018; Pei 2018).

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