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Technological management framework for gas chemical industry using IOT

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Abstract

Important inputs to this research will be IOT technology and innovative trends in IOT technology affecting safety management in the petrochemical industry in China. Safety management in the petrochemical industry may help to minimize the risk of business operations and reduce the negative impact of business production and operations on the environment. The inputs also include demographic data of the experts and respondents such as their age, gender, occupational characteristics and job titles. The outcome of this study is a technology management framework for IOT as an innovation for safety management in China's petrochemical industry. The results of this study will provide useful suggestions for the healthy development of China's petrochemical industry, as well as enable the construction of an environmentally friendly corporate development strategy that reduces carbon emissions and realizes a sustainable development strategy for health and safety. To address the above issues, this project proposes to combine industrial Internet of Things with big data mining, to support safety and production management with science and technology and informationization, and to improve the basic capacity of informationization.

Keywords: technological management, gas chemical, internet of things

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1. Introduction

In the contemporary digital era, the Internet of Things (IoT) has emerged as a revolutionary technology, weaving a network of interconnected devices that communicate and exchange data, fostering a smarter, more efficient world. IoT technology has found applications across diverse sectors, from healthcare and agriculture to manufacturing and supply chain management, demonstrating its versatility and transformative potential. Since 2016, The Central Committee of the Communist Party of China, The State Council, the Ministry of Emergency Management and other relevant government departments continue to issue the Opinions on Implementing the Work Guide to Curb Major and Major Accidents and Building a Dual Prevention Mechanism, the Opinions on Promoting the Reform and Development of Work Safety, the three-year Action Plan for the Special Rectification of National Work Safety, and the Industrial Internet + Work Safety Action Plan (2021-2023). "And other documents, showing the high level of concern for enterprise security at the national level.

Accidents involving hazardous chemicals are common in production, storage, transportation and chemical parks at home and abroad. Sinopec Group, full name of China Petroleum and Chemical Corporation Limited, is a large petroleum and petrochemical enterprise group, with a wide range of businesses, including investment, oil and gas, petroleum engineering, new energy and so on. At present, Sinopec Group is the largest supplier of refined oil and petrochemical products in China, and also has an important position in the international petrochemical market. As a petrochemical group company, there are all kinds of dangers in production, circulation, sales and other fields, which need to be solved by technical means.

In response to the above problems, this topic proposes the combination of industrial Internet of Things and big data mining to support safety production management with science and technology and information technology, and improve the basic ability of information technology. The application of the Internet of Things, mobile Internet, big data and artificial intelligence in the production and transportation of hazardous chemical enterprises is used to intelligently collect the hazardous chemical production monitoring data of chemical enterprises, and build a safety production monitoring and early warning platform for chemical parks and government authorities. The platform is conducive to enterprise cross-departmental cross-level network interconnection and data sharing, relying on the big data platform, further analysis of data, provide scientific and technological support for production safety management, and promote the transformation of hazardous chemical enterprises from traditional management to modern intelligence.

Statement of the Problem - The study focuses on the application of the IOT technology management framework in the Chinese oil industry as a disruptive innovation in China. Specifically, the study seeks to answer the following questions:

- What is the demographic profile of the expert respondents in terms of their Age, Gender, Educational level, Area of expertise, and Years of experience in the industry
- What are the technologies that reduce business risks in China's petrochemical industry?
- Which technologies increase the daily operational risk of the Chinese petrochemical industry?
- What are the disruptive barriers to the day-to-day operations of the Sinopec industry?
- What technology framework can be developed for China's petroleum industries to be considered a disruptive innovation?
- Which of China's petroleum industries would be likely to generate benefits using this framework? What

recommendations can be drawn from this study to reduce business risks in the petrochemical industry?

Significance of the Study - The focus of this study is to develop a technological framework for safety management in the petrochemical industry as a disruptive innovation in China. It examines technology-driven innovations in safety management that could contribute to its disruptive potential. These innovations, brought about by the increasing convergence of cloud, mobile and the Internet of Things (IOT), are considered to be "...... the next indispensable consumer technology for the next three years" (Matuszak, Rios, Hanley, & Wright, 2016). In addition to this, Deloitte (Deloitte, 2017) identifies big data, predictive analytics, artificial intelligence, virtual and augmented reality and blockchain as digital disruptors in the retail sector. In addition to being an identification of the technological factors that affect potential risks in the Chinese petrochemical industry, the study also covers the strategies and functions of technology-driven safety management. It examines the different challenges that must be addressed by the petrochemical industry's production, supply and marketing. These challenges are categorised into political and legal, economic, social and technological factors.

