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Volume 4 | Issue 1 | January 2021 | Page 1-73
Journal of Business Administration Research

Contents

ARTICLE

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Journal of Business Administration Research
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ARTICLE

Handling of Customers Satisfaction and Assessment of Service Qualities on Commercial Bank of Ethiopia in Addis Ababa at East District

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ABSTRACT

Banking sector in Ethiopia is dominant and it is a dense competent area. Due to this the bank managements tend to continually found the strategies that enables them to be competent in this dense competition. These strategies often focus on handling of customers satisfaction to be strongly compete and pooling more customers. Because, service quality is relevant to keep up their competitive advantage and improve customer satisfaction. So, this study examine the handling of customers satisfaction and assessment of service qualities on Commercial Bank of Ethiopia (CBE) in Addis Ababa at East District by applying SERVQUAL model. This study used convenient and random sampling technique to select the sample respondents and 400 respondents were selected branches of CBE in Addis Ababa at east district. The data sources for this study are primary and secondary data sources. The questionnaires are used as primary data source, which are contained SERVQUAL model and the agreements were measured by applying the five Likert point scales. The correlation result revealed that all dimensions of service quality have a strong and significant statistical relationship with customer satisfaction. The quality of service offered by CBE no meets with the expectation of customer (customers satisfied in somewhat quality service). So, the bank needs to reform service quality for satisfy and attract unsatisfied customers.

1. Introduction

Currently fast changing competitive world, companies are losing their significant number of customers. This is because of the quality of the product or not delivering quality service. In other word service sector rapidly increasing and has a great contribution to the economy. Banking industry is one of the most dominant service sectors in Ethiopia and it has significant role on macro and micro economic level of the country. As the significant increasing of service sector to the economy there is a dense competition in the market. So, banks continually found strategy to overcome these dense competitions and gaining a competitive advantage over competitors [1,13,14].

Service quality is a relevant for service companies, and it is crucial tool to keep up their competitive advantage in the

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marketplace. So, banks' competition in the market by using differentiated their products by delivering high quality services are used as a basically competitive tool [2]. Means that service organization providing high quality services able to pool or attract customers to them [3]. Generally service quality is a tool that used to differentiate its product from competitor in the market by increasing customer satisfaction and fostering loyalty for service companies. For service organization, measuring service quality is difficult because of the uniqueness of service like intangibility, heterogeneity, inseparability and perishability [4, 18,19-21].

To solve this difficulty different authors develop different distinctive framework for quality clarification and measurement. Among these the major models are SERVQUAL model developed by Parasuraman et al. [5,6] SERVPREF model developed by Cronin and Taylor [7] BSQ scale proposed by Bahia and Nantel [8] and BAKQUAL scale was proposed by Tsoukatos and Mastrojianni [9]. From these major frameworks, SERVQUAL mode developed by Parasuraman et al. [5,6] was used to analysis this study, which is frequently and widely used model for measuring service quality in the bank industry [4,15]. According to Parasuraman et al. [6] SERVQUAL model, tangibility, reliability, responsiveness, assurance and empathy are distinguished as service qualities [4,16, 30-32].

Many researches have been done on the handing of customer satisfaction and assessment of service quality in banking industry. Most of them indicate that quality of service is higher in handling customer satisfaction and the relationship is positive and significant. A solid foundation in defining and measuring service quality was emanated in the mid-eighties Parasuraman et al. [5] and also Siddiqi and Kazi [24] described that all the service quality attributes are positively related to customer satisfaction and customer satisfaction is positively related to customer loyalty in the retail banking settings. Furthermore, Daniel [26] also stated that high quality of service will result in high customer satisfaction and increase loyalty. Therefore, customer satisfaction service quality dimensions (tangibility, reliability responsiveness, assurance and empathy) have a great effect on customer satisfaction on bank industry. The study of Hennayake [10], were divided service quality dimensions into two as human related factors (reliability, responsiveness and assurance) and non-human related factors (tangibility) and found that human related factors have greater impact on handling of customer satisfaction than non-human related factors service quality. According to the study of Quyet, et al. [11] tangibility had the greatest effect on customer satisfaction and reliability had the last ranked impact on handling customer satisfaction. The finding of Azzam [3] showed that the dimensions of service quality and reliability has the highest contribution to handling customer satisfaction than others. Bethlehem [1] found tangibility, responsiveness, reliability and assurance have positive impact and empathy has the lowest relationship with customer satisfaction. The finding of Meron [12], indicated that assurance has the highest correlation with satisfaction of customers. Similarly, the finding of Dejene [17] showed that assurance have the highest value from other service quality dimensions.

Therefore, this work assesses the handling of customer satisfaction on service quality dimensions in case of CBE in east district of Addis Ababa to assess which quality of service dimensions are a great impact on handling satisfaction of customer. The findings and results that were reported in this study has contribution to the management of the bank and will provide good information about the feeling and level of their customer satisfaction from the services deliver by the bank. So, information's from this study final finding and result is very important to know which problems happen, what the management will be to do to solve these problems, what things are added and minimize to improve customer satisfaction and attract more customers as well as catching the existing customer.

1.1 Research Questions

More specifically, this study answers the following research questions:

Do tangibility, reliability, responsiveness, assurance, and empathy have effects on customer satisfaction in commercial bank of Ethiopia in Addis Ababa at east district?

1.2 Statement of Hypotheses

The hypotheses developed for this study is based on the following assumptions:

H1: The reliability has statistical significance positive effect on customer satisfaction.

H2: The assurance has statistical positive effect on customer satisfaction.

H3: The tangibility has statistical positive effect on customer satisfaction.

H4: The empathy has statistical positive effect on customer satisfaction.

H5: The responsiveness has statistical positive effect on customer satisfaction.

H6: The overall Service quality dimensions has statistical positive effect on customer satisfaction

2. Data Methods

Research is conducted; it constitutes of the collection, measurement and analysis of data. The purpose of the study (exploratory, descriptive), its location the type it should conform to (type of investigation), the extent

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to which it is controlled by the researcher (extent of researcher interference), its temporal aspects (time horizon), and the level at which the data was analyzed (unit of analysis), are integral to research design.

After the needed data was gathered, the next step is analyzed the data. For this study Statistical Package for Social Science (SPSS) software version 25 was employed to analyze and present the data by using the statistical tools for this study. These statistical tools were used for this study are descriptive analysis, correlation and multiple regression analysis. To present a profile of the respondents through tables, frequency distributions and percentages and to identify the mean and standard deviation of service quality dimensions and customer satisfaction a descriptive statistical analysis was employed for this study.

In order to determine the relationships between service quality dimensions (reliability, empathy, responsiveness, tangibility and assurance) and customer satisfaction this study is used Pearson's correlation coefficient. The study is used multiple regression analysis to determine the effect of service quality on customer satisfaction.

2.1 Data Sources

The primary and secondary source of data and method of data collections were consider to this work . This study was used questionnaire as primary data source collection mechanism. and a standard questionnaire was constructed by considering the five dimensions of service quality stated on SERVQUAL model by Parasuraman et al. [5,6]. Further, customer's perception was used to assess customer satisfaction [28,29]. The attitude of the respondent on these variables was measured by using five Likert scales questionnaire labeled. and additionally as secondary data this study was used report publications produced by CBE and different web sites①.

2.2 Target Population and Area

The target population and area of the study are all account holder customers who have current or saving account, age 24 years and above in CBE in Addis Ababa at east district. The researchers were investigated seven branches of commercial bank of Ethiopia in Addis Ababa at east district. CBE has one hundred six branches in Addis Ababa at east district. Due to large number of branches, only seven sample branches (Bole, Gerji, Gurd Sholla, Kotebe, Megenagna, Meri, and Goro Adebabay) were included for this study. The total population from those seven branches that were targeted for this study was 322,045 customers.

2.3 Sample Size

The total sample size was determined by using the following sample size determination formula developed by Yemane [22].

$$n = \frac{N}{1 + Ne^2} \tag{1}$$

Where, n the sample size, N the population size and e is the sampling error (0.05) which is 95% of level of confidence.

According to the above formula, the total sample size for the total number of CBE's customers at the above listed branches is calculated as by using the formula.

$$n = \frac{N}{1 + Ne^2} = 322{,}045/1+322{,}045\ (0.05)^2 = 399.9 = 400 \tag{2}$$

After the total sample size is determined, the researchers were proceed to allocated the total number of samples proportionately for each branches of CBE at Addis Ababa east district based on their respective total number of customers using the following formula.

Sample size at each branch:

$$(n_1)n_1 = \frac{nN_1}{N} \tag{3}$$

Where, n total number of samples, N total number of customers from each branches, N1 total number of customers at each Branch and n1 sample size at each branch.

Based on the above formula the total samples proportionally allocated for each branches of CBE at Addis Ababa east district based on their respective total number of customers.

Table 1. Population and sample size for each branch at east district (primary data collected in 2019)

No	Branch Name	Total number of customer at each branch (N1)	Proportional sample size from each branch (n1)
1	Megenagna (Rastefri)	90,000	112
2	Gerji (Geogirs, mebrathayle)	67,000	83
3	Gurdsholla	60,000	75
4	Kotebe	20,000	25
5	Meri	40,532	50
6	Goro Adebabay	14,513	18
7	Poly (Africa china)	30,000	37
Total	7	322,045	400

① http://www.combanketh.et/AboutUs/CompanyProfile.aspx

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2.4 Reliability and Validity Test

The reliability of the questionnaires checked by using Cronbach's alpha reliability. Alpha reliability used as measuring internal consistency of the mean of the items at the time of administration of the questionnaire. Cronbach's alpha is indicated that the reliability coefficient of items were set in the questionnaire is positively related to each other. It was computed in terms of the average inter correlations among the items measuring the concept. Table 2 shows that, the Cronbach's Alpha of each factor was found between 0.704 and 0.857. It implies that all items which are found in each factor are an acceptable level of internal reliability. Validity was tasted to measure the ability of items to address the concept of each service quality dimensions which are used for this study [6].

Table 2. Reliability test of items

Factors	No. of items	Cronbach's Alpha
Tangibility	4	0.704
Reliability	4	0.797
Responsiveness	4	0.796
Assurance	3	0.792
Empathy	5	0.842
Customer satisfaction	5	0.857

3. Data Analysis and Results

For this study Statistical Package for Social Science (SPSS) software version 25 was employed to analyze and present the data by using the statistical tools. These used statistical tools are descriptive analysis, correlation and multiple regression analysis. To present a profile of the respondents through tables, frequency distributions and percentages and to identify the mean and standard deviation of service quality dimensions and customer satisfaction a descriptive statistical analysis was employed for this study. In order to determine the relationships between service quality dimensions (reliability, empathy, responsiveness, tangibility and assurance) and customer satisfaction this study was used Pearson's correlation coefficient. The study was used multiple regression analysis to determine the effect of service quality on customer satisfaction.

3.1 Analyzing Service Quality Dimensions

In this study the SERVQUAL model was used to measure customers perception about service quality delivered by CBE. SERVQUAL model is used to measure customers expectation about service quality that the bank provide directly compare their expectation with the actual or perceived service. In order to measure the result of customers perception about the quality of service provides by commercial bank of Ethiopia. The mean and standard deviation of each questions about each service quality dimensions are computed as follows.

3.1.1 Tangibility

Tangibility pertains to the physical facilities, equipment, personnel and communication materials.

Table 3. Mean and Standard deviation score for tangibility in survey data 2019

	N				
Items	**Valid**	**Missing**	**Mean ± SD**	**Tangibility (mean of mean)**	**Std. Deviation**
The branch has up to date equipment's	390	0	4.17± 0.2	4.31	0.215
The branch facilities are visually attractive	390	0	4.10 ± 0.24		
The branch has office at convenient location to its customer	390	0	4.41 ± 0.23		
Staffs of the branch at the front line position are well dressed and appear neat.	390	0	4.56 ± 0.19		

3.1.2 Reliability

Reliability refers to the ability to perform the promised services dependably and accurately.

Table 4. Mean and Standard deviation score for reliability in survey data 2019

	N				
Items	**Valid**	**Missing**	**Mean ± SD**	**Reliability (mean of mean)**	**Std. Deviation**
There is a quality of network and speed service enabling the bank provide service as promised	390	0	3.89 ±0.33	3.59	0.337
Keep customer record correctly	390	0	4.10 ± 0.29		
Provide service at the designed and promised time	390	0	3.87 ± 0.35		
Staffs of the branch at the front line position are well dressed and appear neat.	390	0	3.25 ± 0.38		

3.1.3 Responsiveness

Responsiveness refers to willingness or readiness of employee to provide service promptly or even setting up appointment quickly and understanding customers interest, goals or problems.

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Table 5. Mean and standard deviation score for responsiveness in survey data 2019

	N				
Items	**Valid**	**Missing**	**Mean ± SD**	**Responsiveness (mean of mean)**	**Std. Deviation**
Employees provide punctual service	390	0	4.00 ± 0.128	3.92	0.1295
Employees willingness to help customers	390	0	3.77 ± 0.13		
Employees are never busy to respond to customer request	390	0	4.05 ± 0.11		
Employees give quick response when ether is problem	390	0	3.85 ± 0.15		

3.1.4. Assurance

Assurance relates to the knowledge and courtesy of employees and their ability to convey trust and confidence.

Table 6. Mean and standard deviation score for assurance in survey data 2019

	N				
Items	**Valid**	**Missing**	**Mean ± SD**	**Mean of mean (Assurance)**	**Std. Deviation**
Staffs are excellent and trust in personal behavior	390	0	3.74± 0.22	4.31	0.210
staffs are polite	390	0	4.03 ± 0.20		
staffs have adequate knowledge to serve customer	390	0	4.15±0.21		

3.1.5 Empathy

Empathy refers to the provision of caring and individualized attention to customers.

Table 7. Mean and Standard deviation score for empathy in survey data 2019

	N				
Items	**Valid**	**Missing**	**Mean ± SD**	**Mean of mean (empathy)**	**Std. Deviation**
The staff know what customers' specific needs are	390	0	3.65± 0.2	3.48	0.213
Staffs are give customers individual attention	390	0	3.77 ± 0.23		
Staffs give orientation about the new service and the cost related with the service	390	0	4.01± 0.199		
The bank and its employees give do consideration for customers property	390	0	3.49 ± 0.22		

Table 8. Mean and standard deviation of service quality dimensions in survey data 2019

	Tangibility	**Reliability**	**Responsiveness**	**Assurance**	**Empathy**	**Mean of mean**	**Std. Deviation**
N **Valid**	390	390	390	390	390	2.04	0.269
Missing	0	0	0	0	0		
Mean	4.31	3.59	3.92	3.97	3.48		

To summarize all the above tables, tangibility has the highest mean value of 4.31. It implies that customers satisfaction arises from the dimension of service quality tangibility (4.31). The mean valve of assurance, responsiveness, empathy and reliability are 3.97, 3.92, 3.68 and 3.59 respectively. Reliability has the lowest mean value with 3.59. Regarding to this we conclude that the service provide by commercial bank of Ethiopia is somewhat quality of satisfied in most customer service dimensions. According to the study of Quyet et al. [11] tangibility had the greatest satisfaction and reliability had the last satisfaction. The result of this study is consistent with this study.

3.2 Analyzing Customer Satisfaction

The following table indicates that the level of customer satisfaction about the security of the bank service, respectful behavior of the bank staffs, communicative ability of the employee of the bank, performance of the employee of the bank and the various rang of service of CBE. According to the data presented on the Table 8, customers almost satisfied with mean value ranges from 3.59 - 3.80. Therefore, majority of the customers are satisfied with respectful behavior of the bank staffs, the communicative ability of the employee of the bank, the performance of the employee of the bank and various rang of service of CBE. The overall mean result of customer satisfaction is 3.67, which implies that majority of the customers are satisfied by the service provided by the bank. The finding of Endalkachew [23] conducted on Assessing the impact of Core Banking and service quality on Customer Satisfaction in Commercial Bank of Ethiopia (A case of Bishofftu Branch) shows that, 85% of the customer are satisfied with the various rang of service of CBE at Bishofftu branch, which is similar to the result of this study.

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Table 9. Mean and standard deviation of customer satisfaction in survey data 2019

	N				
Items	**Valid**	**Missing**	**Mean ± SD**	**Customer satisfaction (Mean of mean)**	**Std. Deviation**
I am satisfied with the security of the bank services.	390	0	3.60 ± 0.08		
I am satisfied with respectful behavior of the bank staffs	390	0	3.80± 0.098		
I am satisfied with the communicative ability of the employee of the bank	390	0	3.78± 0.099	3.67	0.098
I am satisfied with the performance of the employee of the bank.	390	0	3.59 ± 0.1		
I am satisfied with various rang of service of CBE	390	0	3.71 ± 0.11		

3.3 Correlation Analysis between Service Quality Dimensions and Customer Satisfaction

Correlation analysis is measuring or indicating of liner relationship and measure the strength of the association between two variables. The coefficient of correlation founds between -1 and 1. If the correlation coefficient approaches to positive one there is a strong positive relationship among the two variables. In other way the correlation coefficient is -1, show that the two variables have a strong negative relationship. If there is no a relationship between the two variables the correlation coefficient equal to zero.

The correlation coefficient lie between 0.1 and 0.29 the relationship between two variables are week. When the relationship between two variables moderate, the correlation coefficient found between 0.3 and 0.49 and the correlation coefficient of the two variables is more than 0.5 there is a strong relationship among them. For this study Pearson correlation coefficient was used to study the relationship between service qualities dimensions namely tangibility, reliability, responsiveness, assurance and empathy and customer satisfaction. The following table shows that the Pearson Correlation matrices on the relationship between service qualities dimensions and customer satisfaction.

Table 10. Descriptive statistics and correlations (output of SPSS from surveying data in 2019)

Variables	**Tangibility**	**Reliability**	**Responsiveness**	**Assurance**	**Empathy**	**Empathy**	**Customer satisfaction**	**Mean ± SD**
1	1	0.879	0.190	0.561	0.209	0.209	0.550	0.33± 0.11
2	-0.879	1	0.67	0.156	0.649	0.649	0.651	0.34± 0.31
3	0.190	0.67	1	-0.067	0.478	0.478	0.624	0.22± 0.10
4	0.561	-0.156	-0.067	1	0.911	0.911	0.602	0.83± 0.35
5	-0.209	0.649	0.478	0.911	1	1	0.699	0.57± 0.02
6	0.367	0.819	0.6950	0.413	0.9290	0.9290	1	0.76± 0.42

According to Table 10, all of the five service quality dimensions have a strong statistical or significant positive relationship with customer satisfaction at the p-value 0.000, which is less than the significant level 0.01 (1%). Among them empathy have the strongest relationship with correlation coefficient of 0.699 followed by reliability with coefficient of 0.651, responsiveness 0.624 and assurance 0.602. Tangibility has the weakest relationship with customer satisfaction relatively to the other four dimensions at the Pearson correlation coefficient 0.550.

If there is a positive relationship between two variables, indicates that if one variable increases, the other variable will be increases. Therefore, based on the above discussion service quality dimensions and customer satisfaction have a strong positive correlation. So, offering a better quality of service enhancing customer satisfaction. The finding of Meron [12] conducted on quality of service impacts on satisfaction of customer and the results showed that the correlation to satisfaction, that is assurance (0.606), responsiveness (0.585), reliability (0.512), tangibility (0.501) and empathy (0.487). It was inconsistent with this study. This is due to different factors such as time, number of sample and educational level of the respondents.

3.4 Multiple Regression Analysis of Overall Service Quality Dimensions and Customer Satisfaction

Multiple regressions are the most common and widely used to analyze the relationship between a single continues dependent variable and multiple continues on categorical independent variable [1]. Multiple regression analysis is a form of statistical analysis that seeks the equation representing the effect of two or more independent variables on a single dependent variable. Multiple regression analysis is a statistical model used to analysis or figure out

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the extent of the effect of two or more independent variables on a single dependent variable. More precisely, multiple regressions able to show how the value of dependent variable changes as the value of two or more independent variables is changed [27].

For this study, multiple regression analysis was used to determine the strength of the relationship between the overall service quality dimensions those are contracted on the conceptual framework and customer satisfaction. From the multiple regression analysis of the overall service quality dimensions (independent variables) and customer satisfaction (dependent variable), the model summery revealed that 59.8 % (R^2=0.598) of the variation of customer satisfaction explained by the overall service quality dimensions which are developed in the conceptual framework(Tangibility, Reliability, Responsiveness, Assurance and Empathy). Therefore, service quality dimensions have a positive effect on customer satisfaction.

Table 11. Model Summary of service quality dimensions (Regression output of SPSS from Own survey data in 2019)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.770a	.598	.593	.606

Note: a. Predictors: (Constant), Empathy, Tangibility, Reliability, Assurance and Responsiveness

The following analysis of variance (ANOVA) table demonstrates that the good fitness of the model. More precisely, ANOVA table shows that the significance of the regression model. So, the following ANOVA table refers that the model is significant or good fit at F (5, 376) 112.922, p =0.000. So, the result leads to accept the sixth hypothesis ''Service quality has a positive effect on customer satisfaction''. And also, this answer the first research question that is; does service quality has an effect on customer satisfaction in banking service and what kind of effect in commercial bank of Ethiopia at Addis Ababa in east district?

Table 12. ANOVA of service quality dimensions and customer satisfaction (Regression output of SPSS from Own survey data in 2019)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	209.635	14	42.127	112.922	.000b
	Residual	139.799	375	.368		
	Total	345.434	389			

Notes: a. Dependent Variable: Customer satisfaction b. Predictors: (Constant), Empathy, Tangibility, Reliability, Assurance and Responsiveness

Table 13. Coefficients of service quality dimensions on customer satisfaction (Regression output of SPSS from Own survey data in 2019)

Model		Customer satisfaction		
		*B	Std. Error	Beta
1	(Constant)	.264	.168	
	Tangibility	.155	.054	.130
	Reliability	.199	.054	.204
	Responsiveness	.106	.059	.105
	Assurance	.109	.053	.108
	Empathy	.416	.053	.420
	R Square		0.598	

Note: a. Dependent Variable: Customer satisfaction.

