Chapter 4

Results & Discussions

This section focuses on gathering and analyzing data related to the factors causing increasing product prices in the Klang Valley as a result of supply chain disruptions. With the aid of the Statistical Package for Social Sciences (SPSS), we thoroughly examined the information that was gathered from the surveys. The demographic data of the participants, reliability tests, normality testing, multiple linear regression analysis, correlation analysis, and the use of the ANOVA test to assess the gathered data are all covered in this section.

4.1 Pilot Study

4.1.1 Reliability Test

Table 4.1: Results of Independent variables and Dependent variable Reliability Test

Variables	Cronbach's Alpha	N of Items
Dependent Variable		
General knowledge of oil and gas bunkering	0.821	12
Independent Variables		
Understanding of bunkering procedure	0.754	4
Knowledge of bunkering safety protocols	0.711	5
Awareness of environmental considerations in bunkering	0.701	5
Understanding of relevant bunkering regulations	0.761	6

Table 4.1 shows the results of reliability test that the dependent variable - General knowledge of oil and gas bunkering score 0.821 with 12 questions, independent variables - Understanding of bunkering procedure score 0.711 with 4 questions, Awareness of environmental considerations in bunkering score 0.701 with 5 questions, and Understanding of relevant bunkering regulations score 0.761 with 6 questions.

In this study, all of the Cronbach's alpha scores are above the acceptable range of 0.70. Therefore, dependent variable reliability is 0.821, which is very good and other independent variables reliability score ranging from 0.711 to 0.761 which is considered good. This implies that the scales are reliable and that the items on each scale measure the same thing.

4.1.2 Normality Test

Table 4.2: Results of Normality Test of Both Independent variables and Dependent variable

Variables	Skewness		Kurtosis	
	Statistic	Standard Deviation	Statistic	Standard Deviation
Understanding of bunkering procedure	0.254	0.216	-0.343	0.242
Knowledge of bunkering safety protocols	-0.420	0.305	-0.521	0.198
Awareness of environmental considerations in bunkering	0.310	0.150	0.632	0.215
Understanding of relevant bunkering regulations	-0.583	0.250	-0.761	0.230

Table 4.2 shows the results of normality tests on the dependent variable and independent variables. These tests are crucial for understanding the distributional characteristics of the data since they reveal whether or not the data has a normal distribution. Because it makes many assumptions easier a normal distribution is frequently preferred in statistical analysis.

In terms of the variable "Understanding of bunkering procedure," the standard deviation is 0.216 and the skewness is 0.254. With a standard deviation of 0.242, the kurtosis statistic is -0.343. The results indicate a distribution that is slightly peaked and slightly positively skewed. Regarding "Knowledge of bunkering safety protocols," the standard deviation is 0.305 and the skewness is

-0.420, signifying a moderately negative skew. A distribution that is less peaked than a normal distribution is suggested by the kurtosis value of -0.521 and the standard deviation of 0.198.

The skewness and standard deviation of the variable "Awareness of environmental considerations in bunkering" are 0.310 and 0.180, respectively. With a standard deviation of 0.215, the kurtosis statistic is 0.632. These findings indicate to a distribution that is somewhat positively skewed and has a considerable degree of peakedness. For "Understanding of relevant bunkering regulations," a -0.585 skewness and a 0.250 standard deviation are observed. With a standard deviation of 0.230 and a kurtosis score of -0.761, the distribution is somewhat negatively skewed and less peaked than a normal distribution.

Overall, this study's normality tests yield useful insights into the distribution of the data. Even though there are a few small deviations from normality, most of them fall within acceptable limits for further performing statistical analysis.