In this study, experts from petrochemical industry workers, petrochemical industry consumers, government agencies and higher education and research institutes were selected to identify and prioritise the factors that contribute to increased risk in the petrochemical industry. The sectors that will benefit the most from this study are the following: Enterprises engaged in the petrochemical industry. With the development of Internet of Things and data mining technology in China, Internet of Things monitoring data has important value for enterprise production safety. How to collect and analyze these monitoring data in real time and use information technology to ensure enterprise production safety is a concern of the industry. The new safety technology is very important for the production of chemical enterprises, and the use of the industrial Internet of things, such as "connecting things", data collection and intelligent analysis, will effectively improve the work efficiency of chemical enterprises and ensure production safety. Government authorities. This study provides a safety production monitoring and early warning platform for the government authorities to make up for the deficiencies in the information monitoring and early warning of hazardous chemical enterprises.

Scope and limitations - The focus of this study is to develop a technical framework for safety management in the petrochemical industry as a disruptive innovation in China. It examines technology-driven innovations in security management that may contribute to its disruptive potential. These innovations, brought about by the increasing convergence of cloud, mobile and the Internet of Things (iot), are considered "... The next indispensable consumer technology in the next three years "(Matuszak, Rios, Hanley, & Wright, 2016). In addition to this, Deloitte (2017) has identified big data, predictive analytics, artificial intelligence, virtual and augmented reality, and blockchain as digital disruptors in the retail space. In this study, we selected experts from people working in the petrochemical industry, consumers in the petrochemical industry, government agencies and universities and research institutes to identify and prioritize the factors that contribute to the increased risk in the petrochemical industry. This study is limited to technology driven innovation, applied in the petrochemical industry in a Chinese context. Under the current energy system, both foreign and local, they are being looked at by the average consumer, government agencies and others.

2. Methodology

Research Design - The questionnaire method is a research method in which the researcher uses a uniform, rigorously designed questionnaire to collect data on the subject's cantonal, physical and behavioural characteristics. Its most important feature is that it is generally highly standardised, it is strictly based on a uniformly designed and fixed structured questionnaire, and it allows a large amount of information to be collected in a relatively short period of time. However, it is more difficult to design. The questionnaire method is also the predominant research method used to collect data for this study. As a company-level study, the data required for this paper, including business risk metrics for the Chinese petrochemical industry, could not be obtained from industry or company public sources, so a questionnaire was used to collect the data. A structured questionnaire was used as the survey instrument to avoid ambiguous answers by standardising the answers and to make it easy to complete.

Respondents of the Study - The respondents of this study were mainly working employees in the Chinese petrochemical industry including group employees, sales branch employees, logistics employees as well as general consumers and other stakeholders. 467 workers and stakeholders in the petrochemical industry in China were identified as the subjects for the questionnaire.

Data Collection Instrument - This study follows the basic principles of questionnaire design. Firstly, based on the overall theoretical framework of the study and the structural dimensions of the research variables, the questionnaire "Survey on the Application of IOT Technology in China's Petrochemical Industry" with high reliability and validity is developed. The quantitative relationship between IOT technology and safety management in China's petrochemical industry and other research variables, and the preliminary mechanism of the relationship between IOT technology and safety management in China's petrochemical industry. It also included a 5-point 'strongly disagree' to 'strongly agree' Likert-type scale on which respondents chose the issues that might be exposed in the production and operation aspects of the petrochemical industry in China based on their own work.

Statistical Treatment of Data - Data analysis methods include mathematical and statistical analysis of quantitative data and qualitative data analysis of qualitative data. The mathematical and statistical analysis method is based on the data from the questionnaire survey, and the mathematical and statistical analysis of the initial data is used to present the internal logical connection of the data to achieve the purpose of the questionnaire survey. Different mathematical and statistical methods such as factor analysis, correlation analysis, regression analysis and structural equation modelling were used in this study based on different research purposes, and the statistical software included SPSS22.0 and AMOS21.0 statistical software. Qualitative data analysis methods are also varied and usually fall into three categories: firstly, research notes; secondly, classification techniques such as coding and thematic analysis; and thirdly, linking techniques such as narrative analysis. In this study, coding and thematic analysis techniques were mainly used.