The above multiple regression coefficient pertained that the contribution or the effect of each service quality dimensions (independent variables) on the model. The predictor variables which have a higher beta coefficient with the lower p-value ($p<0.05$) have a significant contribution or effect on the dependent variable. Otherwise, predictor variables which have the small beta coefficient and higher p-value have a little or no effect on the model. The above Table 12, indicate that the overall service quality dimensions (tangibility, reliability responsiveness, assurance and empathy) has a positive and significant effect or contribution on customer satisfaction by 0.155, 0.199, 0.106, 0.109 and 0.416 beta value and at p=0.042, 0.000, 0.006, 0.008 and 0.000 respectively.

From the above table of multiple regression coefficients, the following regression equation was developing to predict the level of customer satisfaction due to the listed predictor on this study.

$$Y= a+\beta_1 x_1+ \beta_2 x_2+ \beta_3 x_3+ \beta_4 x_4+ \beta_5 x_5 \quad (4)$$

$$Y= 0.264+0.155x_1+ 0.199x_2+ 0.106x_3+ 0.109x_4+ 0.416x_5 \quad (5)$$

Where, Y= dependent variable (customer satisfaction), a= constant (if all predictor variables are 0 (zero), the value of dependent variable equals to constant (=0.338)), β_1, β_2, β_3, β_4 and β_5 = the beta coefficient of tangibility, reliability responsiveness, assurance and empathy respectively, x_1, x_2, x_3, x_4 and x_5 = the predictors or independent variables (tangibility, reliability responsiveness, assurance and empathy) respectively.

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4. Discussions

For this study, 400 questionnaires were distributed, and 390 questionnaires were properly filled and collected. The general profile of the respondents showed that 53.8% of the respondents are male whereas the remaining 46.2% are female. Regarding to the age profile of the respondents pertain that 77% of the respondents were between 24-30 years old. It implies that majority customer of commercial bank of Ethiopia at Addis east district are up to 30 years old. The educational background of the respondents showed that 69.2 % of the respondents were degree holders and above. Regarding to the length of time the respondents use the service of CBE, 46.2% of the respondent lasted three years. The data about the type of account of the respondents do have revealed that 87.2 % of them do have saving account. So, majority of the customer of the bank have saving account.

The descriptive analysis of this study pertain that tangibility have the highest value of 4.31 followed by assurance with the mean value of 3.97, responsiveness with the mean of 3.92, empathy with the mean of 3.68 and reliability have the least value which is 3.59. Regarding to this we conclude that the service provide by commercial bank of Ethiopia is somewhat quality of service. The customer satisfaction rank is tangibility > assurance > responsiveness > empathy > reliability. The result of the research conducted by Dejene [17] the effect of service quality on customer satisfaction and showed that the mean value of assurance > responsiveness > empathy > reliability > tangibility. Meron [12] has conducted the impact of service quality on customer satisfaction and indicated that the mean value of assurance > responsiveness > reliability > empathy > tangibility. And also in the study of Quyet et al. [11] tangibility is the greatest and reliability is the last satisfaction. The result of this study is consistent with this study. This difference the above studies is came may be due to time and amount of customers. Study on customer satisfaction is necessary every time until service quality and customer satisfaction becomes constant.

The multiple regression analysis result of this study demonstrate that, all service quality dimensions have a positive and statistically significant effect on customer satisfaction at 95% of level of confidence ($p<0.05$). From the model summary of multiple regression the value of R squared shows that 59.8% of the variation of customer satisfaction explained by service quality dimensions the remaining 40.2 % explained by other factors which doesn't included in this study. A research done by Bethlehem [1] on the impact of service quality on customer satisfaction; the case of Commercial Bank of Ethiopia the regression analysis result shows that, except empathy all service quality dimensions (tangibility, reliability, responsiveness and assurance) have a positive and statistically significant impact on customer satisfaction and 82.7% of the variation of customer satisfaction explained by service quality.

The result of the study conducted by Girma [25] on Service Quality and its influence on customer satisfaction: the case of Oromia International Bank SC. The regression analysis indicate that, "the four independent variables tangibility, reliability, assurance and empathy are influencing costumers" satisfaction significantly at 95% ($\alpha=0.05$) confidence level. However, responsiveness has no significant influence on customers' satisfaction at 95% ($\alpha=0.05$) confidence level. The study of Meron [12] on the impact of service quality on customer satisfaction: the case of Bank of Abyssinia S.C regression analysis shows that, tangibility, responsiveness and assurance have appositive and statistical significant effect on customer satisfaction at 95% level of confidence ($\alpha=0.05$). But reliability and empathy doesn't have statistically significant effect on customer satisfaction and service quality can explain 43.8% of the variation of customer satisfaction. Finally all the above mentioned studies reviled that; service quality dimensions have a positive and statistical significant relationship with customer satisfaction.

5. Conclusions

This study investigated to point out the handling of customer satisfaction on service quality dimensions in case of CBE in east district of Addis Ababa. The satisfaction of the customer rank is tangibility > assurance > responsiveness > empathy > reliability. The dimensions of service qualities had positive and statistically significant impact on satisfaction of customers. Relatively empathy and tangibility have the strongest and weakest correlation with satisfaction of customer by 0.699 and 0.550 correlation coefficients respectively. Reliability, responsiveness and assurance also have statistically significant effect on customer satisfaction with 0.651, 0.624 and 0.602 correlation coefficients respectively. The overall service quality dimensions can explain 59.8% of the variation of customer satisfaction.

Competing interests

The authors declare that they have no competing interests.

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ARTICLE

An Analysis of the Business Climate and the Investment Intentions Trend in Post-revolutionary Tunisia

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ABSTRACT

The paper examined the impact of business climate on the investment intentions of local enterprises, Mediterranean enterprises, and individual entrepreneurs in Tunisia. The paper has used both primary and secondary data. The secondary data is used for literature review and primary data has been collected by survey in Tunisia. Primary data were collected from 257 local and 204 Mediterranean businesses, including Large Corporations, Small businesses and SMEs, and 362 individual Tunisian investors, using a structured questionnaire via face-to-face interviews. Principal Component Analysis, t-test, ANOVA, post-hoc test, and the model of Multinomial Logistic Regression Analysis has been carried out to study the interrelationships among the variables in this paper. A descriptive analysis of the data has also been done. The paper found that the most important economic variables for local and Mediterranean enterprises are the "presence of support system" and "Investment Grants". Though for the Individual Investors the most important economic variables are "Saturation of Market", "Investment grants", and "Data Access". The social variables "safety in daily activities, safety while traveling" and "security level of governance" are the most important variables. Further, the most important political variables affecting investment decisions are "Good governance" and "Law enforcement" of local, Mediterranean enterprises, and individual investors. The paper also found that political dimensions have a significant impact on the investment intentions of local enterprises, while social dimensions have a significant impact on the investment intentions of Mediterranean enterprises. Moreover, economic dimensions have a significant impact on the investment decision of individual investors. The paper suggests that, by developing a favorable climate for businesses, the government should promote investment in Tunisia. Easy credit facilities should be provided to the entrepreneurs. There is a need to provide credit guarantee tools to small and medium-sized businesses for easy access to financial services.

1. Introduction

The Tunisian Revolution in 2011 was both a challenge and an opportunity for the country. The revolution has raised economic instability and unemployment; growth in the fiscal year 2011 dropped to -1.1%, while unemployment grew from 13% in 2010 to 18.9% in 2011 and then to 16.7% in 2012. Around the same time, the revolution

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presented Tunisia with the ability to reconsider its growth strategy for the private sector. The country is focusing on the lessons learned over decades of economic liberalization and is using analytical evidence to implement policies that can contribute to long-term prosperity [11].

Over the past few years, successive governments have pursued much-needed institutional changes to strengthen the market environment of Tunisia, including strengthened banking regulations, investment code, and the original "negative lists" and a law allowing public-private partnerships. The Government of Tunisia (GoT) has also promoted entrepreneurship through the implementation of the Start-Up Act. The GoT also passed the "organic budget laws" to ensure full fiscal accountability and to notify the public about government spending programs over three years. These measures would help Tunisia draw international and domestic investment [10]. The acceleration of Tunisia into the global economy, combined with domestic reforms aimed at rising firm competitiveness, has contributed to an increase in the country's investment.

Tunisia continues to make strides in its transition to democracy in the post-revolution. Since the 2011 revolution, Tunisia has made considerable efforts to improve the business environment of the country by developing a significant infrastructure, a legal framework that promotes investment and policies to build an entrepreneurial community, undertaken by both public authorities and the private sector for training, support, and coaching.

Tunisia has introduced a generous program of rewards for investment in general and the development of SMEs in particular, considering the significant role that entrepreneurship plays in job creation, poverty alleviation, and social and regional inequality.

The structure of the paper has been divided into five sections. The first section introduces the study. The second section is based on the literature review and hypotheses of the study. The third section is related to the data and methodology used in the study. The results of the study are given in fourth section and conclusion and implications are discussed in fifth section.

2. Literature Review and Hypotheses of the Study

Various authors have analysed the factors affecting the investment intention of an individual or a firm. They have found many variables affecting the willingness to invest in any country. In any country, low risk, subsidies and current taxation system are the important variables. (14)

A study examined the factors affecting the investment intentions in Sri Lanka found that risk factors, returns on investment, liquidity of investment, tax consequences of an investments, inflation and the terms of an investment. [15] The theory of planned behaviour is an important predictor of investment decisions. The influence of relatives and friends, and accessibility to funds are an imperative predictors of investment intentions of students [16].

A study found that investors in Tunisia do not always behave rationally while making decisions about investment. In reality, Tunisian investors seem to be unconfident, tentative and very receptive to the reactions and views of others. The other result related to the relationship between demographic variables and financial behavioural factors given, in particular, that variables such as gender, age, socio-professional group and experience both seem to have an impact on the actions of investors operating in the Tunisian market. This research indicates that individuals at a certain age are less subject to behavioural prejudice as they become more educated, whereas older investors who are comparatively less educated and have smaller incomes are vulnerable to behavioural bias [17].

Factors Affecting Investment Intentions of entrepreneurs in Tunisia

Increased turmoil in the wake of the transition, leading to civil unrest and terrorist attacks, undermined the investment climate and seriously affected economic sectors [13]. The investment climate in a country affects the investment intentions of the firms. Hence, the investment intentions of the firms are affected by various factors. And these factors can be social, economic, and political.

The economy of Tunisia is considered as a lower-middle-income country with a GDP per capita of USD 3,713 (13,417 in PPP terms) and a population of 11.7 million in 2019. Tunisia's economy was heavily regulated, which hampered competition and investment. The GoT adopted the Five-year Development Plan (2016-2020), followed by the Economic and Social Roadmap 2018-2020, to accelerate macro-and fiscal-stabilization reforms, modernize social safety nets (SSN), and improve private investment, competitiveness, and productivity [13].

Political stability in a country plays an important role to encourage investment. Political risk is recognized as the likelihood that political decision-making and political and social developments in a nation may affect the economic environment, contributing to a loss of income for the prospective investor. Thus, this risk stems from the confusion as to the future profits of investments that can benefit or impede the interests of the company [1].

The evaluation of a nation at risk relies on the stability of the government, the existence of an independent judiciary, and the reputation of the legal system. The same risk is also associated with investment decisions that can cause

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direct or indirect financial loss or damage to investment projects as a result of changes to the economic or political climate [6].

It has been shown that people favour strong self-efficacy, especially when coupled with the availability of national support programs and efficient networks, which can be seen as a thread that motivates entrepreneurs to engage in the field of venture creation [4,9].

Hypotheses of the Study

(1) There is a significant difference in the investment intensions of Mediterranean enterprises, local enterprises and individuals.

(2) Investment grants is an important economic variable for all the enterprises.

(3) Safety and security level in the country are the most important social variables.

(4) Good governance is a significant political variable impacting investment intentions.

(5) All the dimensions (political, social and economic) have significant impact on the investment intentions of all the enterprises.

2.1 Profile of Firms in Tunisia

The firms can be categorized as SMEs, Medium enterprises, large enterprises, and small businesses according to their size i.e. total investment and numbers of workers.

In Tunisia, there is no official definition of small and medium-sized enterprises. Enterprises with a gross investment of less than 3 million TND in industry and services are known as small and medium enterprises. SMEs are companies that are operated directly by their owners, who undertake financial, technological, and moral obligations in a personal and direct manner. Any enterprise which employs between 10 and 100 workers belongs to the SME group [8]. Furthermore, any enterprises which employ equal to or more than 100 workers belong to a large enterprise. (INS RNE, 2013). Tunisian statistical office indicates that the majority of businesses are single-person enterprises, i.e. self-employed entrepreneurs. They make up nearly 90% of all companies. In Tunisia, 98.2 percent of the total enterprises are MSME, which consists of Micro (76.7%), Small (19.2%), and Medium (2 %) Enterprises. While large enterprises are only 2.2 percent of the total enterprises in Tunisia [3].

2.2 Investment Incentives for SMEs in Tunisia

The Government of Tunisia has made substantial efforts to develop the business environment in Tunisia and to encourage investment in small and medium-sized enterprises. Tunisia was ranked 42nd out of 132 countries for entrepreneurial ecosystem health in 2017 [5].

The Government of Tunisia has enacted various investment incentives code to encourage investment. The investment policies and regulatory framework of Tunisia was based on the 1993 Investment Benefits Code (Law 93-120 of December 1993), which relies on the introduction of the offshore system in 1972 (Law 72-38 of April 1972) [12].

Various tax advantages, combined with a streamlined legal and regulatory structure, have allowed the private equity sector to grow slightly. In the aftermath of the 2011 revolution, the institutional and regulatory framework for private equity investments was strengthened and led to an increase in the creation of investment vehicles such as *SICARs* (Venture Capital Investment Company-investment companies), *FCPRs* (Common Fund of Investment at Risk Fund-mutual funds dedicated to private equity activities) and FAs (Funds Priming-Funds for Startups).

In April 2018, the Government of Tunisia adopted the *Start-Up Act*, to provide tax and other incentives to promote the development and growth of innovative start-ups and small and medium-sized enterprises and to transform Tunisia into a vibrant business center. Furthermore, a new "*horizontal law*", which intends to relax constraints on private investment and eliminate barriers to the investment climate, including those relating to private equity, has been accepted by the Government and sent to Parliament for approval [13].

Various measures have been taken by the government to incentivize the SMEs in Tunisia. *FOPRODI* was set up in 1974 with three following objectives: (1) the strengthening of entrepreneurship through new entrepreneurial ventures in small and medium-sized enterprises (defined as enterprises with a capital of up to one million Tunisian dinars). (2) the decentralization of manufacturing in a country with a strong concentration in the coastal area and of three major cities (Tunis, Sfax, and the City of *FOPRODI*), and (3) reducing the country's persistently high level of the official unemployment rate [7].

GOT has developed training and support measures to promote SMEs. Various support measures have been provided for small enterprise funding with the establishment of the National Fund for the Promotion of Handicrafts and Small Trades (*FONAPRA*) in 1981 and the *Bank for Small and Medium-sized Enterprise Funding* in 2005. The Committee states that the Tunisian Bank of Solidarity (BTS) promotes access to bank loans for entrepreneurs and that it funded 81,803 micro-enterprise ventures between 1998 and 2005, of which 25,437 were set-up by women [7]. Also, the Tunisian Bank of Solidarity (BTS) and Financing bank of SMEs (BFPME) have played an important role in providing credits to SMEs.

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2.3 The Objective of the Study

The objective of this paper is to examine the business climate and investment intentions of local enterprises, Mediterranean enterprises, and individual investors in Tunisia in the post-revolution. It has also examined the impact of the Socio-economic and political environment on the investment intentions of the entrepreneurs.

3. Data and Methodology

The paper has used both primary and secondary data. The secondary data has been used for the literature review. The primary has been collected from the 257 local enterprises and 204 Mediterranean enterprises including Large Enterprises, Small businesses, and SMEs and 362 individual investors from Tunisia by using structured questionnaire through face-to-face interview. Principal Component Analysis, ANOVA, and the model of Multinomial Logistic Regression Analysis have been carried out to study the interrelationships among the variables in this paper. A descriptive analysis of the data has also been done.

3.1 Principle Component Analysis

Principal-components analysis is a method to reduce the dimensionality of multivariate data to make its structure clearer. Using PCA, a score was estimated for three dimensions (social, economic and political), by taking into account the associated items, their positive or negative impact on the total score and the precise impact on the total variation of the estimated score for each dimension. The score for each of the three dimensions was based on the related regression equations:

$$Score_{Politcal\ Variables} = a_1 Pol_1 + a_2 Pol_2 + a_3 Pol_3 + \ldots\ldots\ldots\ldots + a_n Pol_n \quad (1)$$

$$Score_{Economic\ Variables} = b_1 Eco_1 + b_2 Eco_2 + b_3 Eco_3 + \ldots\ldots\ldots\ldots + b_n Eco_n \quad (2)$$

$$Score_{Social\ Variables} = c_1 Soc_1 + c_2 Soc_2 + c_3 Soc_3 + \ldots\ldots\ldots\ldots + c_n Soc_n \quad (3)$$

In the above 3 equations, ai=1,...,n, bi=1,...,n, ci=1,...,n represent the estimations of the parameters from the models related to the three dimensions. The details of political, Economic and Social variables are given in Annexure.

3.2 Multinomial Logistic Regression Model

The model of multinomial logistic regression analysis has been used to study the impact of social, economic and political dimensions on investment intentions of enterprises in this paper.

The relation between a set of predictors and a multicategory nominal (unordered) outcome is estimated by multinomial logistic regression models. In logistic regression analysis, the outcome is always labelled as 0 or1, where 1 means that the interest outcome is present, and 0 indicates that the interest outcome is missing. If p is defined as the probability that outcome is equal to 1, then the equation of multinomial logistic regression can be written as:

$$\hat{P} = \frac{\exp(b_0 + b_1 X_1 + b_2 X_2 + \ldots + b_p X_p}{1 + \exp(b_0 + b_1 X_1 + b_2 X_2 + \ldots + b_p X_p)}$$

Here $\hat{P}$ is defined as expected probability of the presence of outcome. X_1, X_2……, Xp are the different independent variables. In the equation, b_0, b_1, b_2……., bp are the regression coefficients.

In the study ten multinomial regression equations were used. The regression model, with dependent variables (investment intentions of enterprises) against social economic and political dimensions as the explanatory variables were used to study investment intentions of local, Mediterranean and individual enterprises

Here $\hat{P}$ = Investment intentions.

X_1 = Social dimensions, X_2 = Political dimensions, X_3 = Economic dimensions, b_0, b_1, b_2, b_3 are the regression coefficients.

$$\hat{Investment\ Intentions} = \frac{\exp(b_0 + b_1 Social\ dimensions + b_2 Political\ dimensions + b_3 Economic\ dimensions)}{1 + \exp(b_0 + b_1 Social\ dimensions + b_2 Political\ dimension + b_3 Economic\ dimensions)}$$

4. Results and Discussion

4.1 Descriptive Statistics of Local, Mediterranean Enterprises and Individual Entrepreneurs in Tunisia

4.1.1 Descriptive of Local and Mediterranean Enterprises

The studied population consists of different Enterprises classes i.e. large enterprises, small businesses, and SMEs in Tunisia. In the case of both Local and Mediterranean enterprises, more than half are SMEs. The number of large enterprises is very less (Table 1).

The companies are further categorized into three age categories. Most of the companies are 2 to 5 years old. It indicates that investment activities have taken place recently.

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Table 1. Descriptive of Local and Mediterranean Enterprises

Variables	Categories	Local Enterprises		Mediterranean Enterprises	
		Number of Respondents	Percentage (%)	Number of Respondents	Percentage (%)
Age of Company	0-2	74	28.8	56	27.5
	2-5	157	61.1	128	62.7
	6-10	26	10.1	20	9.8
	Total	257	100	204	100.0
Enterprise-Class	Large Enterprise	19	7.4	13	6.4
	Small Business	107	41.6	80	39.2
	SMEs	131	51	111	54.4
	Total	257	100	204	100.0

4.1.2 Descriptive of Individual Enterprises

Table 2 shows the investment activities by individual investors in Tunisia. Individual investors include students, jobseekers, employees, external consultants, and resident investors. 32.3 percent of the total individual investors are students, this is followed by employees (21.8 percent). 18.8 percent of the total individual wanted to do investment in the future. More than half of the individual investors are females. Most of the investors are of the age group between 25 to 37 years old.

Table 2. Descriptive of Individual Entrepreneurs in Tunisia

Variable	Description	Frequency	Percent
Individual Investors	Student	117	32.3
	Jobseeker	63	17.4
	Future investor	68	18.8
	Employee	79	21.8
	External Consultant	25	6.9
	Resident Investor	10	2.8
SEX	Female	203	56.1
	Male	159	43.9
AGE	18-24	94	26.0
	25-37	226	62.4
	38-60	39	10.8
	+61	3	0.8
LEVEL of STUDIES	Bac	12	3.3
	Bac+2	32	8.8
	Bac+3	60	16.6
	Bac+4	31	8.6
	Bac+5	107	29.6
	Bac+6	61	16.9
	Doctor	23	6.4
	Ph.D. student	29	8.0
	Professional training	7	1.9
	Total	362	100.0

4.2 Results of ANOVA for Local and Mediterranean Enterprises

In Table 3, the value of P =0.215. There is no significant difference in the investment intentions between groups of enterprises. Hence, the difference is non-significant in the mean of investment intentions of SMEs, small businesses, and large enterprises.