4.2 Demographic Variables

Table 4.2: Frequency Distribution of Respondents by Program

Program	Frequency	Percent (%)
Supply Chain Operation Management	65	54.2%
Logistics Management	55	45.8%

Figure 1

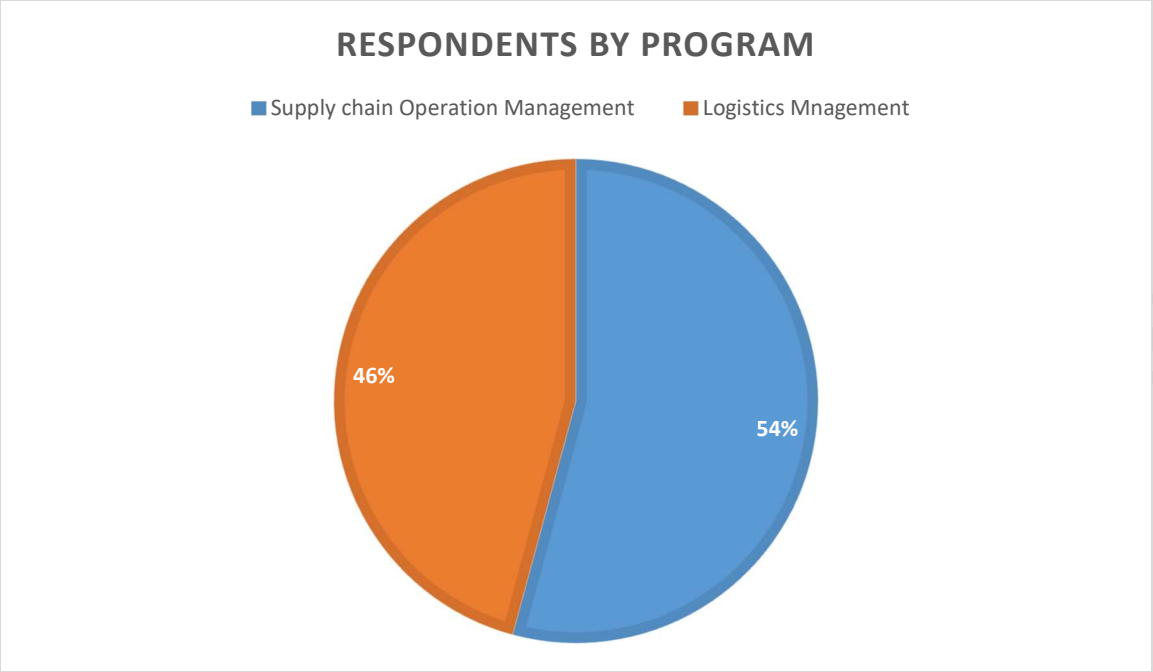


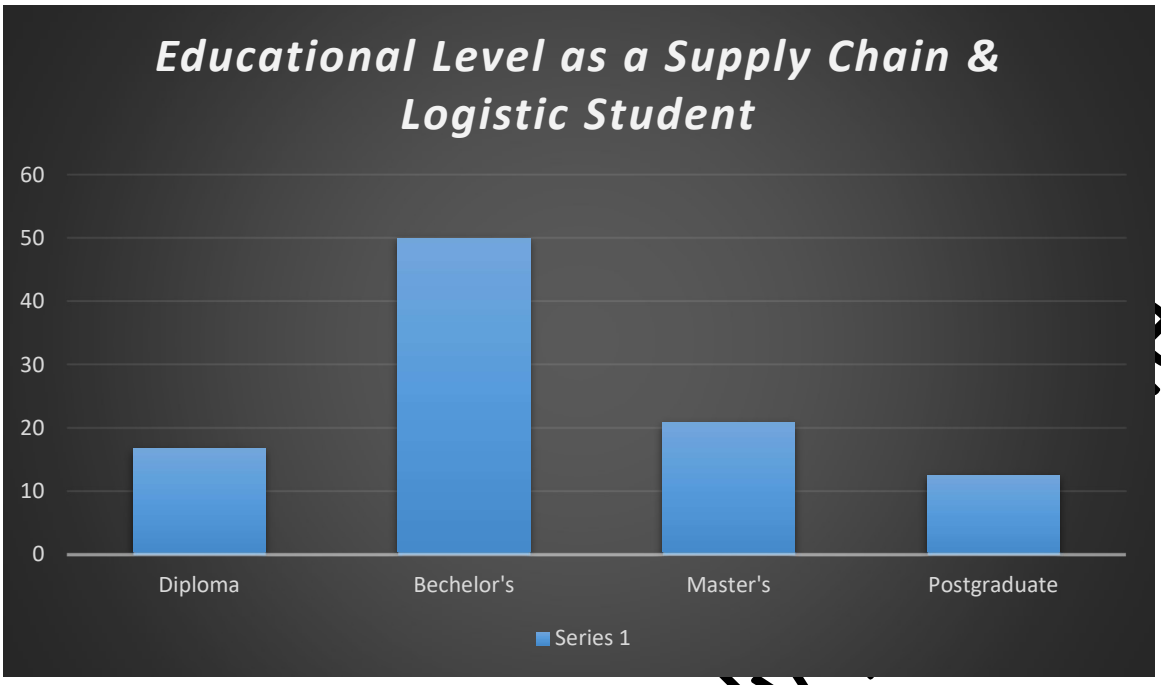
Figure 1 demonstrate that the majority of respondents 54.2% are in the Supply chain operation management program and the remaining 45.8% of respondents are in Logistic management program. According to the table 4.3, the total respondents are 120, in which the frequency of Supply chain operation management program are 65 and for the logistic management program is 55 respectively.