3. Result and discussion

Descriptive Statistics for Safety Knowledge Questions - Continuing the descriptive analysis of each question item of the Safety Knowledge variable, it was found that the distribution of the mean of each question was 3.27-3.34 and the distribution of the standard deviation was 1.064-1.089, which indicated that the overall range of agreement was within the range of agreement, and the distribution of the agreement rate was 44.27-46.70%, which indicated that the sample group's mastery of the Safety Knowledge is at a high level.

Table 1
Safety Knowledge dimension item statistics

Item	Option	Frequency	Percent	Mean	SD	% Agreement
SK1	Strongly disagree	18	3.96	3.31	1.089	46.7
	Disagree	101	22.25			
	Neutrality	123	27.09			
	Agree	147	32.38			
	Strongly Disagree	65	14.32			
SK2	Strongly disagree	17	3.74	3.34	1.065	45.38
	Disagree	86	18.94			
	Neutrality	145	31.94			
	Agree	137	30.18			
	Strongly Disagree	69	15.2			
SK3	Strongly disagree	22	4.85	3.27	1.067	44.71
	Disagree	91	20.04			
	Neutrality	138	30.4			
	Agree	147	32.38			
	Strongly Disagree	56	12.33			

continued

SK4	Strongly disagree	22	4.85	3.3	1.064	45.82
	Disagree	86	18.94			
	Neutrality	138	30.4			
	Agree	151	33.26			
	Strongly Disagree	57	12.56			
SK5	Strongly disagree	22	4.85	3.27	1.066	44.27
	Disagree	91	20.04			
	Neutrality	140	30.84			
	Agree	145	31.94			
	Strongly Disagree	56	12.33			
SK7	Strongly disagree	21	4.63	3.31	1.083	44.94
	Disagree	87	19.16			
	Neutrality	142	31.28			
	Agree	137	30.18			
	Strongly Disagree	67	14.76			

Descriptive Statistics for Safety Attitude Questions - Continuing the descriptive analysis of the individual questions of the Safety Attitude variable, it was found that the distribution of the mean of each question was 3.29-3.41 and the distribution of the standard deviation was 1.017-1.097, which indicated that the overall was within the range of agreement, and the distribution of the rate of agreement was 44.27-50.88 per cent, which indicated that the sample group had a high regard for Safety Attitude .

Table 2

Safety Attitude dimension item statistics

Item	Option	Frequency	Percent	Mean	SD	% Agreement
SA1	Strongly disagree	14	3.08	3.30	1.041	41.85
	Disagree	92	20.26			
	Neutrality	158	34.8			
	Agree	126	27.75			
	Strongly Disagree	64	14.1			
SA2	Strongly disagree	17	3.74	3.41	1.055	50.88
	Disagree	78	17.18			
	Neutrality	128	28.19			
	Agree	163	35.9			
	Strongly Disagree	68	14.98			
SA3	Strongly disagree	18	3.96	3.34	1.049	46.7
	Disagree	82	18.06			
	Neutrality	142	31.28			
	Agree	150	33.04			
	Strongly Disagree	62	13.66			46.10
SA4	Strongly disagree	16	3.52	3.37	1.017	
	Disagree	75	16.52			
	Neutrality	144	31.72			
	Agree	161	35.46			
	Strongly Disagree	58	12.78	3.35	1.059	
SA5	Strongly disagree	15	3.3			44.27
	Disagree	84	18.5			
	Neutrality	154	33.92			
	Agree	128	28.19			
	Strongly Disagree	73	16.08			
SA7	Strongly disagree	16	3.52	3.29	1.02	43.83
	Disagree	88	19.38			
	Neutrality	151	33.26			
	Agree	146	32.16			
	Strongly Disagree	53	11.67			
SA8	Strongly disagree	23	5.07	3.29	1.097	44.28
	Disagree	90	19.82			
	Neutrality	140	30.84			
	Agree	134	29.52			
	Strongly Disagree	67	14.76			

Descriptive Statistics for Hazard Reduction Capability Questions - Continuing the descriptive analysis of each question item of the Hazard Reduction Capability variable, it was found that the distribution of the mean of each question was 3.30-3.43 and the distribution of the standard deviation was 1.119-1.162, which indicated that the overall range of agreement was within the range of agreement, and the distribution of the agreement rate was 47.36-54.85%, which indicated that the sample group was at a high level of mastery of the Hazard Reduction Capability is at a high level of mastery.