Table 3. ANOVA results of the Test of Significance for Local Enterprises

ANOVA					
Are you planning to invest in Tunisia?					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	4.856	2	2.428	1.548	0.215
Within Groups	398.490	254	1.569		
Total	403.346	256			

Table 4 shows that there is a significant difference in the investment intentions between groups (P= 0.000, F=67.354). It indicates that there is a statistically significant difference in the mean investment intentions of different enterprise classes i.e. SMEs, small businesses, and large enterprises.

Table 4. ANOVA results of the Test of Significance for Mediterranean Enterprises

ANOVA					
Are you planning to invest in Tunisia?					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	177.051	2	88.526	67.354	0.000
Within Groups	264.179	201	1.314		
Total	441.230	203			

In Table 5 the test of post-hoc was applied to check the difference in investment intentions of different enterprises classes-large enterprises, small businesses, and SMEs in Mediterranean enterprises.

The test of Games-Howell shows that there is a significant difference in the investment intention of SMEs and small business (P=0.000), and SMEs and large enterprises (P=0.005). Whereas the difference is non-significant in the investment intentions of large businesses and small businesses (P=0.359).

Table 5. Post-hoc test for Mediterranean Enterprises

Multiple Comparisons (Games-Howell)						
Dependent Variable: Are you planning to invest in Tunisia?						
(I) Enterprise-Class:	(J) Enterprises Class	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Large enterprise	Small Business	0.521	0.359	0.346	-0.43	1.47
	SMEs	-1.406*	0.381	0.005	-2.39	-0.42
Small Business	Large enterprise	-0.521	0.359	0.346	-1.47	0.43
	SMEs	-1.927*	0.146	0.000	-2.27	-1.58
SMEs	Large enterprise	1.406*	0.381	0.005	0.42	2.39
	Small Business	1.927*	0.146	0.000	1.58	2.27

Note: *. The mean difference is significant at the 0.05 level.

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Hence, investment decisions of all the enterprises (SMEs, small businesses, and large enterprises) under Mediterranean enterprises are significantly different, but under local enterprises, no significant difference was found.

Individual Entrepreneurs in Tunisia

(1) SEX-WISE investment intentions

An Independent t-test was applied to find the sex-wise investment intentions of the individual entrepreneurs. The study found that there is a non-significant difference in the investment intentions of males and females. t (360) = 0.129, P = 0.897.

(2) Profession-Wise investment intentions

The ANOVA table 6 shows that there is a significant difference between groups in the investment intention of individual investors from different professional classes. (P=0.000, F= 6.248). It indicates that there is a statistically significant difference in the mean investment intention of investors of various profession/

Table 6. Profession-wise results of ANOVA

ANOVA					
Are you planning to invest in Tunisia?					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	50.990	5	10.198	6.248	0.000
Within Groups	581.055	356	1.632		
Total	632.044	361			

The test of post-hoc (Games-Howell) was applied to find the profession-wise difference in the investment intention of individuals (see Annexure Table 7). The results show that there is a significant difference in the investment intentions of students and resident investors (P=0.033), Jobseeker and Resident investors (P=0.016), Future Investor, and Employee (P=0.001), Employee and Resident Investors (P=0.004). Further, there is no statistically significant difference in the investment intentions of External consultants from all other professions.

Thus, there is no significant difference in the sex-wise investment intentions of the individual investor, but there is a significant difference in the investment decisions of individuals from various professionals.

Hence, the hypothesis i.e. there is a significant difference in the investment intensions of Mediterranean enterprises, local enterprises and individuals cannot be conclusively accepted or rejected.

4.3 Estimating the Scores for the Three Dimensions by Using Principal Component Analysis (PCA)

4.3.1 Principal Component Analysis for Local Enterprises in Tunisia

The score was estimated for the three dimensions (Social, Political, and Economic) by using PCA. (Table 8) The score is based on the coefficient of the associated score functions. The calculated coefficient also indicates the significance of the item in describing the total variance of investment intentions based on the items considered.

For the Economic dimension, all the 20 items positively influence the estimated score. The score was highest for the variable ECO18 (Presence of support structure) followed by ECO12 (Investment Grants). It indicates that the presence of support structure and Investment grants are the most important economic variables affecting investment intentions.

For the Social dimensions, all the 10 variables positively influence the score. The highest positive score was shown by the variable SOC7 (Safe during daily activities) followed by SOC8 (Safe while traveling) and SOC10 (security level in your governorate). It indicates that safety and security in a country are very necessary for enterprises in impacting their investment intentions.

For the Political dimensions, all 8 variables show a positive impact. The variable POL2 (Good Governance) has the highest positive score followed by POL3 (Law enforcement) and POL5 (Municipal Governance). It shows that enterprises give top priority to the prevailing government system or authority. If the government system is conducive for the entrepreneur and laws are favorable for the investment, then it has a positive impact on the investment intentions.

Table 8. Component Score Coefficient Matrix for local enterprises

Component Score Coefficient Matrix					
Economic Variables		Social Variables		Political Variables	
ECO1	0.051	**SOC1**	0.117	**POL1**	0.198
ECO2	0.044	**SOC2**	0.101	**POL2**	0.212
ECO3	0.072	**SOC3**	0.097	**POL3**	0.209
ECO4	0.076	**SOC4**	0.136	**POL4**	0.156
ECO5	0.084	**SOC5**	0.187	**POL5**	0.199
ECO6	0.054	**SOC6**	0.187	**POL6**	0.193
ECO7	0.084	**SOC7**	0.214	**POL7**	0.063
ECO8	0.086	**SOC8**	0.198	**POL8**	0.059
ECO9	0.056	**SOC9**	0.135		
ECO10	0.076	**SOC10**	0.196		
ECO11	0.117				
ECO12	0.121				
ECO13	0.110				
ECO14	0.121				
ECO15	0.119				
ECO16	0.107				
ECO17	0.105				
ECO18	0.128				
ECO19	0.082				
ECO20	0.019				
KMO	0.862	**KMO**	0.815	**KMO**	0.889
Sig	0.000	**Sig**	0.000	**Sig**	0.000

Notes: KMO (Kaiser–Meyer–Olkin Measure of Sampling Adequacy). Extraction method: Principal Component; Analysis (PCA). Rotation method: Varimax with Kaiser normalization. Component scores.

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All the dimensions show a high level of statistical Kaiser-Meyer-Olkin (KMO) (over 0.8). It indicates a high level of association between the variables considered for each dimension. The high level of KMO also indicates that the variables included in the analysis explain a significant proportion (over 80%) of the variance calculated for each dimension. Also, there is an absence of collinearity among the variables when testing the influence of the dimensions on investment intentions of the enterprises.

4.3.2 Principal Component Analysis of Mediterranean Enterprises

The principal component analysis has been done in the case of Mediterranean Enterprises in Table 9. The score was estimated in three dimensions (Social, Political, and Economic) using the PCA, and it is based on the coefficient Matrix of the component score.

About the economic dimension, all 13 items have a positive impact on the estimated score. The score was highest for ECO13 (Presence of support structure) followed by ECO10 (Data Access) and ECO11 (Trade Union Rights). It indicates that the presence of a suitable environment in a country has a positive impact on the investment decisions of the enterprises. If there is unrestricted data access, entrepreneurs will be able to gather investment information. Trade Unions are an important part of SMEs and large enterprises, enterprises feel secure with the active participation of trade unions in a country.

All 9 variables of social score significantly affected the score. The score was highest for SOC6 (Safety during daily activities) followed by SOC7 (safe during traveling) and SOC9 (Security level in Tunisia). It reveals that entrepreneurs take investment decisions based on safety and security levels in the country and these are the most important variable affecting investment intentions.

Concerning political aspects, all 7 factors have a positive effect. The variable POL2 (Good Governance) showed the highest score followed by POL5 (political stability) and POL3 (Law enforcement). Hence, the investment decisions of the Mediterranean enterprises are impacted by most of the good government systems, political stability, and favorable law enforcement for investment.

Table 9. Component Score Coefficient Matrix for Mediterranean Enterprises

Component Score Coefficient Matrix					
Economic Variables		**Social Variables**		**Political Variables**	
ECO1	0.071	**SOC1**	0.140	**POL1**	0.248
ECO2	0.080	**SOC2**	0.128	**POL2**	0.281
ECO3	0.084	**SOC3**	0.136	**POL3**	0.270
ECO4	0.048	**SOC4**	0.163	**POL4**	0.165
ECO5	0.105	**SOC5**	0.205	**POL5**	0.255
ECO6	0.125	**SOC6**	0.234	**POL6**	0.094
ECO7	0.160	**SOC7**	0.219	**POL7**	0.072
ECO8	0.145	**SOC8**	0.137		
ECO9	0.152	**SOC9**	0.212		
ECO10	0.182				
ECO11	0.170				
ECO12	0.156				
ECO13	0.191				
KMO	0.836	**KMO**	0.776	**KMO**	0.826
Sig	0.000	**Sig**	0.000	**Sig**	0.000

Notes: KMO (Kaiser–Meyer–Olkin Measure of Sampling Adequacy). Extraction method: Principal Component; Analysis (PCA). Rotation method: Varimax with Kaiser Normalization. Component scores.

All dimensions display a high degree of Kaiser-Meyer-Olkin (KMO) statistics (more than 0.7). This implies that the variables used in the study describe a large proportion (over 75 percent) of the variance measured for each dimension. Additionally, there is a lack of collinearity between them when measuring the effect of the dimensions on the investment intentions of firms.

4.3.3 Principal Component Analysis of Individual Entrepreneurs

The principal component analysis has been carried out for individual entrepreneurs in table 12. The score was estimated in three dimensions (Social, Political, and Economic) using the PCA and is based on the component score matrix (Table 10).

As regards the economic dimension, all 20 items have a positive impact on the estimated score. The highest score of the variable ECO20 (Saturation of the market) indicates the most important variable impacting the investment intentions of individuals. It is followed by ECO12 (Investment Grants), and ECO15 (Data Access). It indicates that the availability of the investment grants has a positive impact on the investment decision of the entrepreneurs and they would like to invest more in the country. Moreover, easily available information helps them to make an investment plan.

Table 10. Component Score Coefficient Matrix

Component Score Coefficient Matrix					
Economic Variables		**Social Variables**		**Political Variables**	
ECO1	0.049	**SOC1**	0.126	**POL1**	0.201
ECO2	0.043	**SOC2**	0.106	**POL2**	0.211
ECO3	0.075	**SOC3**	0.100	**POL3**	0.207
ECO4	0.075	**SOC4**	0.142	**POL4**	0.152

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ECO5	0.089	**SOC5**	0.188	**POL5**	0.196
ECO6	0.055	**SOC6**	0.174	**POL6**	0.194
ECO7	0.085	**SOC7**	0.216	**POL7**	0.068
ECO8	0.084	**SOC8**	0.195	**POL8**	0.061
ECO9	0.060	**SOC9**	0.136		
ECO10	0.071	**SOC10**	0.191		
ECO11	0.120		0.817		
ECO12	0.127		0.000		
ECO13	0.116				
ECO14	0.120				
ECO15	0.123				
ECO16	0.103				
ECO17	0.108				
ECO18	0.128				
ECO19	0.073				
ECO20	0.011				
KMO	0.865	**KMO**	0.817	**KMO**	0.882
Sig	0.000	**Sig**	0.000	**Sig**	0.000

Notes: KMO (Kaiser–Meyer–Olkin Measure of Sampling Adequacy). Extraction method: Principal Component; Analysis (PCA). Rotation method: Varimax with Kaiser normalization. Component scores.

Out of the 10 variables of the social dimension, the variable SOC7 (Safety in daily activities) showed the highest score. It is followed by SOC8 (Safety in traveling) and SOC10 (security level of governance). Again, like the local and Mediterranean Enterprises, Individual entrepreneurs would like to invest if he feels secure and safe in the country.

Out of the 8 variables of political dimensions, the variable POL2 (Good Governance) is the most important variable followed by POL3 (Law enforcement) and POL1 (Absence of corruption). It shows that Individuals would prefer to invest in such a country that is corruption-free with good governance. And there should be suitable laws for the entrepreneur.

All dimensions show a high level of Kaiser-Meyer-Olkin (KMO) statistics (more than 0.8).

Robustness Check

(1) All the three models meet the assumptions of PCA. The data is based on more than 150 individuals or companies.

(2) There is absence of multicollinearity. The VIF value is between 1and 10.

(3) The data is normal with mean zero and standard deviation 1 as shown in the table 11.

(4) The value of Kaiser-Meyer-Olkin (KMO) statistics is more than 0.8 in almost all the cases. It indicates that sampling is adequate.

Table 11 below shows that the scores of all three dimensions are normally distributed with a mean (zero) and a standard deviation (one). For the social dimension, the positive values of the score indicate that social variables play an important role in the investment intention of the enterprises, negative values indicate a negative impact on the investment intention of the enterprises due to lack of appropriate social infrastructure. For the economic variables, the positive value of the score indicates that economic variables play an important role in the investment intentions of the enterprises, but the negative values of the variable indicate that lack of economic facilities hurts the investment decisions of the enterprises.

Table 11. Descriptive Statistics Regarding the Score Estimation of Three Dimensions

Dimensions	N	Minimum	Maximum	Mean	Std. Deviation
Social Variables	257	-2.34871	3.14596	0.0000000	1.00000000
Economic Variables	257	-2.29743	2.48486	0.0000000	1.00000000
Political Variables	257	-1.60609	2.39817	0.0000000	1.00000000
Valid N (listwise)	257				
Mediterranean Enterprises					
Social Variables	204	-2.178	3.211	0	1
Economic Variables	204	-2.283	2.680	0	1
Political Variables	204	-1.777	2.361	0	1
Valid N (listwise)	204				
Individual Entrepreneur					
Social Variables	362	-2.40	3.17	0	1
Economic Variables	362	-2.36	2.46	0	1
Political Variables	362	-1.65	2.32	0	1
Valid N (listwise)	362				

Furthermore, the positive values of the political variables indicate that it has a positive impact on the investment intentions of the enterprises, while the negative values of the score indicate that political instability harms the investment intentions of the enterprises.

The analysis of principal component analysis for local, Mediterranean enterprises and individual investors have found the important variables affecting the investment decisions. The most important economic variables for local and Mediterranean enterprises are the "presence of support system" and "Investment Grants". While for the Individual Investors the most important economic variables are "Saturation of Market", "Investment grants", and "Data Access". So, the hypothesis i.e. Investment grants is an important economic variable for all the enterprises cannot be conclusively accepted or rejected.

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The social variables "safety in daily activities, safety while traveling" and "security level of governance" are the most important variables. Thus, the hypothesis i.e. safety and security are significant social variables for all the enterprises cannot accepted.

And the most important political variables affecting investment decisions are "Good governance" and "Law enforcement" of local, Mediterranean enterprises and individual investors. Hence, the hypothesis i.e. "Good governance" is an important political variable for all the enterprises can be accepted

4.4 Estimating the Influence of the Three Dimensions (Economic, Social and Political) on the Investment Intentions

To estimate the impact of three dimensions (Economic, Political, and Social) on the investment intentions of all the enterprises (SMEs, Small business, and Large Enterprises), multinomial regression analysis has been used.

4.4.1 Results of Multinomial Logistic Regression Analysis

In the table 12 the results of multinomial logistic regression analysis of the covariates for the investment intentions of the local enterprises in Tunisia. Social dimensions have a negative but significant impact on the short-term investments, it indicates that the social environment is not favorable for short term investment in Tunisia. Also, political dimensions have a significant impact on all the short-term, medium-term, and long-term investments, it indicates that the political environment has a significant impact on the investment decision for all types of investment. The final model is a non-significant with [chi-square (12)=20.407, p>.001].

The table 13 shows the covariates of investment intentions of all the enterprise classes (SMEs, Small Business, and Large Enterprises) in the Mediterranean enterprises. Social dimensions have a positive and significant impact on short-term investment decisions compare to long-term investment. It indicates that the social environment has a significant impact on Mediterranean enterprises while investing in short term plans. All other dimensions (political and Economic) were found to be non-significant in affecting the investment intentions of Mediterranean enterprises.

The final model was found to be non-significant with

Table 12. Multinomial logistic regression analysis of covariates for Investment Intentions of All the Enterprises Classes in Local Enterprises

Parameter Estimates									
Investment Intentions of All Enterprises	**Independent Variables**	**B**	**Std. Error**	**Wald**	**Df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
Hesitant to Invest	**Economic Variables**	-0.027	0.043	0.399	1	0.528	0.973	0.895	1.058
	Social Variable	-0.036	0.059	0.386	1	0.534	0.964	0.86	1.082
	Political Variable	0.145	0.078	3.41	1	0.065	1.156	0.991	1.348
Yes, in the short term	**Economic Variables**	0.007	0.042	0.03	1	0.862	1.007	0.928	1.093
	Social Variable	-0.116	0.057	4.106	1	0.043	0.89	0.795	0.996
	Political Variable	0.163	0.076	4.613	1	0.032	1.177	1.014	1.366
Yes, medium-Term	**Economic Variables**	-0.061	0.039	2.486	1	0.115	0.941	0.872	1.015
	Social Variable	-0.044	0.053	0.684	1	0.408	0.957	0.862	1.062
	Political Variable	0.199	0.074	7.33	1	0.007	1.22	1.057	1.41
Yes, long term	**Economic Variables**	-0.037	0.039	0.913	1	0.339	0.964	0.893	1.04
	Social Variable	-0.049	0.053	0.859	1	0.354	0.952	0.857	1.057
	Political Variable	0.202	0.073	7.644	1	0.006	1.224	1.061	1.412
a. The reference category is: No.									
Model Fitting Information									
Model	**Model Fitting Criteria**		**Likelihood Ratio Tests**				**Pseudo R-Square**		
	-2 Log Likelihood		**Chi-Square**		**Df**		**Sig.**	**(Cox and Snell)**	
Intercept Only	762.2								
Final	741.8		20.41		12		0.06	0.076	

Table 13. Multinomial logistic regression analysis of covariates for Investment Intentions of All the Enterprises Classes in Mediterranean Enterprises

Parameter Estimates									
Investment Intentions of All Enterprises	**Independent Variables**	**B**	**Std. Error**	**Wald**	**Df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
Yes, medium-term	Social Variable	0.008	0.070	0.012	1	0.912	1.008	0.878	1.157
	Economic Variables	0.028	0.052	0.294	1	0.587	1.029	0.929	1.140
	Political Variables	-0.054	0.069	0.611	1	0.435	0.947	0.827	1.085
Yes, in the short term	Social Variable	0.207	0.087	5.602	1	0.018	1.230	1.036	1.459
	Economic Variables	-0.052	0.061	0.709	1	0.400	0.950	0.842	1.071
	Political Variables	-0.029	0.084	0.119	1	0.731	0.972	0.824	1.145
Hesitant	Social Variable	0.002	0.071	0.001	1	0.976	1.002	0.873	1.151
	Economic Variables	0.023	0.051	0.195	1	0.659	1.023	0.925	1.131
	Political Variables	-0.101	0.070	2.112	1	0.146	0.904	0.789	1.036
No	Social Variable	0.093	0.063	2.195	1	0.138	1.098	0.970	1.241
	Economic Variables	0.016	0.046	0.120	1	0.729	1.016	0.928	1.112
	Political Variables	-0.093	0.062	2.252	1	0.133	0.911	0.807	1.029
a. The reference category is: Yes, long term.									
Model Fitting Information									
Model	**Model Fitting Criteria**		**Likelihood Ratio Tests**				**Pseudo R-Square**		
	-2 Log Likelihood		**Chi-Square**		**Df**	**Sig.**	**(Cox and Snell)**		
Intercept Only	595.3								
Final	579.6		15.678		12	0.206	0.074		

[chi-square (12) = 15.678, p>0.206].

Hence, it was found that political dimensions have a significant impact on all types of investment plans (short-term, medium-term, and long-term) of local enterprises. While social dimensions have a significant impact on investment decisions for short-term plans in the case of Mediterranean enterprises.

4.4.2 Impact of the Three Dimension on the Investment Intentions of Large Enterprises

Table 14 shows the results of multinomial logistic regression, it shows the impact of three dimensions (Economic, Social, and Political) on the investment intentions of large enterprises in a local business.

The political dimension was found to be significant in impacting the investment intentions of large enterprises in short-term and medium-term investments. It means that the political environment has a great impact on the investment decision of large enterprises of local enterprises. Political dimensions such as political stability, absence of corruption, a conducive government system, and favorable laws for investment have a significant impact on short-term and medium-term plans. The final model is a significant improvement in fit over the null model [chi-square (9) = 25.027, p<0.05].

Table 15 demonstrates the covariates of investment intentions of large enterprises in Mediterranean enterprises. Large enterprises are investing only in medium-term investments, it means they are not interested in short-term and long-term plans. All three dimensions (political, social, and economic) have a non-significant impact on the investment intentions of large enterprises in Mediterranean enterprises. The final model was found to be non-significant [chi-square (6) = 6.96, p>0.324].

Thus, political dimensions have a significant impact on the investment decisions of large enterprises in the case of local enterprises. But in the case of Mediterranean enterprises, large enterprises are only investing in medium term investment plans.

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Table 14. Multinomial logistic regression analysis of covariates for Investment Intentions of Large Enterprises of Local Enterprises

Parameter Estimates									
Investment Intentions of Large Enterprises	**Independent Variables**	**B**	**Std. Error**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
Yes, in the short term	Economic Variables	4.599	122.153	0.001	1	0.970	99.411	1.048E-102	9.43E+105
	Social Variable	-23.169	146.782	0.025	1	0.875	8.664E-11	9.915E-136	7.57E+114
	Political Variable	11.506	0.152	5745.127	1	0.000	99268.281	73722.827	1.34E+05
Yes, medium-Term	Economic Variables	4.366	122.153	0.001	1	0.971	78.765	8.305E-103	7.47E+105
	Social Variable	-23.290	146.782	0.025	1	0.874	7.679E-11	8.791E-136	6.71E+114
	Political Variable	11.519	0.113	10392.266	1	0.000	100632.117	80640.480	1.26E+05
Yes, long term	Economic Variables	4.401	122.153	0.001	1	0.971	81.553	8.598E-103	7.74E+105
	Social Variable	-23.563	146.782	0.026	1	0.872	5.843E-11	6.687E-136	5.11E+114
	Political Variable	11.549	0.000		1		103687.262	103687.262	103687.262
a. The reference category is: No.									