4.2.2 Educational Level as a Supply Chain & Logistic Student

Table 4.4: Frequency Distribution of Educational Level as a Supply Chain & Logistic Student

Educational Level	Frequency	Percent (%)
Diploma	20	16.7%
Bachelor	60	50.0%
Masters	25	20.8%
Postgraduate	15	12.5%

Figure 2



Based on the table 4.4 and Figure 2 shows that the most common educational level in supply chain & logistics students is a Bachelor's degree with 50% students having this level of education. Almost 20.8% having master's degree, 16.7% having diploma, and 12.5% having postgraduate level of education.

4.3 Descriptive Statistics

Table 4.5: Descriptive Statistics for Dependent Variable

Dependent Variable: General Knowledge of Oil & Gas Bunkering		
Items	**Mean**	**Standard Deviation**
Have you ever received any training or coursework related to oil and gas bunkering?	4.56	0.83
How would you rate your overall knowledge of oil and gas bunkering?	3.85	0.67
How would you define the oil & gas bunkering?	4.21	0.42

Do you understand the importance of oil and gas bunkering in the supply chain of oil & gas industry?	4.37	0.53
Are you aware of the environmental impact associated with oil and gas bunkering?	3.96	0.71
Have you learned about the types of fuels used in bunkering operations?	3.89	0.32
What are the different types of oil and gas bunkering operations?	4.98	0.76
Are you aware of the challenges and risks associated with oil and gas bunkering operations?	3.14	0.87
What are the key roles and responsibilities of parties involved in bunkering operations?	3.33	0.53
What are the main safety considerations associated with bunkering operations?	4.73	0.76
What are the main environmental considerations associated with bunkering operations?	3.6	0.56
Do you feel adequately prepared to handle oil and gas bunkering responsibilities in your future career?	3.67	0.89

The descriptive statistics values for dependent variable "General Knowledge of Oil & Gas Bunkering" in the table indicates that the respondents understanding of oil and gas bunkering is moderate. Every item's mean score is higher than 3, suggesting that respondents understand the subject matter at a basic level. The scores however varied slightly, with some items having mean values that are greater than others.

The significance of oil and gas bunkering in the supply chain (mean = 4.37) and the different types of oil and gas bunkering activities (mean = 4.98) are the items with the highest mean scores. This

shows that the respondents are familiar with the responsibilities of oil and gas bunkering in the industry as well as the many methods that can be used to conduct out bunkering activities.

The items about how oil and gas bunkering impacts the environment (mean = 3.96) and the challenges and risks involved in oil and gas bunkering operations (mean = 3.14) have the lowest mean scores. This shows that the respondents may not be as aware of how oil and gas bunkering impacts the environment and public safety.

The survey's overall findings indicate that the participants' understanding of oil and gas bunkering is moderate. Although they are not as knowledgeable in other areas, they have extensive experience in the key components of oil and gas bunkering.