Table 3

Hazard Reduction Capability dimension item statistics

Item	Option	Frequency	Percent	Mean	SD	% Agreement
HR1	Strongly disagree	34	7.49	3.31	1.162	47.36
	Disagree	80	17.62			
	Neutrality	125	27.53			
	Agree	140	30.84			
	Strongly Disagree	75	16.52			
HR2	Strongly disagree	29	6.39	3.30	1.124	44.71
	Disagree	79	17.4			
	Neutrality	143	31.5			
	Agree	131	28.85			
	Strongly Disagree	72	15.86			
HR3	Strongly disagree	25	5.51	3.37	1.143	49.56
	Disagree	88	19.38			
	Neutrality	116	25.55			
	Agree	145	31.94			
	Strongly Disagree	80	17.62			
HR4	Strongly disagree	25	5.51	3.43	1.119	54.85
	Disagree	79	17.4			
	Neutrality	101	22.25			
	Agree	175	38.55			
	Strongly Disagree	74	16.3			

Descriptive statistics for Safety Compliance questions - Continuing the descriptive analysis of each question item of the Safety Compliance variable, it was found that the distribution of the mean of each question was 3.22-3.32 and the distribution of the standard deviation was 1.063-1.097, which indicates that the overall range of agreement is within the range of agreement, and the distribution of the rate of agreement was 39.21-54.85%, which indicates that the sample group is in strong Agree.

Table 4

Safety Compliance dimension item statistics

Item	Option	Frequency	Percent	Mean	SD	% Agreement
SC1	Strongly disagree	18	3.96	3.27	1.079	40.53
	Disagree	95	20.93			
	Neutrality	157	34.58			
	Agree	114	25.11			
	Strongly Disagree	70	15.42			
SC2	Strongly disagree	20	4.41	3.24	1.08	40.53
	Disagree	99	21.81			
	Neutrality	151	33.26			
	Agree	120	26.43			
	Strongly Disagree	64	14.1			
SC3	Strongly disagree	23	5.07	3.28	1.094	42.73
	Disagree	90	19.82			
	Neutrality	147	32.38			
	Agree	127	27.97			
	Strongly Disagree	67	14.76			
SC4	Strongly disagree	29	6.39	3.22	1.097	39.21
	Disagree	84	18.5			
	Neutrality	163	35.9			
	Agree	115	25.33			
	Strongly Disagree	63	13.88			

continued

SC5	Strongly disagree	27	5.95	3.31	1.086	46.04
	Disagree	77	16.96			
	Neutrality	141	31.06			
	Agree	148	32.6			
	Strongly Disagree	61	13.44			
SC7	Strongly disagree	24	5.29	3.32	1.081	45.6
	Disagree	78	17.18			
	Neutrality	145	31.94			
	Agree	142	31.28			
	Strongly Disagree	65	14.32			
SC8	Strongly disagree	19	4.19	3.32	1.063	42.73
	Disagree	79	17.4			
	Neutrality	162	35.68			
	Agree	124	27.31			
	Strongly Disagree	70	15.42			
SC10	Strongly disagree	24	5.29	3.30	1.084	43.39
	Disagree	81	17.84			
	Neutrality	152	33.48			
	Agree	131	28.85			
	Strongly Disagree	66	14.54			

Descriptive statistics for Active Safety questions - By continuing the descriptive analysis of each question item of the Active Safety variable, it was found that the distribution of the mean of each question was 3.27-3.56 and the distribution of the standard deviation was 1.026-1.086, which indicated that the overall was in the range of agreement, and the distribution of the rate of agreement was 42.29-52.21%, which indicated that the sample group was in a high level of mastery of Active Safety.

Table 5

Active Safety dimension item statistics

Item	Option	Frequency	Percent	Mean	SD	% Agreement
AS1	Strongly disagree	21	4.63	3.35	1.056	44.94
	Disagree	71	15.64			
	Neutrality	158	34.8			
	Agree	137	30.18			
	Strongly Disagree	67	14.76			
AS2	Strongly disagree	24	5.29	3.28	1.056	46.25
	Disagree	85	18.72			
	Neutrality	135	29.74			
	Agree	160	35.24			
	Strongly Disagree	50	11.01			
AS3	Strongly disagree	18	3.96	3.29	1.077	42.29
	Disagree	93	20.48			
	Neutrality	151	33.26			
	Agree	123	27.09			
	Strongly Disagree	69	15.2			
AS4	Strongly disagree	19	4.19	3.27	1.048	42.52
	Disagree	90	19.82			
	Neutrality	152	33.48			
	Agree	136	29.96			
	Strongly Disagree	57	12.56			
AS5	Strongly disagree	17	3.74	3.32	1.026	44.72
	Disagree	81	17.84			
	Neutrality	153	33.7			
	Agree	146	32.16			
	Strongly Disagree	57	12.56			
AS6	Strongly disagree	17	3.74	3.32	1.086	46.26
	Disagree	99	21.81			
	Neutrality	128	28.19			
	Agree	142	31.28			
	Strongly Disagree	68	14.98			