Model Fitting Information					
Model	**Model Fitting Criteria**	**Likelihood Ratio Tests**			**Pseudo R-Square**
	-2 Log Likelihood	**Chi-Square**	**Df**	**Sig.**	**(Cox and Snell)**
Intercept Only	48.06494				
Final	23.0377	25.027	9	0.003	0.732

Table 15. Multinomial logistic regression analysis of covariates for Investment Intentions of Large Enterprises in Mediterranean Enterprises

Parameter Estimates									
Investment Intentions of Large Enterprises	**Independent Variables**	**B**	**Std. Error**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
Yes, medium-term	**Social Variable**	-0.048	0.383	0.016	1	0.901	0.953	0.450	2.019
	Economic Variables	-0.061	0.325	0.035	1	0.852	0.941	0.498	1.779
	Political Variables	-0.110	0.238	0.212	1	0.645	0.896	0.562	1.428
Hesitant	**Social variable**	-0.173	0.409	0.179	1	0.672	0.841	0.377	1.875
	Economic Variables	0.204	0.314	0.423	1	0.516	1.227	0.663	2.270
	Political Variables	0.236	0.385	0.374	1	0.541	1.266	0.595	2.693
a. The reference category is: No.									

Model Fitting Information					
Model	**Model Fitting Criteria**	**Likelihood Ratio Tests**			**Pseudo R-Square**
	-2 Log Likelihood	**Chi-Square**	**Df**	**Sig.**	**(Cox and Snell)**
Intercept Only	24.1				
Final	17.1	6.96	6	0.324	0.415

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4.4.3 Impact of the Three Dimension (Political, Social and Economic) on the Investment Intentions of Small Business

Table 16 displays the multinomial logistic regression analysis of the covariates for investment intentions of small businesses in the case of local enterprises. All three dimensions (economic, social, and political) were found to be non-significant in impacting the investment intentions of the small business or none of the dimensions significantly impacting the investment intentions of small businesses. It indicates that the investment decisions of small businesses are not impacted by the socio-economic and political environment of the country. In the table, the final model is a non-significant [chi-square (12) =14.855, p>.001].

Small businesses under Mediterranean enterprises are either hesitant or not interested to do investment.

4.4.4 Impact of the Three Dimension on the Investment Intentions of SMEs

Table 17 displays the multinomial logistic regression analysis of covariates for investment intentions of SMEs of local enterprises.

It shows the impact of three dimensions (Economic, Social, and Political) on the investment intentions of SMEs. In the case of local enterprises, political dimensions are significantly and positively impacting the investment intentions of SMEs in long-term and medium-term investment plans. It indicates that the political environment in post-revolution has a significant impact on the investment decisions of SMEs for long-term and medium-term plans. As the government has enacted various laws and policies

Table 16. Multinomial logistic regression analysis of covariates for Investment Intentions of Small Business in Local Enterprises

Parameter Estimates									
Investment Intentions of Small Business	**Independent Variables**	**B**	**Std. Error**	**Wald**	**Df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
hesitant	**Economic Variables**	0.018	0.092	0.037	1	0.848	1.018	0.850	1.219
	Social Variable	-0.074	0.137	0.296	1	0.586	0.928	0.710	1.213
	Political Variable	0.072	0.164	0.193	1	0.660	1.075	0.780	1.481
Yes, in the short term	**Economic Variables**	0.101	0.091	1.231	1	0.267	1.106	0.926	1.321
	Social Variable	-0.198	0.135	2.164	1	0.141	0.820	0.630	1.068
	Political Variable	0.070	0.160	0.191	1	0.662	1.073	0.783	1.469
Yes, medium-Term	**Economic Variables**	0.044	0.090	0.241	1	0.624	1.045	0.876	1.247
	Social Variable	-0.021	0.134	0.025	1	0.875	0.979	0.752	1.274
	Political Variable	0.032	0.161	0.040	1	0.842	1.033	0.754	1.415
Yes, long term	**Economic Variables**	0.047	0.090	0.267	1	0.605	1.048	0.878	1.250
	Social Variable	-0.082	0.134	0.373	1	0.541	0.921	0.709	1.198
	Political Variable	0.071	0.160	0.195	1	0.659	1.073	0.784	1.469
a. The reference category is: No.									

Model Fitting Information					
Model	**Model Fitting Criteria**	**Likelihood Ratio Tests**			**Pseudo R-Square**
	-2 Log Likelihood	**Chi-Square**	**Df**	**Sig.**	**(Cox and Snell)**
Intercept Only	**316.2114**				
Final	**301.3565**	14.855	12	0.249	0.130

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Table 17. Multinomial logistic regression analysis of covariates for Investment Intentions of SMEs in Local Enterprises

Parameter Estimates									
Investment Intentions of SMEs	**Independent Variables**	**B**	**Std. Error**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
hesitant	Economic Variables	0.005	0.062	0.006	1	0.939	1.005	0.890	1.134
	Social Variable	0.028	0.082	0.118	1	0.731	1.029	0.876	1.209
	Political Variable	0.114	0.105	1.170	1	0.279	1.121	0.912	1.378
Yes, in the short term	Economic Variables	-0.065	0.064	1.031	1	0.310	0.937	0.826	1.063
	Social Variable	0.041	0.083	0.240	1	0.624	1.041	0.885	1.225
	Political Variable	0.168	0.112	2.249	1	0.134	1.182	0.950	1.472
Yes, medium-Term	Economic Variables	-0.106	0.055	3.730	1	0.053	0.900	0.808	1.002
	Social Variable	-0.010	0.072	0.019	1	0.890	0.990	0.860	1.140
	Political Variable	0.247	0.098	6.382	1	0.012	1.280	1.057	1.551
Yes, long term	Economic Variables	-0.062	0.053	1.356	1	0.244	0.940	0.847	1.043
	Social Variable	0.031	0.070	0.193	1	0.660	1.031	0.899	1.183
	Political Variable	0.221	0.095	5.410	1	0.020	1.248	1.035	1.503

a. The reference category is: No.

Model Fitting Information

Model	**Model Fitting Criteria**	**Likelihood Ratio Tests**			Pseudo R-Square
	-2 Log Likelihood	**Chi-Square**	**Df**	**Sig.**	**(Cox and Snell)**
Intercept Only	374.3711				
Final	356.1308	18.240	12	0.109	0.130

Table 18. Multinomial logistic regression analysis of covariates for Investment Intentions of SMEs in Mediterranean Enterprises

Parameter Estimates									
Investment Intentions of SMEs	**Independent Variables**	**B**	**Std. Error**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
Yes, in the short term	Social Variable	0.223	0.093	5.807	1	0.016	1.250	1.043	1.499
	Economic Variables	-0.053	0.064	0.693	1	0.405	0.948	0.836	1.075
	Political Variables	-0.045	0.093	0.241	1	0.624	0.956	0.797	1.146
Yes, medium-term	Social Variable	0.004	0.075	0.003	1	0.954	1.004	0.867	1.163
	Economic Variables	0.021	0.054	0.153	1	0.695	1.021	0.919	1.136
	Political Variables	-0.037	0.077	0.237	1	0.626	0.963	0.829	1.119
hesitant	Social Variable	0.149	0.110	1.850	1	0.174	1.161	0.936	1.440
	Economic Variables	0.061	0.076	0.651	1	0.420	1.063	0.916	1.233
	Political Variables	-0.291	0.119	5.934	1	0.015	0.747	0.591	0.945
No	Social Variable	0.135	0.086	2.470	1	0.116	1.144	0.967	1.354
	Economic Variables	0.045	0.062	0.535	1	0.465	1.046	0.927	1.181
	Political Variables	-0.166	0.091	3.334	1	0.068	0.847	0.708	1.012

a. The reference category is: Yes, long term.

Model Fitting Information

Model	**Model Fitting Criteria**	**Likelihood Ratio Tests**			**Pseudo R-Square**
	-2 Log Likelihood	**Chi-Square**	**Df**	**Sig.**	**(Cox and Snell)**
Intercept Only	345.1				
Final	324.3	20.78	12	0.054	0.171

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to encourage SMEs in post-revolution. The final model is non-significant [chi-square (12) =18.240, p>.001].

Table 18 shows the covariates of the investment intentions of SMEs in Mediterranean enterprises. The social dimensions significantly affecting the investment intentions of SMEs for short-term investment compare to long-term investments. It indicates that Mediterranean enterprises found the social environment of Tunisia favorable for short-term plans. All other dimensions (political and economic) were non-significant in impacting the investment intentions of SMEs. The final model is non-significant [chi-square (12)=20.78, p>.001].

From the above analysis, it reveals that political dimensions have a significant impact on the investment intentions of local enterprises, while the social dimensions have a significant impact on the investment decisions of Mediterranean enterprises.

4.4.5 Estimating the Influence of the Three Dimensions on the Investment Intentions of Individuals

Table 19 illustrates the results of multinomial regression analysis for all the individual Investors. The covariates of the investment intentions show that economic dimensions have a significant impact on short-term investment intentions.

The political and social dimensions are non-significantly affecting the investment decisions of individuals in Tunisia. The final model is a significant improvement in fit over the null model [chi-square (15) = 32.432, p<0.05].

For those who are already entrepreneurs, all the three dimensions non-significantly impacting their investment decisions because they do not need to invest more.

Thus, only economic dimensions have a significant impact on the investment decisions of the individuals, while political and social dimensions have a non-significant impact on investment intentions.

(1) Sex-Wise Investment Intentions

Sex-wise multinomial regression has been carried out to know the impact of three dimensions (Political, social, economic) on the investment intentions of individuals.

Table 20 shows the covariates of investment intentions of female investors in Tunisia.

Table 19. Multinomial logistic regression analysis of covariates for Investment Intentions of All Individual Investors

Parameter Estimates									
Investment Intentions of All Individual Investors	**Independent Variables**	**B**	**Std. Error**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
Yes, in the short term	Social Variables	-0.065	0.037	3.085	1	0.079	0.937	0.871	1.008
	Economic Variables	0.064	0.029	4.874	1	0.027	1.067	1.007	1.129
	Political Variables	-0.033	0.042	0.629	1	0.428	0.967	0.891	1.050
Yes, long term	Social Variables	0.005	0.028	0.033	1	0.855	1.005	0.951	1.062
	Economic Variables	0.025	0.022	1.297	1	0.255	1.026	0.982	1.071
	Political Variables	0.024	0.032	0.596	1	0.440	1.025	0.963	1.090
Already entrepreneur	Social Variables	0.034	0.051	0.453	1	0.501	1.035	0.937	1.143
	Economic Variables	0.026	0.040	0.424	1	0.515	1.026	0.949	1.110
	Political Variables	-0.056	0.060	0.868	1	0.352	0.945	0.840	1.064
Hesitant	Social Variables	0.008	0.033	0.054	1	0.817	1.008	0.944	1.076
	Economic Variables	0.028	0.026	1.109	1	0.292	1.028	0.976	1.082
	Political Variables	-0.039	0.039	1.001	1	0.317	0.962	0.891	1.038
No	Social Variables	0.060	0.050	1.411	1	0.235	1.062	0.962	1.172
	Economic Variables	0.047	0.038	1.528	1	0.216	1.048	0.973	1.130
	Political Variables	-0.194	0.071	7.426	1	0.006	0.823	0.716	0.947
a. The reference category is: Yes, Medium Term.									

Model Fitting Information					
Model	**Model Fitting Criteria**	Likelihood Ratio Tests			Pseudo R-Square
	-2 Log Likelihood	**Chi-Square**	**Df**	**Sig.**	**(Cox and Snell)**
Intercept Only	1146.684				
Final	1114.252	32.432	15	0.006	0.086

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Table 20. Multinomial logistic regression analysis of covariates for Investment Intentions of Female Investors

Parameter Estimates									
Investment Intentions of Female Investors	**Independent Variables**	**B**	**Std. Error**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
Yes, Medium Term	Social Variables	0.096	0.061	2.456	1	0.117	1.101	0.976	1.242
	Economic Variables	-0.105	0.045	5.481	1	0.019	0.900	0.824	0.983
	Political Variables	0.067	0.059	1.265	1	0.261	1.069	0.952	1.201
Yes, long term	Social Variables	0.174	0.061	8.229	1	0.004	1.190	1.057	1.341
	Economic Variables	-0.123	0.045	7.627	1	0.006	0.884	0.810	0.965
	Political Variables	0.100	0.058	2.963	1	0.085	1.106	0.986	1.239
Already entrepreneur	Social Variables	0.073	0.121	0.362	1	0.547	1.076	0.848	1.364
	Economic Variables	-0.017	0.088	0.037	1	0.848	0.983	0.827	1.168
	Political Variables	-0.018	0.117	0.024	1	0.878	0.982	0.781	1.236
Hesitant	Social Variables	0.098	0.067	2.132	1	0.144	1.103	0.967	1.259
	Economic Variables	-0.028	0.049	0.328	1	0.567	0.973	0.884	1.070
	Political Variables	-0.037	0.065	0.331	1	0.565	0.963	0.848	1.094
No	Social Variables	0.102	0.098	1.086	1	0.297	1.108	0.914	1.342
	Economic Variables	-0.117	0.069	2.907	1	0.088	0.889	0.777	1.018
	Political Variables	-0.028	0.110	0.063	1	0.801	0.973	0.784	1.206

a. The reference category is: Yes, in the short term.

Model Fitting Information

Model	**Model Fitting Criteria**	**Likelihood Ratio Tests**			**Pseudo R-Square**
	-2 Log Likelihood	**Chi-Square**	**Df**	**Sig.**	**(Cox and Snell)**
Intercept Only	613.0				
Final	583.7	29.379	15	0.014	0.135

Table 21. Multinomial logistic regression analysis of covariates for Investment Intentions of Male Investors

Parameter Estimates									
Investment Intentions of Male Investors	**Independent Variables**	**B**	**Std. Error**	**Wald**	**Df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
Yes, in the short term	Social Variables	-0.057	0.049	1.316	1	0.251	0.945	0.858	1.041
	Economic Variables	0.035	0.042	0.700	1	0.403	1.036	0.954	1.125
	Political Variables	-0.012	0.062	0.040	1	0.841	0.988	0.875	1.115
Yes, long term	Social Variables	-0.064	0.042	2.390	1	0.122	0.938	0.864	1.017
	Economic Variables	0.091	0.037	6.167	1	0.013	1.096	1.019	1.178
	Political Variables	0.022	0.050	0.198	1	0.657	1.022	0.928	1.127
Already entrepreneur	Social Variables	0.013	0.058	0.051	1	0.821	1.013	0.904	1.135
	Economic Variables	0.013	0.049	0.066	1	0.797	1.013	0.920	1.114
	Political Variables	-0.048	0.075	0.407	1	0.523	0.953	0.822	1.105
Hesitant	Social Variables	0.005	0.047	0.011	1	0.915	1.005	0.917	1.102
	Economic Variables	-0.026	0.039	0.457	1	0.499	0.974	0.902	1.051
	Political Variables	0.029	0.056	0.276	1	0.599	1.030	0.923	1.150
No	Social Variables	0.087	0.071	1.518	1	0.218	1.091	0.950	1.252
	Economic Variables	0.099	0.054	3.324	1	0.068	1.104	0.993	1.228
	Political Variables	-0.266	0.106	6.323	1	0.012	0.767	0.623	0.943

a. The reference category is: Yes, medium Term.

Model Fitting Information

Model	**Model Fitting Criteria**	**Likelihood Ratio Tests**			**Pseudo R-Square**
	-2 Log Likelihood	Chi-Square	Df	**Sig.**	**(Cox and Snell)**
Intercept Only	527.9				
Final	494.0	33.925	15	0.003	0.192

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The economic dimensions significantly but negatively impacted the investment decisions of females both for medium-term and long-term investment. It indicates they do not find the economic environment of Tunisia favorable for medium-term and long-term investment. Further, social dimensions positively and significantly impacted the medium-term investment decisions. It means the social environment is conducive for the medium-term investment plans. Regarding model fitting information, the final model is a significant improvement in fit over the null model [chi-square (15) = 29.379, $p<0.05$].

(2) Investment Intentions of Males

Table 21 demonstrates the impact of three dimensions (social, economic, and political) on investment intentions of males in Tunisia.

The economic dimensions have a significant impact on the investment intentions of the male for long term investment compare to medium-term investment. All other dimensions have a non-significant impact on the investment decisions of male.

Model fitting information shows that the final model is a significant improvement in fit over the null model [chi-square (15) = 33.925, $p<0.05$].

Thus, sex-wise analysis shows that social dimensions have a significant impact on the investment intentions of female investors, while economic dimensions have a significant impact on the investment decisions of male investors.

Therefore, the hypothesis i.e. all the dimensions (political, social and economic) have significant impact on the investment intentions of all the enterprises cannot be conclusively accepted or rejected.

The model multinomial logistic regression analysis is based on the normally distributed data with mean zero and standard deviation one. No multicollinearity has been found in the regression analysis. Hence, the model is suitable for the analysis.

5. Conclusion and implications

The paper found the impact of socio-economic and political dimensions on the investment intentions of local, Mediterranean enterprises, and individual enterprises in Tunisia in the post-revolution. After the revolution in 2011, Tunisia has been facing the problem of unemployment. The government of Tunisia has been encouraging investment in the country promoting SMEs. GOT implemented various acts to encourage investment such as the "Start-Up Act", "Organic budget law", and "horizontal law". In addition to the above, GOT has developed training and support measures to promote SMEs.

The paper found a significant difference in the investment intention of all the enterprises (SMEs, small businesses, and large enterprises) under Mediterranean enterprises, but no significant difference was found under local enterprises. The most important economic variables for local and Mediterranean enterprises are the "presence of support system" and "Investment Grants". While for the Individual Investors the most important economic variables are "Saturation of Market", "Investment grants", and "Data Access". The social variables "safety in daily activities, safety while traveling" and "security level of governance" are the most important variables. And the most important political variables affecting investment decisions are "Good governance" and "Law enforcement" of local, Mediterranean enterprises and individual investors.

The paper also found that political dimensions have a significant impact on the investment intentions of local enterprises, while social dimensions have a significant impact on the investment intentions of Mediterranean enterprises. Furthermore, economic dimensions have a significant impact on the investment decision of individual investors.

The paper suggests that the Government should encourage investment in Tunisia by making a favorable environment for enterprises that can meet the expectations of the local, Mediterranean and individual enterprises. Easy credit facilities should be made for entrepreneurs and low interest rate should be provided on loans to encourage them to invest. There is a need to provide credit guarantee instruments to SMEs for easy access to financial resources.

Appendixes

Table 7. Post-Hoc Test (Games-Howell) for individual Entrepreneurs (Profession-wise)

Are you planning to invest in Tunisia?						
(I) Profession	(J) Profession	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Student	Jobseeker	0.177	0.213	0.961	-0.44	0.79
	Future investor	-0.291	0.172	0.539	-0.79	0.20
	Employee	0.508	0.187	0.078	-0.03	1.05
	Extern Consultant	-0.388	0.328	0.842	-1.38	0.61
	Resident Investor	-1.388*	0.379	0.033	-2.68	-0.10

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Jobseeker	Student	-0.177	0.213	0.961	-0.79	0.44
	Future investor	-0.468	0.214	0.253	-1.09	0.15
	Employee	0.331	0.227	0.690	-0.33	0.99
	Extern Consultant	-0.565	0.352	0.601	-1.62	0.49
	Resident Investor	-1.565*	0.400	0.016	-2.88	-0.25
Future investor	Student	0.291	0.172	0.539	-0.20	0.79
	Jobseeker	0.468	0.214	0.253	-0.15	1.09
	Employee	.799*	0.189	0.001	0.25	1.34
	External Consultant	-0.097	0.329	1.000	-1.09	0.90
	Resident Investor	-1.097	0.379	0.112	-2.39	0.19
Employee	Student	-0.508	0.187	0.078	-1.05	0.03
	Jobseeker	-0.331	0.227	0.690	-0.99	0.33
	Future investor	-.799*	0.189	0.001	-1.34	-0.25
	Extern Consultant	-0.896	0.337	0.110	-1.91	0.12
	Resident Investor	-1.896*	0.387	0.004	-3.19	-0.60
External Consultant	Student	0.388	0.328	0.842	-0.61	1.38
	Jobseeker	0.565	0.352	0.601	-0.49	1.62
	Future investor	0.097	0.329	1.000	-0.90	1.09
	Employee	0.896	0.337	0.110	-0.12	1.91
	Resident Investor	-1.000	0.471	0.312	-2.47	0.47
Resident Investor	Student	1.388*	0.379	0.033	0.10	2.68
	Jobseeker	1.565*	0.400	0.016	0.25	2.88
	Future investor	1.097	0.379	0.112	-0.19	2.39
	Employee	1.896*	0.387	0.004	0.60	3.19
	Extern Consultant	1.000	0.471	0.312	-0.47	2.47

Note: *. The mean difference is significant at the 0.05 level.