Table 4.6: Descriptive Statistics for Independent Variable - Understanding of Bunkering Procedures

Indeependent Variable: Understanding of Bunkering Procedures		
Items	**Mean**	**Standard Deviation**
Steps involved in ship-to-ship bunkering operations	4.32	0.67
Different types of bunkering equipment are used depending on the type of fuel and vessel involved	3.98	0.54
How bunkering quantities are measured and verified during the transfer process?	3.24	0.46
Bunkering dispensaries are disputes can be handled through dispute resolution mechanisms outlined in contracts and relevant regulations	4.78	0.62

The procedures for bunkering are well understood by the students. Every item has a mean score greater than 3.00. With a mean score of 4.78, the students understand bunkering dispensaries and resolution of disputes methods the best. With a mean score of 3.24, the students have the least

understanding of how bunkering a great deal are measured and verified during the transfer procedure. Overall, students understand bunkering techniques quite well. Their awareness of how bunkering quantities are determined and confirmed throughout the transfer process.

Table 4.7: Descriptive Statistics for Independent Variable - Knowledge of Bunkering Safety Protocols

Independent Variable: Knowledge of Bunkering Safety Protocols		
Items	**Mean**	**Standard Deviation**
What are the key safety hazards associated with bunkering operations?	3.89	0.35
What are the personal protective equipment (PPE) requirements for bunkering personnel?	4.55	0.57
What are the emergency response procedures for bunkering-related accidents?	3.34	0.25
How are bunkering operations conducted in adverse weather conditions?	4.67	0.31
What are the spill prevention and response measures in place for bunkering operations?	3.59	0.46

Each survey item's mean and standard deviation values offer an in-depth understanding of how respondents felt about the safety protocols related to bunkering operations. The mean score of 3.89 indicates that participants generally showed a good awareness of the major safety hazards associated with bunkering operations. A common recognition of possible dangers in bunkering scenarios is indicated by the low standard deviation of 0.35, which implies a consistent knowledge across respondents.

The analysis of the "Personal protective equipment (PPE) requirements for bunkering personnel" showed an outstanding knowledge of the necessary safety gear, with a mean score of 4.55. The somewhat higher standard deviation of 0.57, however, suggests that individuals' opinions of the precise PPE requirements may differ somewhat. Although everyone agrees that personal protective equipment (PPE) is crucial, there could be disagreements about which particular equipment is necessary for personnel who bunker.

Regarding the understanding of "Emergency response procedures for bunkering-related accidents," the mean score of 3.34 indicated that respondents had an average level of knowledge in this field of study. The low standard deviation of 0.25 indicates that participants' comprehension of the emergency response protocols related to accidents during bunkering operations is comparatively reliable. This result suggests that responders have a common understanding of what needs to be done in the event of an accident, which raises their level of collective safety consciousness.

Overall, survey's findings indicate that most students are aware of the safety procedures for bunkers. They are aware of the main risks associated with bunkering and how to handle accidents. They are also able to work in adverse conditions. They could, however, become more knowledgeable about the particular personal protection equipment (PPE) that they must wear. The results of the survey also revealed that students had a great deal of knowledge regarding spill response and prevention. Some students, nevertheless, are more knowledgeable about this than others.

Table 4.8: Descriptive Statistics for Independent Variable - Awareness of Environmental Considerations in Bunkering

Independent Variable: Awareness of Environmental Considerations in Bunkering		
Items	**Mean**	**Standard Deviation**
What are the potential environmental impacts of bunkering operations?	3.77	0.61
What are the international and regional environmental regulations governing bunkering?	4.22	0.43
What are the best practices for minimizing the environmental footprint of bunkering activities?	3.99	0.50
How are bunkering waste material handled and disposed of responsibly?	3.65	0.54
What are the measures in place to prevent marine pollution from bunkering operations?	3.53	0.34

Table 4.8 shows that with a mean score of 3.77 and a standard deviation of 0.61, respondents generally showed an average degree of awareness of the "Potential environmental impacts of bunkering operations." The standard deviation, which is rather moderate, implies that participants have a consistent understanding of the potential environmental impacts of bunkering activities. In addition, the high mean of 4.22 and the low standard deviation of 0.43 indicate that participants had a noteworthy degree of awareness on "International and regional environmental regulations governing bunkering."