continued

AS8	Strongly disagree	22	4.85	3.27	1.054	45.15
	Disagree	90	19.82			
	Neutrality	137	30.18			
	Agree	154	33.92			
	Strongly Disagree	51	11.23			
AS9	Strongly disagree	18	3.96	3.56	1.048	52.21
	Disagree	43	9.47			
	Neutrality	156	34.36			
	Agree	141	31.06			
	Strongly Disagree	96	21.15			

Descriptive Statistics for Perceived Usefulness Questions - Continuing the descriptive analysis of the Perceived Usefulness variable for each question, it was found that the distribution of the mean of each question was 3.22-3.25 and the distribution of the standard deviation was 0.928-1.003, which indicated that the whole was in the range of agreement, and the distribution of the rate of agreement was 37.00-41.63%, which indicated that the sample group was very agreeable to Perceived Usefulness.

Table 6

Perceived Usefulness dimension item statistics

Item	Option	Frequency	Percent	Mean	SD	% Agreement
PEU1	Strongly disagree	17	3.74	3.22	0.928	37.0
	Disagree	69	15.2			
	Neutrality	200	44.05			
	Agree	132	29.07			
	Strongly Disagree	36	7.93			
PEU2	Strongly disagree	20	4.41	3.25	0.953	41.63
	Disagree	69	15.2			
	Neutrality	176	38.77			
	Agree	155	34.14			
	Strongly Disagree	34	7.49			
PEU3	Strongly disagree	22	4.85	3.22	1.003	41.41
	Disagree	84	18.5			
	Neutrality	160	35.24			
	Agree	149	32.82			
	Strongly Disagree	39	8.59			

Descriptive Statistics for Willingness To Use Questions - By continuing the descriptive analysis of each question item of the Willingness To Use variable, it was found that the distribution of the mean of each question was 3.56-3.61 and the distribution of the standard deviation was 1.110-1.1880, which indicated that the whole was in the range of agreement, and the distribution of the rate of agreement was 53.96-56.83%, which indicated that the sample group's opinion on Willingness To Use was relatively Strong.

Table 7

Perceived Usefulness dimension item statistics

Item	Option	Frequency	Percent	Mean	SD	% Agreement
UI1	Strongly disagree	18	3.96	3.58	1.110	53.96
	Disagree	57	12.56			
	Neutrality	134	29.52			
	Agree	132	29.07			
	Strongly Disagree	113	24.89			
UI2	Strongly disagree	25	5.51	3.56	1.126	55.07
	Disagree	51	11.23			
	Neutrality	128	28.19			
	Agree	145	31.94			
	Strongly Disagree	105	23.13			

continued

UI3	Strongly disagree	24	5.29	3.61	1.143	56.83
	Disagree	52	11.45			
	Neutrality	120	26.43			
	Agree	140	30.84			
	Strongly Disagree	118	25.99			
UI4	Strongly disagree	27	5.95	3.58	1.180	56.83
	Disagree	59	13			
	Neutrality	110	24.23			
	Agree	138	30.4			
	Strongly Disagree	120	26.43			

Related Analysis - Pearson correlation analysis is a common statistical method used to measure the strength and direction of a linear relationship between two variables. Based on the concept of covariance, Pearson correlation analysis is a simple and easy-to-use method of analysing the relationship between quantitative data. It can be analysed to include the relationship between the variables and the degree of strength of the relationship. In this study, the measured variables are all continuous numerical variables, so Pearson correlation analysis was used to analyse the correlation of each variable.