Variables Details of Mediterranean Enterprises

Economic Variables		Social Variables		Political Variables	
Telecommunications networks	ECO1	Education	SOC1	Absence of corruption	POL1
Road, maritime & air infrastructure	ECO2	Education	SOC1	Good governance	POL2
Accessibility Bank financing	ECO3	Health establishments	SOC2	Law enforcement	POL3
Accessibility to Foreign credit lines	ECO4	Local transport networks	SOC3	Freedom of investment for foreigners	POL4
Availability of information related to the investment	ECO5	Convenience needed	SOC4	Political stability	POL5
Availability of human resources	ECO6	Safe in accommodation	SOC5	Freedom to invest in Tunisia	POL6
Investment grants	ECO7	Safe during daily activities	SOC6	Investment incentive laws	POL7
Infrastructure	ECO8	Safe while traveling	SOC7		
Accompaniment	ECO9	Safety	SOC8		
Data access	ECO10	Security Lavel	SOC9		
Trade union rights	ECO11				
Tax policy	ECO12				
Presence of support structures	ECO13				

Details of Variables under local enterprises

Economic Variables		Social Variables		Political Variables	
Telecommunications networks	ECO1	Education	SOC1	Absence of corruption	POL1
Road, maritime & air infrastructure	ECO2	Health establishments	SOC2	Good governance	POL2
Investment incentives from public & private institutions	ECO3	Local transport networks	SOC3	Law enforcement	POL3
Accessibility Bank financing	ECO4	Convenience needed	SOC4	Freedom of investment for foreigners	POL4
Public investment funds	ECO5	Safe at work	SOC5	Municipal governance	POL5
Accessibility Crowdfunding	ECO6	Safe in accommodation	SOC6	Political stability	POL6
Accessibility to Micro-credits	ECO7	Safe during daily activities	SOC7	Freedom to invest in Tunisia	POL7
Accessibility to Private investment funds	ECO8	Safe while traveling	SOC8	Investment incentive laws	POL8
Accessibility to Foreign credit lines	ECO9	Safety	SOC9		
Availability of information related to the investment	ECO10	Security level in your governorate	SOC10		
Availability of human resources	ECO11				
Investment grants	ECO12				
Iinfrastructure	ECO13				
Accompaniment	ECO14				
Data access	ECO15				
Trade union rights	ECO16				
Tax policy	ECO17				
Presence of support structures	ECO18				
Investment support structures in Tunisia (APII, CCI, APIA, Espace Entreprendre, Cepex	ECO19				
Saturation of the Market	ECO20				

Variables Details of Individual enterprises

Economic Variables		Social Variables		Political Variables	
Telecommunications networks	ECO1	Education	SOC1	Absence of corruption	POL1
Road, maritime & air infrastructure	ECO2	Health establishments	SOC2	Good governance	POL2
Investment incentives from public & private institutions	ECO3	Local transport networks	SOC3	Law enforcement	POL3
Accessibility Bank financing	ECO4	Convenience needed	SOC4	Freedom of investment for foreigners	POL4
Public investment funds	ECO5	Safe at work	SOC5	Municipal governance	POL5
Accessibility Crowdfunding	ECO6	Safe in accommodation	SOC6	Political stability	POL6
Accessibility to Micro-credits	ECO7	Safe during daily activities	SOC7	Freedom to invest in Tunisia	POL7
Accessibility to Private investment funds	ECO8	Safe while traveling	SOC8	Investment incentive laws	POL8
Accessibility to Foreign credit lines	ECO9	Safety	SOC9		
Availability of information related to the investment	ECO10	Security level in your governorate	SOC10		
Availability of human resources	ECO11				
Investment grants	ECO12				
Iinfrastructure	ECO13				
Support	ECO14				
Data access	ECO15				
Trade union rights	ECO16				
Tax policy	ECO17				
Presence of support structures	ECO18				
Investment support structures in Tunisia	ECO19				
Saturation of the Market	ECO20				

Methodology: Principal Component Analysis, t-test, ANOVA, the test of post-hoc, and the model of Multinomial Logistic Regression Analysis has been carried out to study the interrelationships among the variables in this paper.

ANOVA: The test of ANOVA has been used to find a significant difference in the investment intentions of enterprise classes (SMEs, Small businesses, and large enterprises) in the case of Mediterranean and local enterprises.

If the value of $P<0.05$, there is a significant difference

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in the investment intentions of enterprises. While if the value of P >0.05, There is no significant difference in the investment intentions of enterprise groups.

If the value of P<0.05, we can use further the test of post-hoc to know about which enterprise class is significantly different from the other classes.

t-test: t-test is used to find out the sex-wise significant difference. If the value of P<0.05, there is a significant difference in the investment intentions of male-female.

Principal Component analysis: In the PCA, Component Score Coefficient Matrix has been used to find the score of all the variables of social, economic, and political dimensions.

The significance of the variables has been measured according to the score. The variable with the highest score will be known as the most important variable.

The higher the value of KMO, the more efficient is the test of PCA.

All the variables under social, economic, and political combined to make a single variable. Based on the regression score of each dimension, descriptive statistics have been calculated. The score of all the three dimensions will be normally distributed if there are mean=0 and standard deviation =1

Multinomial Logistics Regression Analysis: This test is used when the dependent variable has data with multiple responses. All the combined three dimensions are used as independent variables. And "Are you planning to invest" is used as a dependent variable.

Under this test impact of all the dimensions (social, economic, and political) on investment intentions of all the enterprise classes (SMEs, Small businesses, and large enterprises) has been measured in the case of local as well as Mediterranean enterprises. In the case of individuals, sex-wise analysis has been done.

The test will find how the social, economic, or political dimensions are affecting investment decisions while investing in short-term, long-term, and medium-term investments. The sig level i.e. P-value is less than 0.05 indicates the significant impact of the particular dimension on the investment decisions.

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ARTICLE

Artificial Neural Networks in Risk Management: A Bibliometric Study

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ABSTRACT

This study presents a bibliometric analysis of Artificial Neural Networks in Risk Management. The study considered articles from the I.S.I. Web of Knowledge and Scopus databases, Identification of publishers, countries, periodicals and the keywords most frequently cited. We used the CiteSpace® software to analyze this material, which provides a set of features to support bibliometrics, including the reference maps. This study provides data collection on Artificial Neural Networks applied to risk management. The number of works identified in this study is significant, and in the last ten years, the number of citations has increased. We did not identify the increase in paper count within the same period.

1. Introduction

Risk management (RM) is a process that deals with risk identification, as well as analysis, response, monitoring, and control of these events [23]. RM aims to increase the probability and impact of positive events and reduce the likelihood and impact of adverse events [23].

The qualitative analysis aims to rank the identified risks, which considers their probability and impact. The quantitative analysis aims to provide detailed information for risks that require further investigation. The most common tools for performing quantitative analysis are the Monte Carlo simulation technique and Decision Tree [23].

However, the application of Artificial Neural Networks as quantitative risk analysis can bring benefits, such as minimizing the effects of dependence on experts and the possibility of performing an agile and efficient risk assessment [7].

This paper offers a review of the academic publications on the subject of Artificial Neural Networks in RM and discuss the key characteristics identified in the bibliometric analysis. We carried out this research through bibliometrics, which analyzes the creation of a science field to determine its characteristics [36]. There are five sections to this article. The first section presents the study subject,

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and the second section presents the concepts of RM and Artificial Neural Networks. The third section provides the method of research used in this paper, while the fourth section describes the findings of the bibliometric analysis. The Fifth section finally shows the conclusions.

2. Related Work

2.1 Risk Management

RM is the field with the most considerable lack of management awareness. After this report, the question about RM increased [15]. However, few organizations applied widely to RM [24]. RM's goals are to increase the likelihood and impact of positive events and to minimize these factors in adverse events [23]. The RM cycle consists of all the activities required to identify risks that could potentially affect the project [31]. Whatever its scope, RM is one of Project Management's neglected areas [15,24]. The RM methods are still not commonly used by firms [24], and their use is below expectations [11].

RM has several strategies, of which it is worth emphasizing the PMBOK (Project Management Body of Knowledge) [23], CMMI (Capability Maturity Model Integration) [28] and the S.E.I. (Software Engineering Institute) [13]. There are several RM strategies, but there is unity among the principal activities that make up this phase [19].

Evaluation and rating of threats are critical, determining the likelihood of their occurrence and effect on the project [14]. Notwithstanding this suggestion, few tools exist to support project managers in identifying and categorizing risk factors [35].

2.2 Artificial Networks

Artificial Neural Networks (ANN) are computational structures inspired by living beings nervous system and offer a mathematical model based on the natural processing of neurons [29]. They are made up of several processing units which are easy to operate [12].

Among the features supporting the use of Artificial Neural Networks in complex applications can be mentioned: the ability to adapt over experience, the ability to learn, the ability to generalize, the organization of data, the tolerance to faults and the ease of prototyping [29].

There are many applications where artificial neural networks can be used, for example in process control, in which, through the mapping relationship between the input and output variables of a particular control system, a network can be created which can generalize such a relationship [1].

The use of Artificial Neural Networks to enhance RM processes can be found in several studies [7,8,9,21]. One of RM's weaknesses is its failure to assess the risks identified for closed project performance [27]. The authors suggest using Artificial Neural Networks in RM to predict the probability of present risks using historical bases [27]. The use of Artificial Neural Networks also allows the authors to answer the following questions concerning RM: I what is the probability of project success? How to determine whether the threats affecting the project targets?

3. Research Method

Bibliometric research is a quantitative analysis technique developed at the end of the 1960s by Pritchard [30]. It is a field of information science research that plays a vital role in the study of scientific production [10,17].

The purpose of bibliometrics is to quantify the performance of scientific research through statistical analysis in the form of papers, documents, references, patents, among other indicators so that scientists, institutions and countries can be assessed [20]. Using quantitative methods to analyze scientific literature using bibliometric measures systematically is the central point of bibliometrics [2,4].

The bibliometric analysis offers an understanding of the past and current situation of the research field. It offers opportunities for researchers and others interested in the subject to enrich the discussion of potential paths taken by science and scientific developments [36].

4. Data Collection

We scanned papers on 10/10/2019 for the conduction of bibliometric analysis, and we only found papers published between 2009 and 2019. Another filtering criteria were to find only papers with particular keywords in the field. For each of the indexes, we carried out three searches according to the following keywords:

(1) Risk Management;

(2) Artificial Neural Networks;

(3) Artificial Neural Networks Risk Management.

We carried out the study's production in two stages:

(1) Data collection: the related data was obtained from the I.S.I. Web of Knowledge and Scopus.

(2) Bibliometric study: analysis of data obtained through the use of database tools and bibliometrics assistance using the CiteSpace® software.

A valuable tool for the diagnosis of scientific output is the I.S.I Web of Knowledge database since it is considered to be the most extensive and multidisciplinary critical bibliographic data for scientific information [32,34]. The I.S.I Web of Knowledge has a limited number of scientific journals that set strict standards for those magazines that are included in the index. Scopus is a website supported by Elsevier that covers journals and academic conferenc-

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es [34]. Scopus has more indexed journals and has greater coverage of open access journals than the I.S.I. Web of Knowledge [3]. For bibliometric review, this research utilizes the I.S.I. Web of Information and Scopus databases. The use of the I.S.I. Web of Knowledge and Scopus together is more beneficial than using just one because it facilitates the recognition of specific references [18].

In addition to the CiteSpace ® software, we used the statistical features and illustrations of I.S.I. Web of Knowledge and Scopus databases to help bibliometric analysis, which helps to examine the relations between writers, organizations, nations, keywords, publishing sources or references in the scientific literature [5,25]. Many software tools support bibliometrics, but one of the best is CiteSpace® [6,25].

5. Results

In the first search of the I.S.I. Web of Knowledge and Scopus databases, which collected 19,509 and 55,845 papers, we used the word "Risk Management". The results obtained over the past ten years are presented in Figure 1. The number of documents listed in Scopus is more significant than those found in the database of the I.S.I. Web of Knowledge.

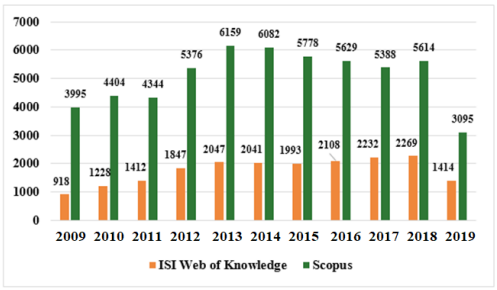

Figure 1. Number of papers per year of Risk Management

We looked in the repositories also for the word Artificial Neural Networks. We identified 20,462 papers from the I.S.I. Web of Knowledge and 60,429 from Scopus Database. Figure 2 presents the results collected in both repositories from this search over the last ten years. There is a higher number of items found at Scopus.

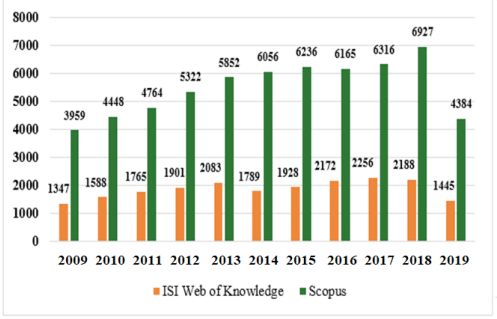

Figure 2. Number of papers per year of Artificial Neural Networks

Based on these observations, the sheer volume of publications relating to the terms: Risk Management and Artificial Neural Networks. This research, however, aims to perform a bibliometric study of the two terms together, considering only risk management papers from Artificial Neural Networks.

Therefore we conducted a search in these libraries for these two terms combined. The results obtained using concepts, risk management and artificial neural networks are presented in Figure 3. This search concentrated, like the previous search, on finding papers published in the last 10 years and 43 papers were found at the I.S.I. We of Knowledge and 183 at Scopus, for a total of 226 papers. The number of papers in both collections is smaller than the terms searched separately.

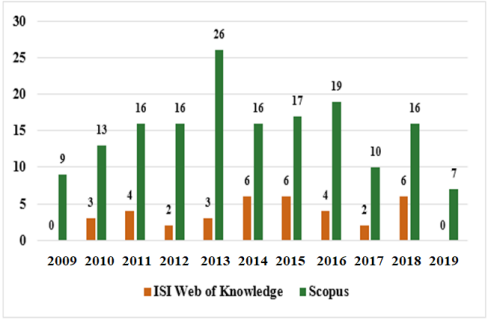

Figure 3. Number of papers per year of Risk Management Artificial Neural Networks

To ensure their relation to the application of Artificial Neural Networks in Risk Management, we reviewed the abstract of the 226 papers. All articles addressed this subject, and so we used them to do the bibliometric study. The following research was carried out: (1) citation analysis, (2) analysis of relevant references to the publication, (3) identification of the critical authors, (4) identification of top countries, and (5) citation map formation.

Using the database citation analysis function, over the years, we defined the quote as shown in Figure 4. In the last ten years, there has been an improvement in both datasets.

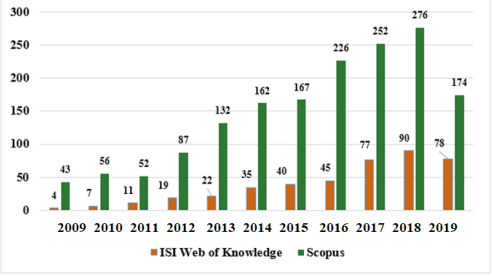

Figure 4. Number of citations per year

The I.S.I. Web of Knowledge and Scopus repositories also

have a feature to identify written sources, including articles, conferences, books, among other references. We identified the primary publication sources that discussed this issue. Table 1 presents the sources in each of the repositories, which received the most significant number of publications.

Table 1. Major publication sources

I.S.I. Web of Knowledge	
Source publication	**Publications**
Advances in Neural Networks - Lecture Notes in Computer Science	3
Scopus	
Source publication	**Publications**
Neurocomputing	3

The journal Advances in Neural Networks - Lecture Notes in Computer Science does not have Impact Factor (IF) by J.C.R. (Journal Citation Reports) [33]. However, the Neurocomputing journal has 2,083 IF the J.C.R. [33].

We used a feature provided by the repositories to classify the principal authors of the 226 articles. Table 2 provides the author with the most significant number of publications in the two databases studied.

Table 2. Main authors in I.S.I. Web of Knowledge and Scopus databases

I.S.I. Web of Knowledge	
Author	**Publications**
Norman R. Swanson	3
Scopus	
Authors	**Publications**
Adnan Khashman, Kinkeung Lai, Xiaohua Jin, Hiroyuki Mori	3

The repositories have provided a resource for identifying countries that discuss the topic more and track it more. Country-by-country review of publications helps you to discover if the conduct of sources depends on the internationality of the work and understand whether different knowledge and actions might be available to writers of different nationalities [22]. As shown in Figure 5, the United States is the leading country on the I.S.I. Web of Knowledge website for the number of publications.

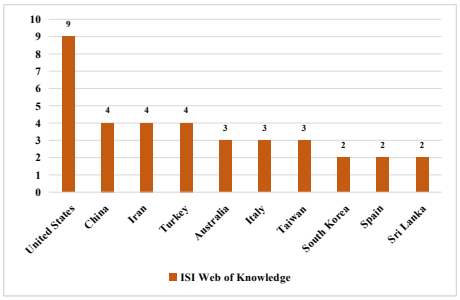

Figure 5. Countries with a more significant number of works on the I.S.I. Web of Knowledge

The countries with the largest number of publications at Scopus are shown in figure 6. China is the country with the most publications.

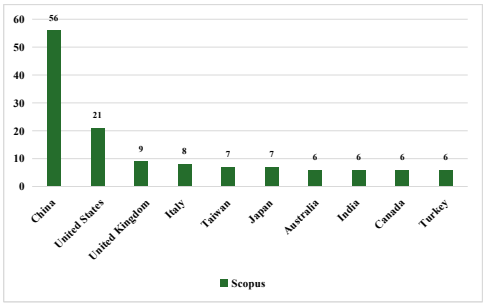

Figure 6. Countries with a higher number of papers published at Scopus

The last research that we conducted using the I.S.I. Web of Knowledge and Scopus services was the creation of the list with quotations. A quote map is a tool used to align the articles with their respective cited papers, and the most cited paper appears at the center of the map. Based on the data in Figure 4, I.S.I. Web of Knowledge Database paper with the largest number of citations is Drought forecasting artificial neural using networks and time series of drought indices, by the authors Saeid Morid Vladimir Smakhtin and K. Bagherzadeh. The authors published this in 2007 at the International Journal of Climatology journal and received 39 citations in the I.S.I. Web of Knowledge.

In the Scopus database, the article with the largest number of citations is Neural networks for credit risk evaluation: Investigation of different neural models and learning schemes, by the author Adnan Khashman, published in 2010 in the Expert Systems with Applications journal. This paper received 51 citations in Scopus and is the second most cited in the I.S.I. Web of Knowledge with 30 citations.

The CiteSpace ® software citations map tool allows to view and examine trends and patterns in a research field or domain within a specified period [16]. We built the chart to classify the writers who are most cited. Figure 7 shows the authors listed in at least four of the analyzed studies at

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I.S.I. Web of Knowledge.

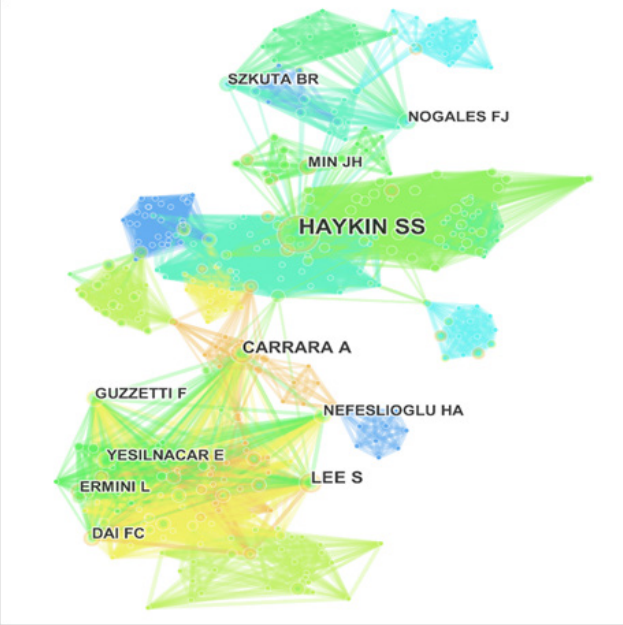

Figure 7. Citation map of the papers from I.S.I. Web of Knowledge

Table 3 presents the authors and their total number of citations, considering only the papers identified by this research.

Table 3. Main authors at I.S.I. Web of Knowledge

Total	Citations from papers of this research	Authors
1.226	9	Haykin, S.
872	4	Nefeslioglu, H. A.
586	4	Dai, F. C.
371	4	Yesilnacar, E.
346	4	Ermini, L.
323	5	Carrara, A.
298	5	Lee, S.
225	4	Min, J. H.
180	4	Szkuta, B. R.
5	4	Nogales, F. J.
4	4	Guzzetti, F.

Also, we developed the Scopus database citation map. Figure 8 presents the authors cited by at least five of the studies analyzed from this database.

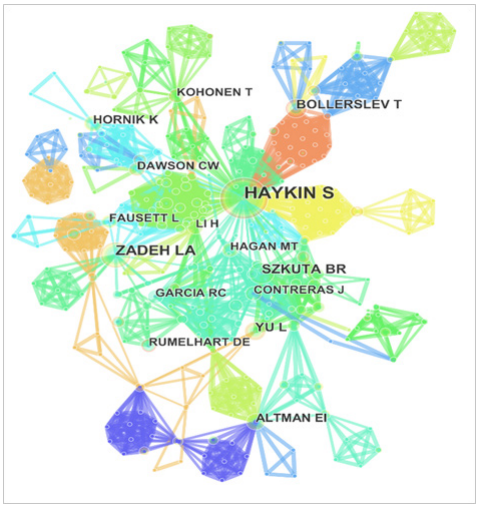

Figure 8. Citation map of the papers from Scopus

Table 4 presents the authors and their number of citations. The author Loft A. Zadeh has the highest number of citations at Scopus. Simon S. Haykin has, however, more citations from papers identified in this study, taking a leading position in both databases examined.