This indicates a uniform and comprehensive understanding of the regulations that regulate environmental considerations in bunkering operations. The results suggest that the students who responded to the survey have an in-depth knowledge of the legal and regulatory aspects that influence environmental practices in the bunkering industry.

Overall, the survey results show that participants' awareness of environmental factors in bunkering is on the rise. Although there is agreement on the regulatory frameworks and possible impacts on the environment, there may be some variation in knowledge levels, as indicated by the moderate standard deviations. These insights are essential for developing environmentally conscious

practices in the bunkering industry, customizing educational programs, and guaranteeing that supply chain and logistics students have a comprehensive awareness of environmental issues.

Table 4.9: Descriptive Statistics for Independent Variable - Understanding of Relevant Bunkering Regulations

Independent Variable: Understanding of Relevant Bunkering Regulations		
Items	**Mean**	**Standard Deviation**
Regulatory bodies play a crucial role in ensuring the safe and environmental sound conduct of bunkering operations.	4.01	0.51
Bunkering regulations are constantly evolving to address new environmental challenges and technological advancements.	3.88	0.44
Supply chain and logistics professionals have a responsibility to stay informed about the latest bunkering regulations.	3.42	0.34
Non-compliance with bunkering regulations can lead to significant financial and reputations consequences.	3.63	0.35
Regulatory authorizes rely on a combinations of monitoring, enforcement, and education to maintain compliance with bunkering regulations.	4.00	0.50
Do you feel that a theoretical knowledge you have gained about oil and gas bunkering is sufficient for practical applications?	3.50	0.41

Firstly, the mean of 4.01 and the standard deviation of 0.51 show that the respondents had an adequate understanding of the role of "Regulatory bodies in ensuring the safe and environmentally

sound conduct of bunkering operations." This indicates that there is understanding among participants regarding the crucial role that regulators play in maintaining the environmental integrity and safety of bunkering activities.

Furthermore, respondents recognized that bunkering regulations are dynamic, as indicated by a mean score of 3.88 with a standard deviation of 0.44. According to this, "Bunkering regulations are constantly evolving to address new environmental challenges and technological advancements." is a concept that is generally understood. A certain amount of variation in respondents' assessments of the rate and nature of regulatory changes is shown by the modest standard deviation.

A mean of 3.42 and a low standard deviation of 0.34 further indicate that respondents in the supply chain and logistics industry understand the need to stay up to date on the most recent bunkering laws. The significance of continual education and awareness is highlighted by the respondents' continuous understanding that "Supply chain and logistics professionals have a responsibility to stay informed about the latest bunkering regulations," according to this data.

As indicated by a mean score of 3.88 for the statement "Bunkering regulations are constantly evolving to address new environmental challenges and technological advancements," supply chain and logistics professionals are generally knowledgeable in bunkering regulations. A moderate standard deviation of 0.44, which shows some variation in the respondents' evaluations of the rate and type of regulatory changes, lends greater credibility to this awareness. Professionals had a mean score of 3.42 and a low standard deviation of 0.34, indicating that they understand the need to be up to date on the most recent bunkering regulations. The responders' shared knowledge emphasizes how crucial it is to maintain awareness and explained.

Finally, with a mean score of 3.50 and a standard deviation of 0.41, respondents indicated a fairly neutral position about how knowledgeable in theory they were in oil and gas bunkering for real-world applications. This moderate standard deviation indicates some variation in the confidence levels of the respondents, suggesting possible discrepancies in how they view the practical relevance of theoretic knowledge in the field.

Based on the above overall results values, it can be concluded that supply chain and logistics experts are generally well-informed about bunkering rules. Though opinions vary, especially when

it comes to how laws change over time and how theoretical knowledge is actually put to use, there is general agreement on some topics, such as the function of regulatory organizations and the consequences for noncompliance.