Table 8
Pearson correlation analysis

Variable	1	2	3	4	5	6	7
1 Safety Knowledge	1						
2 Safety Attitude	0.310**	1					
3 Hazard Reduction Capability	0.049	0.037	1				
4 Safety Compliance	0.404**	0.297**	-0.059	1			
5 Active Safety	0.368**	0.373**	0.054	0.434**	1		
6 Perceived Usefulness	0.094*	0.07	-0.104*	0.195**	0.147**	1	
7 Willingness To Use	0.358**	0.305**	-0.260**	0.395**	0.383**	0.356**	1

Note: * $p<0.05$ ** $p<0.01$

From the table above, Pearson correlation analysis was used to investigate the correlation between seven variables: Safety Knowledge, Safety Attitude, Hazard Reduction Capability, Safety Compliance, Active Safety, Perceived Usefulness, and Willingness To Use. Willingness To Use, and Pearson's correlation coefficient was used to indicate the strength of the correlation. The analysis shows that the correlation coefficients between Safety Knowledge and the five variables Safety Attitude, Safety Compliance, Active Safety, Perceived Usefulness, Willingness To Use are all significant ($p<0.05$). The correlation coefficients are 0.310, 0.404, 0.368, 0.094, 0.358, all of which are greater than 0, implying that there is a significant relationship between Safety Knowledge and Safety Attitude, Safety Compliance, Active Safety, Perceived Usefulness, Willingness To Use. Willingness To Use. Meanwhile, the two variables Safety Knowledge and Hazard Reduction Capability do not show significance ($p>0.05$), and the value of the correlation coefficient is close to 0, which means that Safety Knowledge and Hazard Reduction Capability have no correlation.

Regression Analysis - Linear regression models are often used to verify the relationship between the influence of variables and detect hypotheses, according to the hypothesized relationship in this study, a multiple linear regression model is constructed, if the regression coefficient corresponds to a significance p-value of less than 0.05, it is considered to be established for the path, and p-value is greater than 0.05, it is considered to be not established for the regression coefficient. Multiple covariance discrimination must be performed in linear regression model to determine whether there is serious multiple covariance in the multiple linear regression equation by looking at the maximum value of the VIF of each variable, if the maximum value of the VIF of each variable is less than 10, the regression equation is considered to be reasonable and free of multiple covariance problem with some statistical significance (Chatterjee, & Hadi, 2006). Regression analysis by example. john wiley & sons.). The multiple linear regression model constructed in this study is as follows:

Table 9
Regression analysis table

Variable	β	t	p	VIF
Constant		3.843	0.000**	
Gender	-0.037	-0.999	0.318	1.017
Age	0.041	0.947	0.344	1.365
Education	-0.029	-0.76	0.447	1.058
Company	-0.031	-0.822	0.412	1.044
Work Experience	-0.062	-1.486	0.138	1.247
Position	0.017	0.434	0.664	1.145
Safety Knowledge	0.188	4.404	0.000***	1.317
Safety Attitude	0.137	3.318	0.001**	1.24
Hazard Reduction Capability	-0.250	-6.614	0.000***	1.032
Safety Compliance	0.132	2.96	0.003**	1.432
Active Safety	0.186	4.226	0.000***	1.407
Perceived Usefulness	0.248	6.454	0.000***	1.069
R Square	0.391			
Adjusted R Square	0.374			
F	F (12,441)=23.597, p=0.000			
D-W	1.930			

Note: * p<0.05; ** p<0.01; *** p<0.001

From the above table it can be seen that Gender, Age, Education, Company, Work Experience, Position,as control variables and Safety Knowledge, Safety Attitude, Hazard Reduction Capability, Safety Compliance, Active Safety, Perceived Usefulness as independent variables and Willingness To Use as dependent variable were analysed in a linear regression analysis and from the above table, it can be seen that the model has R-squared 0.391 which means that Safety Knowledge, Safety Attitude, Hazard Reduction Capability, Safety Compliance, Active Safety, Perceived Usefulness can explain the 39.1% change in Willingness To Use. The ANOVA test of the model shows that the model passes the F-test (F=23.597, p=0.000<0.05), which means that the model is valid. In addition, the multicollinearity test of the model shows that all the VIF values in the model are less than 5, which means that there is no problem of covariance; and the D-W value is 1.930 around the number 2, which means that the model does not have autocorrelation. There is no autocorrelation in the model, and in summary it can be seen that the model is better. The final specific analysis can be seen:

Safety Knowledge will have a significant positive effect on Willingness To Use (β=0.188, t=4.404, p=0.000<0.001).