Table 4. Main authors at Scopus

Total	Citations from papers of this research	Authors
29.694	10	Zadeh, L A.
20.800	6	Hornik, K.
19.777	7	Bollerslev, T.
13350	7	Yu, L.
12.588	5	Rumelhart, D. E.
10.339	5	Contreras, J.
8.540	6	Altman, EI.
4.133	5	Hagan, M. T.
3.579	5	Garcia, R. C.
2.180	16	Haykin, S.
312	5	Kohonen, T.
259	8	Szkuta, B. R.
197	5	Li, H.
5	5	Dawson, C. W.
5	5	Fausett, L

The final analysis in this study includes identifying the keywords of the papers analyzed via the CiteSpace ® software. Keywords are the most essential paper identifiers which allow the identification of the topics that are the most discussed in a research area [26]. Identifying the main keywords also strengthens the bibliometric study's search strings. Figure 8 shows the keywords discussed in five or more articles analyzed at I.S.I. Web of Knowledge. In Figure 9, the word "neural-networks" stands out because it's

the most listed.

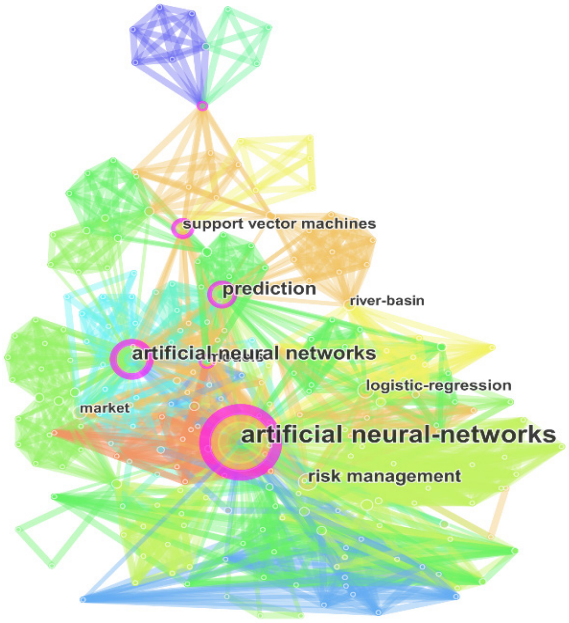

Figure 9. Map of the main keywords cited by the papers from I.S.I. Web of Knowledge

This analysis is crucial because it allows us to find that other terms may be used in the search for papers related to this theme. For example, the terms "neural-networks" and "neural networks" showed differences in their use.

Table 5 presents the keywords from Figure 9 and their citations. We observed that the term "neural-networks artificial" was the most cited.

Table 5. Main keywords cited by the papers from I.S.I. Web of Knowledge

Number of citations	Keywords
17	artificial neural-networks
9	Artificial Neural Networks
7	Prediction
6	risk management
5	Models
5	support vector machines
5	logistic-regression
4	river-basin
4	market

Also, we developed the Scopus database citation map. Figure 10 presents the keywords listed in four papers or more. The terms "artificial neural-networks" and non-hyphen "artificial neural networks" stand out in Figure 10 as they are among the most frequently cited keywords.

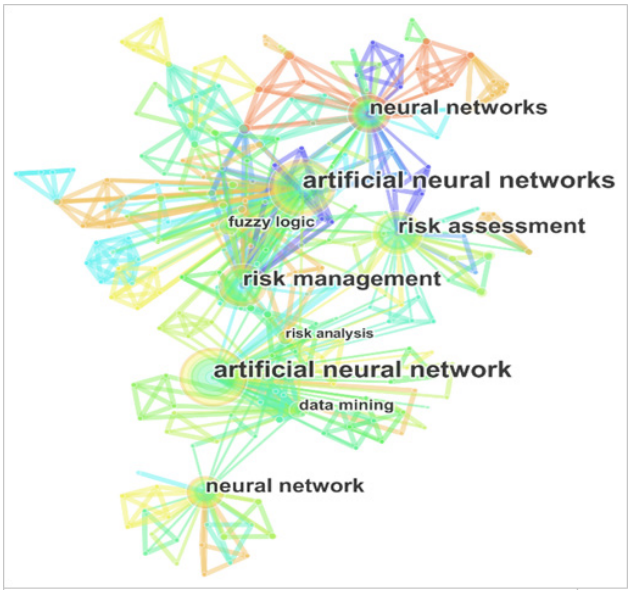

Figure 10. Map of the main keywords cited by the papers from Scopus

Table 6 presents the main keywords with their respective number of citations.

Table 6. Main keywords cited by the papers from Scopus

Number of citations	Keywords
18	artificial neural networks
17	artificial neural network
13	risk assessment
13	risk management
12	neural networks
10	neural network
5	data mining
5	fuzzy logic
4	risk analysis

The term "neural-networks artificial" with the hyphen was the most often cited at I.S.I. Web of Knowledge and without the hyphen, the most often cited at Scopus.

6. Conclusions

This paper presented a study of scientific publications on Artificial Neural Networks in RM, and the main features of this subject were discussed. The bibliometrics-based research, which helps to examine the creation of a science field to identify its features.

Initially, we did two surveys: one on RM; the other on Artificial Neural Networks. In these two studied repositories, we observed a significant number of papers on these subjects: the I.S.I. Web of Science and the Scopus. Nonetheless, the use of the two topics together in the quest

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resulted in fewer papers at I.S.I. Web of Knowledge and Scopus, 43 and 183, respectively. The search was limited to articles from 2009 to 2019.

From the identified papers, we performed a bibliometric study using the resources of the I.S.I. Web of Knowledge and Scopus. For both repositories, we conducted the following analyzes: analysis of publications and references, identification of essential sources of reporting, writers and countries, creation of quotation maps.

With the help of the CiteSpace ® program, we created the citation maps, enabling identification of the primary authors mentioned in the papers analyzed, in addition to the most common keywords. The author Simon Haykin is the most widely cited in the reviewed 226 studies.

This study allows researchers to know the core features of Artificial Neural Networks publications in RM. The results indicate that there is a significant number of papers on the subject, but we have not seen a significant increase in the number of papers in the last ten years. However, at the same time, there is an increase in the number of citations.

The countries with the highest number of publications on this subject are China and the United States. The study also identified some potential sources of publications and inquiries that could help state of the art, highlighting the journals Advances in Neural Networks - Lecture Notes in Computer Science and Neurocomputing.

Finally, this work provides research opportunities and contributes to the understanding of the Artificial Neural Networks bibliographic context in RM The realization of this bibliometric study is crucial as it provides the theoretical and practical foundation for the construction of the logical thinking built on this topic.

Acknowledgments

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ARTICLE

The Relationship Between the Circular Economy and Sustainable Waste Management in European Union

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ABSTRACT

Modern life has contributed both to increasing living standards, increasing comfort and the development of society, but also to increasing the amount of waste that suffocates the planet and threatens the existence of present and future generations. Among the solutions that are sought and that are included in various programs and policies, the concept of circular economy is one that is increasingly discussed when talking about the sustainable development of society. The circular economy implies a reduction of the natural resources consumed due to both recycling and their fair consumption. At the U.E. level the foundations have been laid for policies aimed at waste management to ensure the application of the principles of the circular economy.

Considering the importance that the quantification of the indicators for implementing the circular economy have on the elaboration of more efficient policies, but also on the determination of the degree of implementation of this concept, in this paper we intend to analyze the evolution of these indicators from 2010-2019, in the European Union using a customized version of the DPSIR model. Their analysis led us to the conclusion that although important steps have been taken towards the transition to the circular economy, there are still many aspects that need to be improved in order to achieve the proposed objectives through European policies.

1. Introduction

The emergence of modern society characterized by an increase in population and an increase in urbanization, the technology development of information and communications, income growth accompanied by increasing living standards, reducing the life cycle of products as a result of transforming the society into a society of consumption were accompanied by the increase in the volume of waste produced, but also by their diversification and the flows they generate, all this taking place on the sharp reduction of natural resources and the increase of pollution. That is why the concerns of existing decision-makers at international level regarding waste management have intensified from the need to identify sustainable economic and social development solutions, which involve both the management of raw materials and by-products, waste, energy consumed, etc., so as to ensure the conservation of limited resources and the protection of the environment. In this

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context, an essential condition of the socio-economic evolution of the society is represented by the way of waste management.

The effects of the circular economy would also mean an improvement in the quality of life and an improvement in human health [6], or health and well-being are important elements of economic and social development, and are found in the general objectives of European policies along with those on sustainable models consumption, ecologies have environmental protection [5].

The European Parliament adopted in 2015 an action plan, containing 54 measures, in order to accelerate the transition to the circular economy, through which it was intended to stimulate global competitiveness and promote sustainable economic growth and create new jobs the work.

The Communication "Closing the Loop - An E.U. Action Plan for the Circular Economy" - (COM (2015) includes for the first time the definition of the circular economy, which was conceived as a model of production and consumption involving both sharing and reuse of materials; products, their repair or renovation, as well as their recycling.This way the "closing of the loop", ie the circularity, is a concept that has been proposed since 1977 by Stahei and Reday - Mulvey in a report entitled "The potential of to replace human labor for energy "and which supported the idea of creating new jobs, reducing waste and increasing economic competitiveness [7].

Thus, at the E.U. level, through these policies were established criteria for implementing the principles of the circular economy at the level of member countries, which proposed: reducing the amount of household waste stored; increasing the amount of household waste to be reused or recycled and prohibiting the storage of waste.

The Ellen MacArthur Foundation is also the one that paved the way for the circular economy. Thus, the study on the circular economy shows that this is an economy that is restorative and regenerative by design and aims to keep products, components and materials at their highest utility and value at all times, being inspired by nature, where nothing is lost everything changes [9].

These approaches to European policies have continued. Thus in 2018 through the Action Plan on the circular economy - (COM (2018) 32) were set as objectives: the use of recycling, increasing the use of secondary raw materials, replacing chemicals of concern and reducing their use in order to improve their traceability.

Also in 2018 another European strategy for plastics in a circular economy - (COM (2018) 28 aims to recycle all plastic packaging by 2030, thus ensuring the transition to a more circular economy.

Through Directive (EU) 2018/851 amending Directive 2008/98/EC on waste, EU Member States they were invited to take the necessary measures to reduce food waste related to supply chains, to monitor the quantities of food waste, but also to report on progress.

The EU's approach to the circular economy involves promoting resource efficiency, but also reducing the impact on the environment by reusing products, materials or resources so that waste generation is minimal and pollution is reduced. At the same time the E.U. promotes ethical and fair trade, as well as the most sustainable management of supply chains. Actions taken can also stimulate investment, create a level playing field and remove barriers to the single market.

The circular economy does not only follow the economic or environmental aspects, but also the social and governance aspects. However, its essence is to ensure the recycling and reuse of materials and products, also analyzing gas emissions with a role in environmental degradation [3].

2. Material and Methods

The research methodology involved the study of literature in order to define the circular economy and identify the indicators based on which it can be quantified (1), research international databases that provide information to calculate indicators (2), calculation, analysis and interpretation indicators (3) and the formulation of conclusions regarding the study (4).

The analysis followed the progress made in the E.U. on waste management, following both economic and social and environmental aspects, using a customized version of the DPSIR model belonging to the European Environment Agency, which in its turn is an extended version of the "Pressure-State-Response" model. "Created by the OECD and which allows the creation of a vision regarding the decision-making context related to one or more sectors of activity."

The DPSIR model (Driving forces, Pressures, States, Impact and Responses) was proposed by the European Environment Agency in 1999, in order to identify the main indicators underlying the understanding of the complex links between economic, social and environmental systems thus the possibility of performing an integrated analysis of environmental protection activities. It was also used by the United Nations and subsequently adopted by the US Environmental Protection Agency (EPA). Its use has been made in various fields such as the management of agricultural systems, the management of soil resources, water resources, marine resources, but its most frequent use is related to environmental protection. EPA has added

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to the existing elements other explicit issues related to human health by adding the health of ecosystems, and also issues related to sustainability [1].

Each of the five domains (Driving forces, Pressures, State, Impact and Responses) contains sub-domains to which specific indicators are attributed, which underlie the decision-making process and which substantiate a systemic and dynamic vision of it.

The model thus captures the existing interactions between its components establishing the causal relationships between them, and which can be weak links, strong qualitative links or strong quantitative links. Establishing a balance between components allows a transition to the circular economy.

In the study of the transition to the circular economy, the DPSIR model includes: D - the development needs of individuals, of society, which promotes a certain model of production and consumption; P- effects on the environment; The current state of the various components of the environment; I- the changes occurred in the change of the current state of the environment and which affect the welfare at social level; R- response of the company or decision makers on the impact [4,11]. This approach has been used in the analysis of environmental issues, both globally and zonally [2].

The model has been used in other studies which show that the relationship between driving forces (D) - pressures (P) brings to the fore the role of efficient technologies and the process of innovation to meet the challenges / present state (S), the impact (I) and the need to identify the most appropriate type of response (R) " [8].

On one hand, the analysis of the relationships used by the DPSIR model presents the relationship of three elements: Motor forces (D) - Pressures (P) - Response (R), which provide an image of their causal links, and on the other hand achieved by the relationship between State (S) - Impact (I) - Response (R).

The model proposed by *Tartiu et. al., 2018*, considers that the relationship between driving forces (D) - pressures (P) emphasizes the role that the use of efficient technologies and innovation have in relation to current challenges (S), as well as impact (I) and the need finding an effective response (R).

3. Results and Dicussions

Through this study we aimed to analyze the correlations between the circular economy and sustainable development.

The analysis carried out through the DPSIR model follows the level of implementation of the circular economy principles at the European Union level as modalities for achieving the objectives of sustainable development, considering that the indicators that characterize the circular economy are also indicators of sustainable development, economic, social, environmental objectives, following the management of consumed resources and the resulting waste.

The driving forces used in the model to promote the circular economy were represented by the evolution of GDP relative to greenhouse gas emissions.

For the pressure analysis, the indicators followed were: the evolution of the population, both for the total population of the European Union, and for the population of the ones over 64 years. GHG emissions analyzed in relation to the evolution of GDP are an indicator for measuring pressures.

The common Elements of Response are represented by the implementation of legislation in the field of environmental protection, policies applied to increase efficiency in the use of resources, raising awareness of the population on the need to move to the circular economy. The indicator used was the recycling rate for different categories of waste, analyzed comparatively from 2010-2019.

The proposed indicators for Status (S) are: direct material inputs (KAI), material dependence (DE), imports, and for Impact (I): competitiveness index.

The economic development analyzed from the perspective of the circular economy must follow both the economic impact (GDP growth, share of investments, etc.), the impact on the environment (use of resources, reduction of greenhouse gas emissions, reduction of pollution) and social impact (changes demographics, education, quality of life, social inequities, etc.)

Waste is an important problem for the environment, but at the same time it is an economic loss for society. At the level of 2018, Europeans produced an average quantity of 5.19 tons/capita, of which the amount of municipal waste was 492 kg/capita. Although a large amount of waste is recycled, another part is turned into compost, there is a smaller part that is stored. That is why we need to change both the way we produce and the way we consume, in order to produce a smaller amount of waste, but also using it as a resource that can lead to saving depletable resources.

Proposing to analyze the indicators presented above, we found that at the EU-28 level the GDP growth rate had an oscillating evolution, with the highest value recorded in 2018 (USD 15,962 trillion). The declines in 2015 and 2016 were due to the effects of the economic crisis that began in 2007 and whose shocks continued to be felt in the following years. A revival of the economic situation began to be felt only towards the end of 2016 when both the world economy and that of the E.U. recorded a modest

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recovery, continuing to grow until 2019, whose end of the year was again affected by the shocks of the Covod-19 crisis.

Regarding the CO2 emissions per capita, there is a decrease per capita in the analyzed period as a result of the transition to the production of alternative energy and the decrease of the share represented by the energy produced from fossil fuel sources. At the same time, at the E.U. level the European scheme for greenhouse gas emissions trading has been implemented, which has had the effect of reducing these emissions (EU ETS).

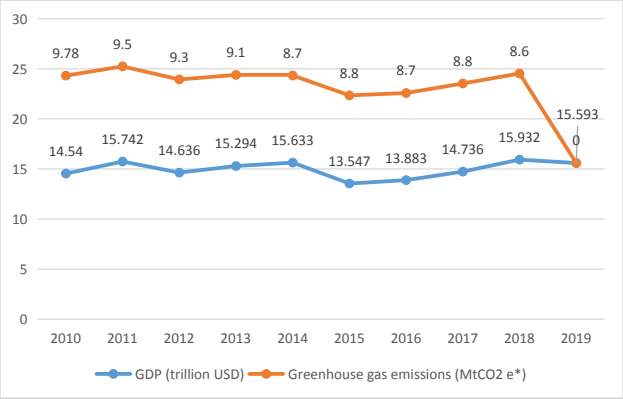

Figure 1. Evolution of GDP relative to greenhouse gas emissions

Source: own processing [10]

These indicators must be correlated with the evolution of the population at the E.U. level. - 28. Where demographic changes affect the amount of waste generated. Thus, the increase in the number of households made up of a single person or a small number of members can have influences on the amount of waste [12]. Thus, based on the data published on January 1, we find a continuous increase of the population during the analyzed period, although this was not significant. The increase from 2019 to 2010 was 2%.

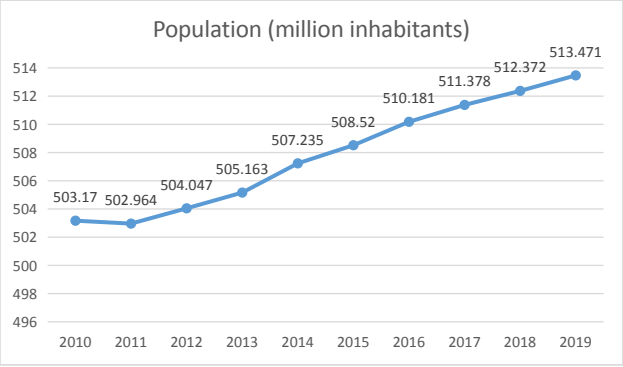

Figure 2. The evolution of the E.U. population

Source: own processing [10]

Another aspect that should be correlated with the evolution of the E.U. population. is the percentage represented by people over 65 years of age, which shows that life expectancy increased by 14% in the analyzed period, but this does not greatly influence current consumption patterns, the degree of adoption to them by the population more in age being much younger. As the population grows, the amount of raw material processed also increases, which causes an increase in the amount of waste.

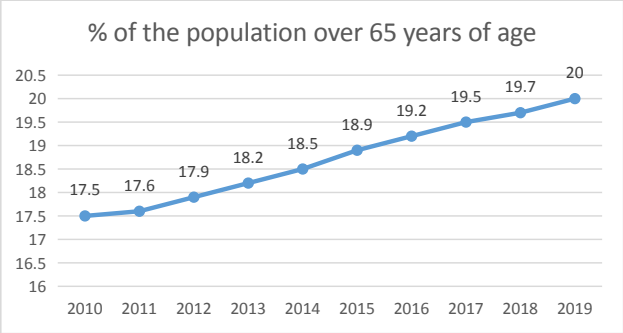

Figure 3. Evolution of the population over 65 years of age (% of total population)

Source: own processing [10]

The intensity of primary energy is the indicator expresses the productivity of resources or energy used. It is determined in relation to the value of GDP and can be expressed in toe / 1000 Euro or in toe / 1000 Euro PPC, ie in euros at purchasing power parity. Primary energy consumption is an important indicator in monitoring the progress that the E.U. made them to achieve the targets that are set by European directives, being defined as the difference calculated between gross primary energy consumption and non-energy consumption of energy carriers (natural gas, oil, etc.).

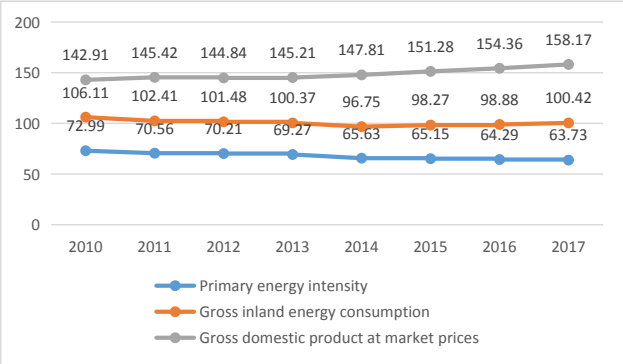

Figure 4. Evolution of primary energy intensity

Source: own processing [10]

Eurostat data on the primary energy intensity show that its value decreased during the period under review, given that there was an increase in GDP in the E.U. - 28. The decrease from 2017 compared to 2010 was 13%.

There is also an increase in gross domestic energy

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consumption within the E.U., but at a slower pace than economic growth. While from 2010 to 2014 the decrease in gross energy consumption was about 0.8% per year, GDP growth was about 1.2% per year. In 2016 and 2017, gross energy consumption increased by 1.6%, and GDP increased by 2.5%. In 2017, the average primary energy intensity for the 28 member states of the European Union was 3.3 toe / capita.

This is due to the increase in energy efficiency, on the one hand in the final consumption sectors where energy efficiency programs have been adopted, and on the other hand due to the reduction of the amount of primary energy required to produce a final energy unit. The primary energy intensity indicator is a macroeconomic parameter whose values depend on the structure of the economy, but which can also characterize energy efficiency.

Schimbările structurale care au avut loc in economie au inclus si o creştere a contribuţiei pe care serviciile au avut-o in formarea PIB, precum şi o trecere la industrii care sunt mai puţin consumatoare de energie, dar care au o valoare adăugată mai mare. Productivitatea utilizarii resurselor se determina prin raportul dintre consumul material si PIB.