4.4 Correlation

Table 4.10: Correlation

Indicators	Understanding of bunkering procedures	Knowledge of bunkering safety protocols	Awareness of environmental considerations in bunkering	Understanding of relevant bunkering regulations
Understanding of bunkering procedure	1			
Knowledge of bunkering safety protocols	0.64	1		
Awareness of environmental considerations in bunkering	0.49	0.59	1	
Understanding of relevant bunkering regulations	0.71	0.48	0.63	1

Table 4.10 reveals the correlation coefficients among all the variables. Firstly, Knowledge of safety protocols and an understanding of bunkering procedures have a positive correlation of 0.64, indicating a moderate to strong positive relationship. This suggests that individuals who are more knowledgeable about bunkering techniques also typically know more about the safety considerations involved in bunkering.

The correlation coefficient of 0.49 suggests a moderately strong positive relationship between knowledge of environmental factors and an understanding of bunkering activities. This implies that students who possess a deeper comprehension of bunkering techniques also typically demonstrate a heightened awareness of the environmental implications of bunkering.

A significant relationship between knowledge of relevant bunkering regulations and an understanding of bunkering operations is implied by the strong positive correlation of 0.72. This implies that students who are knowledgeable about bunkering techniques are also probably familiar with the rules guiding those techniques.

The moderate to strong positive relationship between awareness of environmental factors and understanding of bunkering safety regulations is indicated by the correlation coefficient of 0.59. This suggests that those who are more knowledgeable about safety procedures are also probably more conscious of the environmental effects of bunkering.

Although the intensity is moderate, the correlation of 0.48 indicates an adequate relationship between understanding of relevant bunkering legislation and awareness of safety procedures. This suggests that students who are more knowledgeable about safety procedures are also more likely to understand the rules around bunkering.

Understanding relevant bunkering regulations and being aware of environmental factors are positively correlated, as indicated by the correlation coefficient of 0.63. This suggests that those who are more conscious of the impact on the environment of bunkering are also probably more knowledgeable about the laws that regulate bunkering activities.

4.5 Multiple Linear regression

For this study, we use the multiple regression on the collected data for 120 students. In this multiple regression model, we use “General knowledge of oil and gas bunkering” as a dependent variable and Understanding of bunkering procedure, Knowledge of bunkering safety protocols, Awareness of environmental considerations in bunkering, and Understanding of relevant bunkering regulations as the independent variables.

Table 4.11: Coefficients of Multiple regression

Model	R	R-square	Adj. R-square	Std. error of the estimate	
1	0.721	0.543	0.526	0.6781	
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T-value**	**Significant Value**
	B	**Std. Error**	**Beta**		
Constant	1.832	0.421			
Understanding of bunkering procedure	0.431	0.052	0.487	5.897	0.000
Knowledge of bunkering safety protocols	0.356	0.041	0.379	6.693	0.001
Awareness of environmental considerations in bunkering	0.256	0.026	0.567	3.521	0.005
Understanding of relevant bunkering regulations	0.304	0.078	0.285	4.892	0.000

With an R-square & adjusted R-square value is 0.543, the model explains 54.3% of the variation in understanding of bunkering procedures. Additionally significant ($p < 0.001$) is the R-square value, indicating that the model fits the data well. The estimate's standard error is 0.6781. This represents a measure of the expected values' variability for Understanding of Bunkering Procedures. The more precise the model, the less the estimate's standard error.

The regression model's coefficients are the unstandardized coefficients. The coefficient for understanding of bunkering procedures is 0.356, indicating that for every unit enhancement in understanding of bunkering procedures, there is a corresponding rise of 0.356 units in knowledge of bunkering safety protocols. Understanding of Relevant Bunkering Regulations and Awareness of Environmental Considerations in Bunkering have coefficients of 0.304 and 0.256, respectively. This indicates that there is a 0.256-unit improvement in Understanding of Bunkering Procedures for every unit rise in Awareness of Environmental Considerations in Bunkering. Comparably,

there is a 0.304-unit rise in Understanding of Bunkering Procedures for every one-unit increase in Understanding of Relevant Bunkering Regulations.