Safety Attitude will have a significant positive effect on Willingness To Use (β=0.137, t=3.318, p=0.000<0.001).

Hazard Reduction Capability will have a significant negative effect on Willingness To Use (β=-0.250, t=-6.614, p=0.000<0.001).

Safety Compliance will have a significant positive relationship on Willingness To Use (β=0.132, t=2.960, p=0.003<0.01).

Active Safety will have a significant positive relationship on Willingness To Use (β=0.186, t=4.226, p=0.000<0.001).

Perceived Usefulness will have a significant positive relationship on Willingness To Use (β=0.248, t=6.454, p=0.000<0.001).

To summarize the analysis: Safety Knowledge, Safety Attitude, Safety Compliance, Active Safety, Perceived

Usefulness will have a significant positive effect on Willingness To Use. And Hazard Reduction Capability has a significant negative effect on Willingness To Use.

4. Conclusion and Recommendations

4.1 Conclusion

Based on the theory of technology management, this study takes science and technology innovation theory, technology track theory and other theories into consideration, and analyzes the specific situation of China's petrochemical industry and petrochemical technology management system in the background of the development of petrochemical technology, and summarizes the following main points and conclusions: First, in today's continuous development of science and technology, technology management has been gradually emphasized by more and more enterprises. China's petrochemical industry as a large energy enterprise, in the petroleum carbon production, petroleum machine equipment and other aspects of technology management has been very perfect. However, in the petrochemical industry, the original technology management system still relies on the original technology management system, more or less there will be a lack of deep understanding of technology, management methods and methods of discrepancies and many other problems. China's petrochemical industry is now facing the opportunities and challenges of upgrading and transformation, and the development of petrochemical industry is a necessary way to enhance the competitiveness of enterprises.

Secondly, there are some deficiencies in the technical management of China's petrochemical industry, which are mainly manifested in the petrochemical technology management process to be sorted out, petrochemical technology management system to be set up, petrochemical technology management personnel to be enriched, and the awareness of petrochemical technology management to be strengthened and so on. In today's competitive market environment, enterprises should constantly improve their competitiveness and should not let go of the slightest opportunity for improvement. Thirdly, combining the construction of technology management system in China's petrochemical industry and some of its achievements, the main problems in petrochemical technology management mentioned in the previous article are summarized below.

Thirdly, in combination with the construction and partial effectiveness of the technology management system in China's petrochemical industry, we will analyze and answer the main problems in the petrochemical technology management mentioned in the previous article, so that China's petrochemical industry can develop and grow in a better petrochemical technology management environment and win a place in the market competition. The study of technology management system is a long-term project for each enterprise, which needs to consider many aspects and constantly adapt to the current environment and the internal needs of the enterprise, and it is not a one-day effort, and should be improved in the long run. In addition, due to the limitations of my own understanding and insufficient knowledge, there are still many aspects of the technology management system in China's petrochemical industry that need to be further improved, such as specific technology management methods, R&D related content, technology management related performance assessment indicators, etc. At the same time, the currently constructed technology management system of petrochemical industry needs to be further improved. At the same time, the currently constructed petrochemical technology management system needs to be tested in the actual operation of the enterprise. Practice produces true knowledge, only in practice and constantly polished and perfected, in order to better match with the enterprise, to help enterprises in the fierce competition in an invincible position. Fourth, from the results of the questionnaire analysis, safety knowledge, safety attitude, safety compliance and active safety have a positive effect on safety management, while the ability to reduce hazards has a negative effect on safety management. Also subgroup regression of the sample showed that different age, education level, work experience and job position did not affect the level and direction of significance.

4.2 Recommendation

If we want to enhance the competitiveness of the enterprise, realize the diversified development of the enterprise, and make it become a competitive international first-class energy enterprise, we also need to take a step further in the management of petrochemical and petrochemical technology, and gradually make the petrochemical industry of the group take a leading position in the petrochemical field. In order to catch up with foreign advanced energy enterprises, China's petrochemical industry also needs to improve its ability in technology management in all aspects, and at the same time build a technology management system applicable to China's petrochemical industry. To ensure the safe development of the energy industry, it is necessary to increase the training and assessment of staff safety knowledge, and at the same time, it is necessary to involve strict work processes, increase the standardization of work processes and other measures to reduce the occurrence of safety accidents. The management of the enterprise needs to carefully sort out the problems that exist in the production and operation process of the enterprise, and discover and formulate safety reminders in a timely manner.

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