The optimization of resource consumption is also achieved by implementing legislation on waste management that must be as efficient as possible. In this sense, the comparative analysis of the way in which the recycling rates for the main types of waste evolved in the period 2010-2019.

The way waste is managed is closely linked to existing legislation at the EU level. The main legislative instrument is the Waste Framework Directive which aims to prevent the production of waste, but to use it as a resource, and then to reduce the amount of waste stored. Thus, a hierarchy of the waste management model is presented, starting primarily from the prevention of waste, the ways of preparing them for reuse, recycling or recovery, as well as the ways of disposing of them. The directive also sets specific targets for each EU country. Thus, by the end of 2020, the recycling rate set for municipal waste was set at 50%, the recycling rate for paper was set at 74%, and the recycling rate for non-hazardous construction and demolition waste was set at 70%.

The waste collection process is a sensitive point in their management. Collection rates vary depending on the level of income, finding that high- and middle-income countries ensure almost universal waste collection, while in low-income countries the collection rate is about 48% in urban areas and about 26 % in rural areas. Also, the level of income influences the composition of waste, finding that in high-income countries there is a lower amount of green waste and food waste and a higher amount of dry waste that can be recycled.

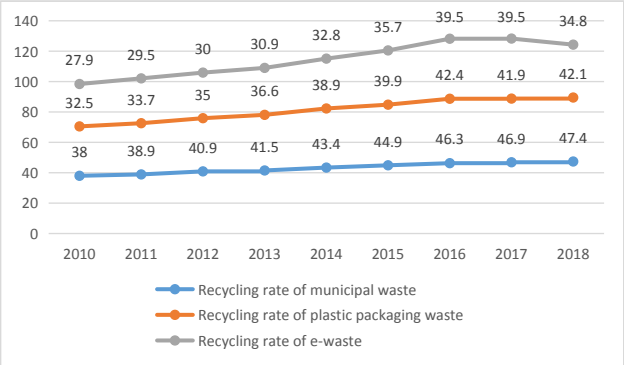

Figure 5. Evolution of recycling rates for different categories of waste

Source: own processing [10]

It is found that recycling rates are increasing during the analyzed period. The recycling of plastic packaging waste registered a rate of 42.1% in 2018, which represents an increase of 30% compared to 2010, and the recycling rates of household waste and e-waste increased by 25% in the same period.

The highest recycling rate is construction and demolition waste, which reaches up to 34% of total waste in the EU. They are characterized by a high recovery rate, but need even more efficient management to strengthen the circular economy of the EU. More and more efficiently the exchange of information on the reuse of secondary raw materials can contribute to the implementation of actions that have been inspired by the circular economy. However, despite the large amounts of construction waste, it is found that past construction practices make the resulting material flows unsuitable for closing the loop in this sector, thus preventing the full application of the objectives of the circular economy.

On the other hand, the circular economy uses resources that can be represented by waste that makes it possible to close the loop, representing at the same time an important source of productivity growth. Therefore, we will further analyze the indicators related to Status (S), Impact (I) and Response (R).

The common indicators for the selected Status and Impact were: direct material inputs, material dependence, imports and competitiveness index [8]. The direct inflows of materials reflect the level of development from a technological point of view, in direct connection with the quantities of natural resources in the form of reserves, but also in relation to the intensity of foreign trade. Material dependence reflects the economy's dependence on the amount of domestic natural resources.

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A key priority is to measure resource efficiency as well as waste reduction by tracking material flows.

Monitoring the efficient use of resources is important both in terms of increasing the amount of recycling materials, and in terms of increasing the share of secondary resources used or reducing waste streams, with an impact on the environment.

The material flows that are reflected by the above indicators, and that use as a unit of measurement billion tons / year, show the recirculation rates of starting with 2014, the year before the European Directive, compared to 2017 and 2018. It is thus found a increase in the rate of circularity of material use which in 2018 was 11.9% and which was due on the one hand to the increase in the amount of materials used and processed, which also contributed to an increase in total emissions, and on the other hand to a direct decrease exploited materials and natural resources extracted. It is also found that in order to ensure the flow of material necessary for processing, there were both increases in the value of imports at the EU level, but also increases in exports. The rate of circularity of material use was 11.2% in 2012 and 11.4% in 2016. However, estimates of the amount of material processed, gas emissions or population growth are not encouraging.

Thus, it is estimated that in 2060, worldwide the amount of used material will reach 167 Gt, increasing by 111% compared to 2010, materials use / capita / day will reach 45 kg in 2060, compared to 33 kg in 2010, and greenhouse gas emission from materials extraction and processing will reach 21%. However, material intensity will decrease in 2017-2060 by 1.3% [13].

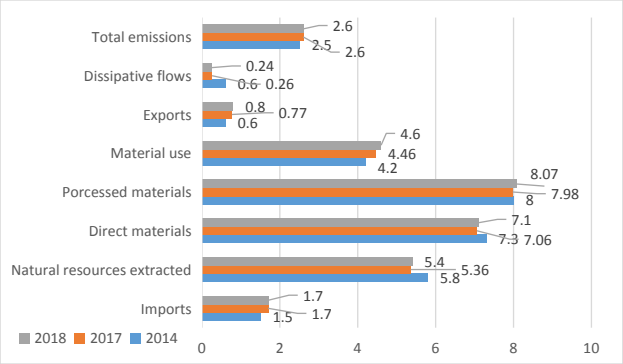

Figure 6. Comparative analysis of material flows

Source: own processing [10]

Equally important is the aspect of public awareness about the importance of natural resources for the future of the planet and the optimization of resource use in the circular economy.

Next we will analyze the economic resources that have been allocated by the general economy for those activities and actions of prevention, reduction, but also elimination of pollution or environmental degradation. EPE is divided into current expenses and investments. The mandatory and standardized system included in 2017 on EPEA has improved and will continue to improve the reporting system.

The costs of environmental protection, ie pollution reduction, biodiversity protection, wastewater management, as well as waste, research and development or education and training are an important component in supporting the circular economy.

The role of the analysis of environmental protection expenditures is to evaluate environmental policies. Expenditure information highlights cleaning costs and less cost reductions that are the result of reduced greenhouse gas emissions or high environmental protection measures.

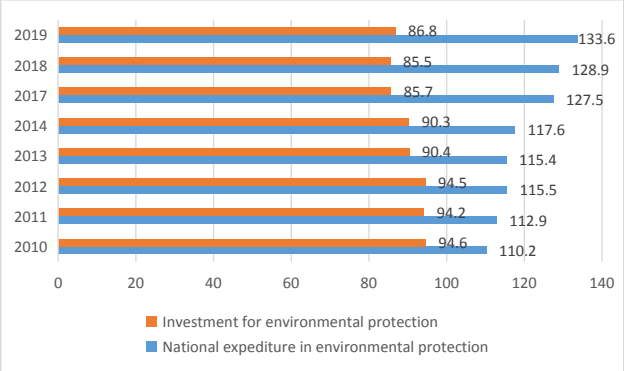

Figure 7. Evolution of environmental protection expenditures and other investments in environmental protection

Source: own processing [10]

Data taken from Eurostat data show that environmental protection spending in the E.U. increased during the analyzed period. Thus, at the level of 2019, the value of 133.60 million Euros, increasing by 21% compared to 2010. This takes place against the background of the trend of transferring the taxation method, ie the transition from the taxation of human capital to the taxation of resource consumption. In terms of investments for environmental protection, they decreased by 8% in 2019 compared to 2010.

The European strategy on the bioeconomy, which was renewed in 2018, aimed at both modernizing and consolidating the industrial base at E.U. level through new value chains, but also more cost-efficient industrial processes.

At the E.U. level there are many policies aimed at a circular economy represented by the Action Plan for the economy, environmental policies, climate policies, energy policies, etc. The main objectives are to create strong synergies between elements in order to increase the benefits within the Union, but also the capacity to exploit the op-

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portunities of the circular economy.

Recent initiatives include the "Circular Economy Action Plan for a Cleaner and More Competitive Europe", which was published on 11 March 2020 and includes measures to reduce waste from newer sectors (electronics, textiles, construction, as well as the inclusion of new objectives aimed at reducing waste, but also the adoption of ways to manage and recycle waste in the long term.

Compared to previous E.U. legislation addressing product sustainability, the new legislative initiative gives consumers the "right to repair" electronic products.

The European Commission is also proposing to create a common database for "smart circular applications" to provide consumers with information on products and value chains.

Consumer legislation will also be reviewed so that they can be provided with reliable information on the life of products, maintenance services and spare parts, so that companies must comply with these minimum sustainability labeling requirements, for information, and for ICT and electronics, it is mandatory to provide modernization services.

Another aspect concerns the adoption of additional sustainability requirements for products arriving on the E.U. market and coming from other countries.

Following the adoption of these legislative as well as non-legislative measures on the circular economy, in 2021 the European Commission will develop additional indicators on resource efficiency, consumption and material footprint.

4. Conclusions

Circular economy is an alternative to the linear economic model based on the theory of using natural resources available for a long time, easy to exploit and whose elimination does not involve high costs. Given that the world is facing planetary limits, there is a need to implement a new model, that of the circular economy which aims to maintain the usefulness of goods and products for as long as possible, while maintaining its value, which reduces the pressure on the environment.

In this context, waste management is an important part of the circular economy, which involves an in-depth analysis of the entire value chain of products, starting with their extraction, ecological design and obtaining finished products that are a new resource used in another section. At the same time, the concept of circular economy is closely linked to increasing competitiveness, and ensuring optimal use of resources involves the use of models that promote their sustainable use.

The role of the DPSIR model was to analyze the flow of factors that must be followed when making legislative decisions regarding waste management, but also on the other elements that characterize the circular economy. The relations established between the component elements offer a dynamic approach regarding the public policies in the field of waste and recycling and their reuse in the attempt to respect the principles of the circular economy and the green economy.

Against the background of population growth, resource consumption will increase, but we can move to a reduction in consumption intensity as a result of taking measures to protect natural resources. Thus, recycling becomes a more competitive way of using materials than the exploitation of natural resources as a result of the development of technology, but also due to more competitive prices.

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ARTICLE

A Study on the Mutual Rental Model of Container Shipping Alliance Cabins based on Blockchain

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ABSTRACT

As one of the main modes of capacity sharing in the shipping alliance, the essence of which is the space mutual rent transaction among members. However, under the current trading system, the sharing of capacity between shipping enterprises requires a lot of transaction costs and communication costs, cooperation efficiency is not high, and there is a certain competitive relationship between enterprises, they work for their own interests, resulting in more difficult cooperation, and blockchain consensus mechanism, intelligent contracts, distributed bookkeeping and other characteristics can solve these problems of alliance cooperation. Therefore, based on the idea of blockchain, this paper designs a model of mutual lease cooperation in shipping union cabins, gives the model and process of mutual lease transactions based on blockchain, realizes mutual trust and win-win situation among members, simulates through the combination of Hyperledger Fabric and Matlab, and verifies the applicability of blockchain to shipping alliance capacity sharing cooperation.

1. Introduction

Today, container transportation is the preferred mode of maritime import and export trade transportation. With the development of large-scale ships, the use of super-large container ships can reduce the cost of single-box transportation and achieve economies of scale, but the uncertainty of shipping market demand and excess container capacity still exist. In addition, the outbreak of neo-crown pneumonia has affected the shipping industry as a whole, with entry or transit restrictions in ports in various countries leading to a continued decline in shipping demand and additional costs from the suspension of large numbers of container captains. And the shipping alliance can be in the field of transport services routes and ports to complement each other, ship time coordination, capacity sharing, as well as in the field of transport ancillary services information exchange, the construction of common terminals and dumps, the sharing of inland logistics system, so that on the one hand can achieve economies of scale, better control costs, on the other hand, can also make full use of resources, so that alliance members in the market downturn to resist the risk of excess capacity, to achieve win-win cooperation.

In terms of capacity sharing, the forms of cooperation of the Container Shipping Alliance include class

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inter-lease, class exchange and co-shipment, and cabin mutual-lease is the most commonly used form. However, in the mode of space mutual rent cooperation, the capacity cooperation between alliance members involves the communication of multiple data, which requires a high degree of information sharing among members, however, the cooperation data between members is still stored on their own servers, when the data saved by the partners is consistent, the cooperation can proceed smoothly, but in fact, due to the different servers, software, staff and data recording methods, it is difficult to achieve complete data, so enterprises often check transaction data through the form of accounting, Inefficient and wasted a lot of manpower and material resources. It is difficult to establish trust relationships between enterprises, resulting in limited capacity-sharing cooperation, and the need to pay intermediary fees for managing cooperative transactions within the Alliance through intermediaries, resulting in increased costs. In addition, for the mode of mutual lease cooperation in class, the alliance formed by the strategic alliance is a relatively loose organization formed by the members through the conclusion of the space mutual lease agreement, although the shipping alliance has some provisions and restrictions on the distribution of routes, capacity-sharing cabin arrangements, freight rates, etc., but is not protected by law, and the authenticity of the data generated in the course of the transaction is difficult to guarantee, the trust between members needs to be strengthened. In addition, the settlement of funds after the transaction also needs to be carried out with the participation of banks and other financial institutions, banks charge a certain amount of interest, resulting in increased transaction costs. For member's cabin mutual lease transaction, how to price the class in order to maximize the benefits of the alliance is an important part to consider.

In short, the alliance of shipping enterprises is an effective way to solve the current downturn in the shipping market. However, there are obstacles to data sharing, trust building and maximizing alliance benefits when working together on capacity among members of shipping alliances. As a secure and reliable distributed database, blockchain has the advantages of de-centralization, high trust and data non-tampering, can achieve secure and trustworthy data sharing, members of the joint accounting to ensure the authenticity of each transaction and difficult to tamper with, intelligent contracts can realize the automatic execution of transactions and rapid transfer of benefits, can effectively avoid malicious arrears. Therefore, blockchain technology can be used as the underlying technology of cooperation among the members of the shipping alliance to achieve the benign development of the alliance.

2. Review of the Relevant Literature

At present, the shipping alliance is the focus of the current development of the shipping industry. Shih-Liang Chao [1] studies have found that in the case of a serious imbalance between supply and demand, the alliance between shipping companies can achieve flexible adjustment of the remaining capacity. As one of the main modes of capacity cooperation of the shipping alliance, the space inter-lease is the mode of capacity cooperation, most scholars have studied the construction of the mode of space allocation, Xuan Qiu and so on [2], think that in the context of "Belt and Road", container liner alliance ship sharing is very important to establish an effective maritime transport network, and for the situation of ships, design two kinds of container space allocation model. Chen Jihong and others [3] set up a model for the rental and configuration of container liner positions based on the shipping alliance based on the method of ship distribution on liner routes.

Scholars consider that it is an important breakthrough in the development of shipping industry to promote the transformation of shipping industry through paperless, intelligent and other digital means, thereby reducing the human dependence of the industry. Xu Kai [4] believes that the use of electronic bill of lading in China's container shipping business is a very good opportunity. Blockchain technology is at the peak of the expected maturity curve of Hong Kong's information technology, and the combination of shipping industry and blockchain technology has broad application potential. Li [5] believes that blockchain distributed databases and decentralization features can simplify the transaction of funds and reduce the flow of shipping documents, to achieve process monitoring. Ashraf Shirani [6] studied the feasibility of using blockchain technology in container shipping logistics, designed and developed web-based concept validation prototype applications, and simulated the potential capabilities of blockchain.

Blockchain-based inter-lease transactions between members of the shipping alliance have great independence and are typical P2P transactions. Blockchain P2P trading is the most researched area is the retail power trading market, Wenxuan Zhao [7], etc. through the introduction of transaction matching center and the use of blockchain intelligent contracts, the construction of blockchain-based power trading model. Matteo Troncia [8] proposes a new fully automated P2P local power market platform that enables decentralized operation of the energy and ancillary services market in distribution networks. Blockchain technology can provide a good system solution for the development of shipping alliances, put cooperative

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transactions between alliance members on the chain, can guarantee the authenticity of transaction data, enhance the trust of members. However, in the specific class mutual lease transaction, how to use blockchain technology to develop a reasonable class mutual lease pricing strategy to protect the interests of the alliance as a whole and individual members, is very worthy of study. Richa Agarwal [9] and others, based on the concepts of mathematical planning and game theory, have designed a side payment mechanism to guide carriers in shipping alliances to pursue the best overall interests of the alliance. In the study of blockchain P2P power trading, Wang Dewen [10] and others designed a two-way auction pricing mechanism to obtain clearing prices, and gave a regional energy trading process based on smart contracts. However, the shipping alliance class mutual lease transaction and the power P2P transaction is somewhat different, the class mutual lease is carried out under the premise of limited space resources, and does not have the auxiliary service market as the power market as a supplement. In addition, the indivisible nature of the demand for space is also one of the characteristics of the space mutual rental transaction different from the power and energy transaction. Therefore, how to design the space mutual rent pricing strategy on the basis of blockchain is also the focus of this paper.

3. Blockchain-based Shipping Alliance Class Inter-lease Transaction Framework

Blockchain-based shipping alliance class mutual rental model is the blockchain system as the underlying technology system of cooperation among alliance members, the data information generated in the process of space mutual lease transactions are stored on the blockchain, and through the blockchain to achieve transfer settlement. Unlike traditional trading methods, both parties no longer rely on intermediaries for mutual trust and cooperation, as shown in Figure 2. The main body of the shipping alliance class inter-lease transaction is the class supplier and demander, during the trading cycle, the space supply direction blockchain trading system submits the availability information of the class (including route, number of classes, class of travel and class unit quotation, etc.) and the class mutual-lease transaction request, which is submitted to the system by the charter authority of the class demand, and then the system sends the request to the certification authority of the blockchain trading system (Certificate Authority, CA) to determine whether the class mutual lease transaction request meets the requirements, if it meets the requirements, the transaction request will be sent to the mutual lease transaction matching center. The Transaction Matching Center (TMC) will automatically perform matching according to the preset pricing strategy. In the matching process, the quotations reported by the members of the alliance are encrypted by digital encryption technology, and the other party's quotations cannot be seen among the members, that is, the system connects the member's quotes with a string of random strings and uses Hash encryption as a sealed quote, which not only makes the sealed quote un tamperable, but also ensures that the quote is not disclosed to other members prematurely[14]. After the mutual lease cooperation match is successful, the system sends the transaction information to both parties to the transaction, waits for confirmation by both parties, formulates the contract for the transaction and uses the private key to sign. Fabric's multi-channel mechanism creates a channel for each transaction, each of which contains only the two parties to the class-of-travel mutual lease, thus isolating the data within and outside the channel. Finally, the digital proof that the class supply side transfers control of the cabin through the blockchain to the demand side with which it trades. After that, the transaction is broadcast to the entire network, the node is confirmed by consensus mechanism and recorded in the blockchain, and the trading system receives the confirmation information and sends it to the dispatch center. At the end of a trading cycle, the system uses smart contracts to transfer and settle data recorded on the blockchain.

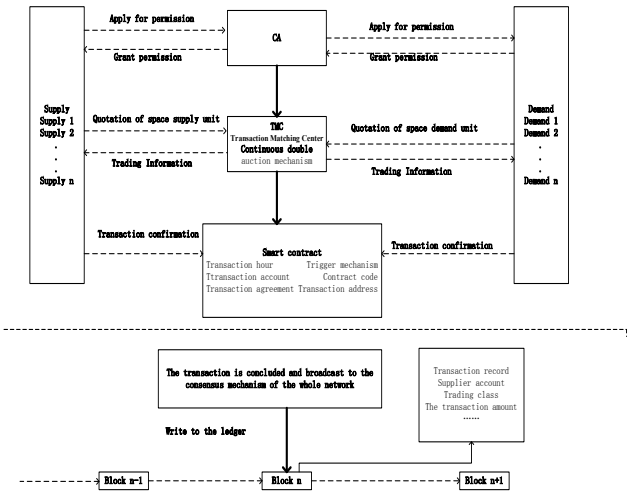

Figure 2. Overall architecture of based on the blockchain shipping alliance of shipping space mutual lease

4. Shipping Alliance Class inter-lease trading Method based on Smart Contracts

4.1 Class Inter-lease Transaction Process based on Smart Contracts

In a blockchain environment, participants can perform

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trusted operations without the involvement of a third party through smart contracts. According to the characteristics of the class mutual lease transaction, it can be divided into five stages: transaction authentication, information release, transaction matching, transaction confirmation and fund settlement, the specific process is shown in Figure 3.

4.1.1 Transaction Certification phase

At this stage, members of the shipping union with availage and demand for space apply to CA for access to the relevant set of attributes in the trading network (including identification, wallet address, member type and permissions, etc.), while CA uses the primary private key MPK to issue public and private keys and digital certificates to each member unit.

4.1.2 Information Release Phase

During the n-1 cycle prior to the start of the transaction, shipping alliance members report supply and demand information to the blockchain system based on their own supply and demand conditions and publish it through TMC. Among them, the information release function of the class supply side and the demand side are shown in the formula (1) and (2).

$$Int_a\left(ID_a, Addr_a, L_a, S_a, ASK_a, Sig_a\right) \rightarrow Supply \tag{1}$$

$$Int_b\left(ID_b, Addr_b, L_b, S_b, ASK_b, Sig_b\right) \rightarrow Demand \tag{2}$$

Among them, ID_a and ID_b are the identity of the class supplier and the demand side respectively, $Addr$ is the wallet address, R_a and R_b represent the supply side and demand side route, ASK_a and ASK_b are an array containing quotations and the number of seat supply and demand, and Sig generates signatures for the information.