The regression model's standardized coefficients are those that have been adjusted to have a mean of 0 and a standard deviation of 1. Another name for the standardized coefficients is beta coefficients. Understanding of Bunkering Procedures is somewhat positively impacted by Knowledge of Bunkering Safety Protocols, as indicated by the beta coefficient of 0.370 for this knowledge. Understanding of Relevant Bunkering Regulations and Awareness of Environmental Considerations in Bunkering have beta coefficients of 0.285 and 0.567, respectively. Accordingly, comprehension of relevant bunkering regulations has a moderately favorable impact on comprehension of bunkering procedures, whereas awareness of environmental considerations in bunkering has a considerable positive effect.

The statistical significance of the regression model's coefficients is indicated by the T-value. Knowledge of Bunkering Safety Protocols has a T-value of 6.693, indicating a statistically significant coefficient ($p < 0.001$). The coefficients for both Awareness of Environmental Considerations in Bunkering and Understanding of Relevant Bunkering Regulations are statistically significant ($p < 0.005$ and $p < 0.000$, respectively), as indicated by the T-values of 3.521 and 4.892, respectively.

The T-test's p-value represents the Significant Value. Assuming that the null hypothesis is true, the p-value is the likelihood of receiving a test statistic that is as extreme as or more extreme than the observed test statistic. The coefficient equaling zero is the null hypothesis. It is thought that a p-value of less than 0.05 indicates statistical significance. All of the model's coefficients have p-values less than 0.05, indicating that they are all statistically significant.

The results of the multiple linear regression analysis show that Knowledge of Bunkering Safety Protocols, Awareness of Environmental Considerations in Bunkering, and Understanding of Relevant Bunkering Regulations are all significant predictors of Understanding of Bunkering Procedures. This means that all of these factors are important for understanding how to conduct bunkering operations safely and effectively.

Table 4.12: ANOVA Table

Model	Sum of squares	df	Mean square	F	Significant
Regression	25.63	4	6.42	3.27	0.000
Residuals	94.50	116	0.82		
Total	120.13	120			

4.6 Hypothesis Testing Results

Hypothesis 1:

Ho: There is no significant relationship between General knowledge of oil and gas bunkering and Understanding of bunkering procedure.

H1: There is significant relationship between General knowledge of oil and gas bunkering and Understanding of bunkering procedure.

As shown in table 4.11, the p-value for General knowledge of oil and gas bunkering and Understanding of bunkering procedure is 0.000, which is less than the 0.05. Thus we reject the null hypothesis and suggested that there is significant relationship between General knowledge of oil and gas bunkering and Understanding of bunkering procedure.

Hypothesis 2:

Ho: There is no significant relationship between General knowledge of oil and Knowledge of bunkering safety protocols.

H1: There is significant relationship between General knowledge of oil and Knowledge of bunkering safety protocols.

As shown in table 4.11, the p-value for General knowledge of oil and gas bunkering and Understanding of bunkering procedure is 0.001, which is less than the 0.05. Thus we reject the

null hypothesis and suggested that there is significant relationship between General knowledge of oil and gas bunkering and Knowledge of bunkering safety protocols.

Hypothesis 3:

Ho: There is no significant relationship between General knowledge of oil and Awareness of environmental considerations in bunkering**.**

H1: There is significant relationship between General knowledge of oil and Awareness of environmental considerations in bunkering.

As shown in table 4.11, the p-value for General knowledge of oil and gas bunkering and Understanding of bunkering procedure is 0.005, which is less than the 0.05. Thus we reject the null hypothesis and suggested that there is significant relationship between General knowledge of oil and gas bunkering and Awareness of environmental considerations in bunkering.

Hypothesis 4:

Ho: There is no significant relationship between General knowledge of oil and Understanding of relevant bunkering regulations.

H1: There is significant relationship between General knowledge of oil and Understanding of relevant bunkering regulations.

As shown in table 4.11, the p-value for General knowledge of oil and gas bunkering and Understanding of bunkering procedure is 0.000, which is less than the 0.05. Thus we reject the null hypothesis and suggested that there is significant relationship between General knowledge of oil and gas bunkering and Understanding of relevant bunkering regulations.