4.1.3 Trade Matching Phase

Class mutual lease traders through TMC transaction matching, TMC executes a continuous two-way auction mechanism to determine the transaction price (see section 3.2), the transaction match is successful and then added timestamp Tab, generating the transaction match result Result.

$$Match\left(Demand, Supply, T_{ab}\right) \rightarrow Result \tag{3}$$

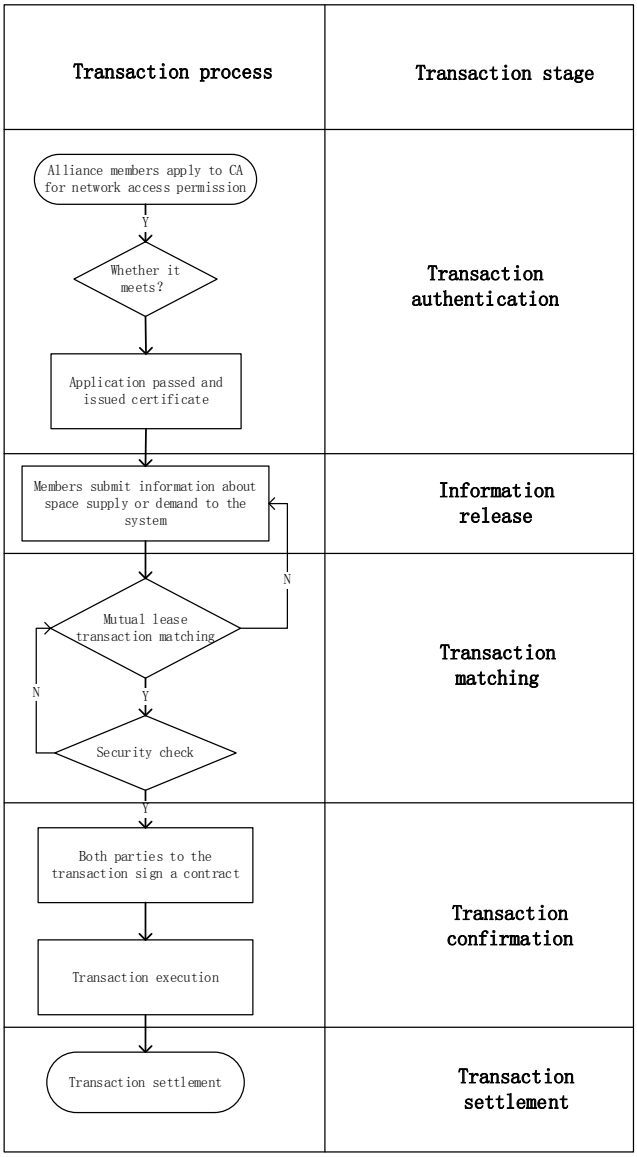

Figure 3. Mutual leasing trade process based on intelligent contract

4.1.4 Trade Confirmation Phase

Transaction matching results will be broadcast to the entire network for transaction verification, and the content of the order will be distributed through consensus mechanism calculation and authentication, and then the P2P webcast certification results will be used. Once the authentication is successful, the parties to the transaction select a suitable TMC node to form a shift path for control of the cabin, while the TMC generates a random number, as shown in the formula (4).

$$Hash\left(SU_{id}, DU_{id}, TMC_{id}\right) \rightarrow Rand \tag{4}$$

Among them, SU_{id}, DU_{id} represents the identity in-

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formation of the class supply side and the demand side, TMC_{id} is the matching information of the class inter-lease transaction, and *Rand* is the generated random number.

4.1.5 Trade Settlement Phase

When the transaction is completed, it is submitted to the sorting service for sorting, and the random number Rand formed by hash encryption is combined with the transaction match result Result into a transaction that is included in the blockchain ledger, as shown in the formula (5).

$$Int_r = (Result, Rand) \rightarrow Record \tag{5}$$

Due to market uncertainty, there is strong uncertainty between the two parties to the class inter-lease transaction, there may be no contract to rent and lease the cabin, so in the transaction settlement phase designed a trust-based penalty mechanism to adjust the distribution of the interests of the last member, thereby avoiding the risk of trust in the transaction (see section 3.3).

4.2 Based on the Improved Two-way Auction Mechanism, the Class Rent Pricing Strategy

Traditional shipping alliances often apply for classes including rental prices through leasing members, asking the class of travel available for rent by the class supplier, and when the number of classes and the rental of the cabins replied by the supplier meet their intended objectives, the two sides sign a mutual lease agreement and enter into cooperation. This is not only inefficient, but also reduces the range of choices between the two sides, which is not conducive to maximizing their interests. Therefore, this paper adopts a continuous two-way auction mechanism based on blockchain to develop the pricing strategy of mutual rental of space among members. The two-way auction mechanism is in the case that the trading participant is many-to-many, the buyer and seller can submit the expected quotation at any time during a certain trading cycle, through the "price first, time first" principle, once the match is successful can be completed [15].

However, in the shipping alliance space mutual lease model, not only the matching of prices, but also the matching of supply and demand, it is necessary to consider the matching of supply and demand. Assuming that the demand is indivisible, the transaction will only be carried out when the demand is fully satisfied. Therefore, based on the Gjerstad-Dickhaut (GD) strategy [16], this paper proposes an improved double auction mechanism that considers the supply and demand of space in the blockchain environment, and uses the historical transaction information recorded by the blockchain technology to establish trust Function to adjust the quote. Realize peer-to-peer transactions in a decentralized environment. In this peer-to-peer transaction model, participants make independent decisions, and use "benefit first, time first" as the auction principle, that is, the system first considers the auction portfolio that maximizes the total profit. When the supplier receives the same benefit, then The demand side is selected according to the order of registration time. In this mechanism, the mutual lease transactions between shipping alliance members are divided into n cycles. During the cycle, the blockchain system will collect the supply and demand of the space submitted by the supplier and demander of the space, including the initial quotation. Information, the system matches with the goal of maximizing overall benefits, and returns the matching results to the supplier and the demander. Both parties agree to complete the auction, and the two parties reach cooperation. It should be noted that due to different routes, alliance members may be either the suppliers or the demanders of space. Let the set of space suppliers in the system be $I = \{1, 2, \ldots, n\}$, the fixed shipping cost of the supplier $i \in I$ is f_i, the cost of unleased unit space is c_i, the maximum supply is D_i. So that the collection of the demand side of the cabin is , the demand of the demand side $j \in J$ is q_j, and is willing to rent space at a higher reserve price bh_j. After the transaction is matched, the lowest quotation of the unsuccessful supplier is set to Q_{ask}, if all the seats of the supplier can be rented, then $Q_{ask} = max$, max means the highest quotation of the supplier allowed by the market; In the same way, the highest quotation of the demander who has not successfully traded is set to Q_{bid}. If the demand can be fully satisfied, then $Q_{bid} = 0$. The supply and demand members of the class that have not been successfully matched need to modify the quotation to participate in the matching again, in the newly submitted quotation information, the supplier's quotation should not be greater than Q_{ask}, and the demander's quotation should not be less than Q_{bid}, otherwise, the system will invalidate its quotation and cannot continue to participate in matching, before the start of the trading cycle, $Q_{ask} = max$, $Q_{bid} = 0$ [17].

Before the start of the trading cycle, each space provider predicts the expected transaction volume , and calculates the lowest price it is willing to accept as , as shown in formula (6).

$$al_i = \frac{f_i + ex_i \cdot c_i}{ex_i} \tag{6}$$

The specific strategy of double auction of a certain

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route is as follows:

(1) After the beginning of the transaction cycle, the space supplier and the demander respectively continuously submit quotation information to the blockchain system. The quotation information submitted by the space supplier is $ask(q_i, p_i, i)$, which means that the supplier *i* hopes to rent q_i spaces at the unit price of ; the demand information of p_i the demand side is $bid(q_j, p_j, j)$, which means that the demand side *j* wants to rent q_j units at the unit price of q_j. The system arranges the supplier's quotations in ascending order, the demander's quotations in descending order, and the same quotations are arranged in the order of quotation time.

(2) During the transaction, suppose the supplier's historical quotation set is $A = \{a_1, a_2, \ldots a_n\}$, The demand-side historical quotation set is $B = \{b_1, b_2, \ldots b_m\}$, Introduce the trust function [18], expressed as follows:

Supplier-side trust function:

$$\begin{cases} p^*(a_i) = \dfrac{\sum_{a_j \geq a_i} TA(a_j) + \sum_{b_j \geq a_i} TB(b_j)}{\sum_{a_j \geq a_i} TA(a_j) + \sum_{b_j \geq a_i} TB(b_j) + \sum_{a_j \leq a_i} RA(a_j)} \\ p^*(0) = 1, p^*(M_a) = 0 \end{cases} \tag{8}$$

Among them, $a_i \in A(i = 1, 2, \ldots, n)$, TA and TB are the set of successful transactions in the historical quotations of the supplier and the demander, respectively, RA is the set of unsuccessful transactions, that is, $A = TA + RA$, it is assumed here that the supplier's offer is 0 and is always acceptable, that is, $p*(0) = 1$, and there is a very high offer that is always rejected, that is, $p*(Ma) = 0$,

Demand-side trust function:

$$\begin{cases} q^*(b_i) = \dfrac{\sum_{b_j \leq b_i} TB(b_j) + \sum_{a_j \leq b_i} TA(a_j)}{\sum_{b_j \leq b_i} TB(b_j) + \sum_{a_j \leq b_i} TA(a_j) + \sum_{b_j \geq b_i} RB(b_j)} \\ q^*(0) = 0, q^*(M_b) = 1 \end{cases} \tag{9}$$

Among them, $b_j \in B(j = 1, 2, \ldots, m)$, RB is the set of unsuccessful quotations in the historical quotations of the demand side, namely $B = TB + RB$. Assuming that the demand side's quotation is always rejected by the market when it is 0, that is, $q*(0) = 0$, there is a very high quotation that can always be accepted by the market, that is, $q*(Mb) = 1$.

Discrete function continuity: Since the quotation is a discrete data set, the trust function is also a discrete function. Therefore, the cubic spline interpolation method is used here to make the trust function continuous. Methods as below:

For the supplier, arrange its historical quotations in the order from low to high, and the two-dimensional coordinates of any two adjacent quotations a_i, a_{i+1} are $(a_i, p^*(a_i))$, $(a_{i+1}, p^*(a_{i+1}))$, using cubic spline interpolation to solve the continuous function $p(a)$, as shown in equation (10)(11). And solve the equation coefficients c_1, c_2, c_3, c_4 through the formula.

$$p(a) = c_1 a^3 + c_2 a^2 + c_3 a + c_4 \tag{10}$$

$$s.t. \begin{cases} p(a_i) = p^*(a_i) \\ p(a_{i+1}) = p^*(a_{i+1}) \\ p'(a_i) = 0 \\ p'(a_{i+1}) = 0 \end{cases} \tag{11}$$

$$\begin{bmatrix} a_i^3 & a_i^2 & a_i & 1 \\ a_{i+1}^3 & a_{i+1}^2 & a_{i+1} & 1 \\ 3a_i^2 & 2a_i & 1 & 0 \\ 3a_{i+1}^2 & 2a_{i+1} & 1 & 0 \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{bmatrix} = \begin{bmatrix} p^*(a_i) \\ p^*(a_{i+1}) \\ 0 \\ 0 \end{bmatrix} \tag{12}$$

The historical quotations of the demand side are arranged in order from high to low, and the discrete trust function is expanded into a continuous function in the same way as above.

(3) Calculate and adjust the maximum expected profit quotation of the supplier and the demander through the trust function, as shown in equations (13) and (14).

$$\widehat{a} = \arg \max_{al \leq a \leq Qask} p(a) \cdot (a - al) \tag{13}$$

$$\widehat{b} = \arg \max_{Qbid \leq b \leq bh} q(b) \cdot (bh - b) \tag{14}$$

Among them, $\widehat{a}$ and $\widehat{b}$ represent the maximum expected profit quotation of the supplier and the demander, *al* and *bh* are the lowest price that the supplier is willing to accept and the highest price that the demander is willing to pay. If $Q_{ask} < al$, the supplier's quotation information will not be submitted by the system; similarly, if $Q_{bid} > bh$, the demander's quotation information will not be submitted. That is to say, the supplier's quotation is not lower than the lowest price it is willing to accept, and the demander's quotation is not higher than the highest price it is willing to pay.

The overall profit of the alliance is calculated as follows:

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$$P_{total} = P_s + P_v \tag{15}$$

$$s.t.\begin{cases} P_s = \sum_{i \in Is}\left[\left(\sum_j d_{ij} \cdot bp_{ij}\right) - \left(f_i + \sum_j d_{ij} u_i\right)\right] \\ P_v = \sum_{j \in Iv} q_j \left(bh_j - sp_j\right) \\ \sum_k d_{ik} \le D_i \end{cases} \tag{16}$$

Among them, P_{total} represents the overall profit of the alliance, P_s and P_v respectively represent the total profit of the supplier and the demander of all spaces, Is is the set of suppliers of all successful transactions, d_{ij} and bp_{ij} represent the quantity and rental price of different demand-side transaction slots of supplier *i* respectively, and the sum of the slots of all demand-side *j* that successfully transacted with *i* is not greater than *i* The maximum space capacity D_i, sp_i represents the transaction price of the demander, and *Iv* is the set of demanders of all successful transactions (all the demands of the demander are met before the transaction).

4.3 Punishment Mechanism for Breach of Contract based on Trust

When the number of seats actually supplied by the supplier member is less than the amount agreed in the smart contract, it will cause a default. In order to avoid the risk of default, a penalty mechanism needs to be designed to punish members who do not perform operations in accordance with the contract. The transaction after the penalty of member i The electricity price is shown in equations (17) and (18).

$$G_{i,t} = \left(\frac{H_{i,t}}{100} - 1\right) bp_{i,t} \tag{17}$$

$$H_{i,t} = \begin{cases} 100, \dfrac{O_{i,t}}{E_{i,t}} \le \mu \\ 100[1-(1-\alpha)\dfrac{O_{i,t}}{E_{i,t}}], \dfrac{O_{i,t}}{E_{i,t}} > \mu \end{cases} \tag{18}$$

Among them, $H_{i,t}$ represents the supplier's reputation value in the t-th trading cycle; $O_{i,t}$ represents the actual number of leased spaces and the number of spaces transacted in the contract of the i-th supplier in the t-th period, $E_{i,t}$ represents the number of trading slots of member *i* in the t-th cycle, *a* represents the degree of trust (derived from the previous section), and μ represents the difference between the number of slots actually provided by member *i* and the number of slots transacted The deviation, when μ is set to 0.2, the trading reputation curve of members whose trust degree *a* is 0.3, 0.5, and 0.8 is shown in Figure 4.

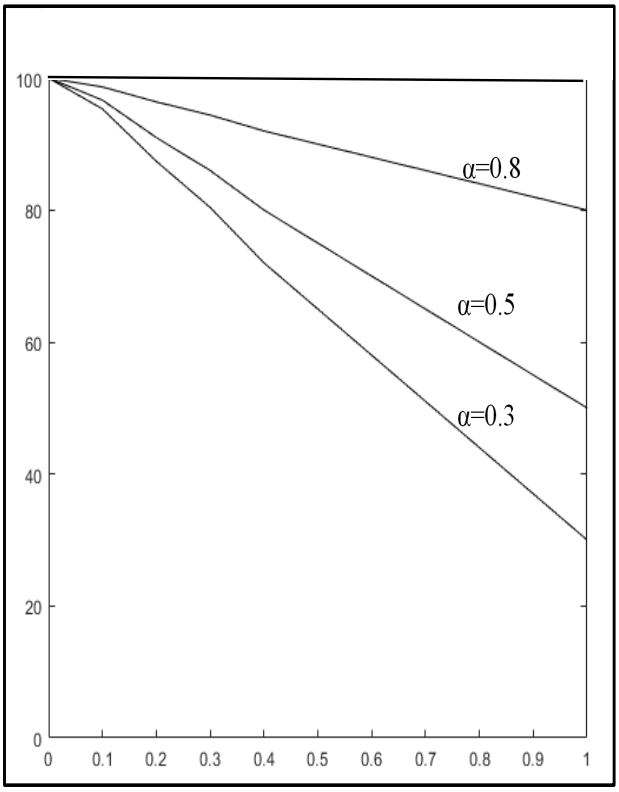

Figure 4. Credit curve

5. Case Simulation

In order to verify the feasibility of the blockchain shipping alliance space mutual lease transaction, on the basis of the Fabric network, a local client is created through the Java SDK to serve as the space mutual lease transaction platform. Under the Ubuntu 18.04 system, install the Docker container to configure the relevant Participants can call smart contracts (chain codes) through the application terminal to initiate a mutual lease transaction.And use Matlab to simulate the transaction matching center for testing. Because the continuous double auction market is automatically quoted by the agent, the quotation time is extremely short. The quotation period of the participants in the mutual lease transaction of space is set to 1s, and the alliance members automatically quote within the 1s range. The initial quotation information of members participating in the mutual lease of shipping alliance space is shown in Table 1.

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Table 1. Shipping alliance shipping space mutual rental transaction information

The member type	ex_i/TEU	f_i/CNY	c_i/CNY·TEU^{-1}	p_i/CNY·TEU^{-1}
Supply 1	500	135700	6600	16600
Supply 2	500	125800	4500	14100
Supply 3	500	106200	4200	16200
Supply 4	700	153800	5500	13700
Supply 5	400	123500	6500	18600
Supply 6	500	141200	8500	14800
The member type	q_j/TEU	p_j/CNY·TEU^{-1}		bh_j/CNY·TEU^{-1}
Demand 1	400	15800		18700
Demand 2	200	14800		19200
Demand 3	300	13800		17500
Demand 4	500	13800		15600
Demand 5	300	18000		16100
Demand 6	300	15800		16600
Demand 7	600	14800		15000
Demand 8	200	14800		16500

The simulation results are shown in Figure 5, where the bracket labels indicate the serial numbers of the supplier and the demander respectively. There are five rounds of quotation in the transaction. In the second round, 6, 7, and 8 belong to the third, fourth and fifth trading rounds respectively.

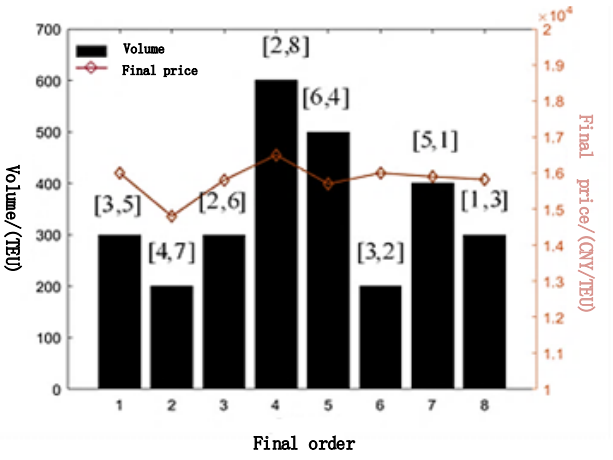

Figure 5. Result of Members' shipping space mutual rental transaction

Finally, the blockchain system settles the transaction. Transaction payment settlement refers to the payment operation through the payment institution after the mutual lease cooperation of space is completed. The alliance chain is responsible for the accounting processing of the transaction results. The system executes the benefit distribution result as shown in Figure 6 below. Through the consensus mechanism, each node guarantees that the ledger records are consistent, each transaction is transparent and open and cannot be tampered with, and members can view the transaction records through the blockchain query function.

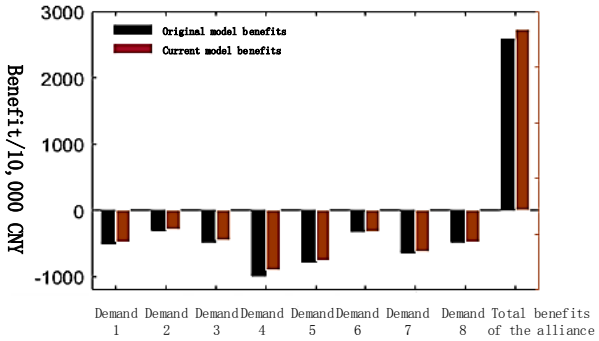

Figure 6. Result of benefit distribution

6. Conclusion

This paper studies on the basis of blockchain, shipping alliance members to carry out mutual lease cooperation between shipping alliances, through the construction of the mutual lease model, the combination of blockchain technology and alliance internal cooperation, and the use of blockchain consensus mechanism, To realize the trust collaboration between members. In terms of cooperative rental pricing for space mutual leases, this paper establishes a dual auction model for space mutual leases, which not only protects the interests of members, but also realizes the increase in the overall interests of the alliance. The blockchain smart contract replaces the paper contract, which is automatically executed and cannot be tampered with at will, effectively improving the efficiency of member cooperation. In addition, the blockchain uses the historical quotation information of the alliance members to calculate the trust and reputation value of the members, and obtains the penalty transaction cost in the case of a member's default, thereby restricting the behavior of the members and reducing the risk of default.

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ARTICLE

Human Resource Management and Quality Assurance System to achieve Competitive Advantage

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ABSTRACT

This study aims at the role of human resources management and quality assurance system to achieving the competitive advantage for the organization. Human resource management are the most important component among the organization's components, because, even an organization owns all other resources (materials, financial, technological) without the appropriate, skilled and experienced human resources, failure will be the expected result. Addressing By the Mobilis Telecom company, the study and through exploring the recruitment resources and methods that used by the company, in hiring the best employees, and the role of these methods in achieving the competitive advantage in Telecommunications sector. The findings of the study were that the company success in the recruitment process was relying on the employment agencies, firstly and on the universities, secondly. Also the company aimed on maintaining quality assurance system through recruiting method that based on Telecommunications experience and advancement in studying. In order to achieve the competitive advantage, the Company focused on innovation and creating new products and services for its clients. The statistical analysis proved that there is a strong relationship between recruitment resources used by the Company and achieving the competitive advantage, Also a relationship between the quality assurance system of the employees and the ability to gain the competitive advantage.

1. Introduction

Human resources have most important resource used by modern organizations. Is main thinker and element in production services, it is means of production service processes, and it also the organization's conscience, its beating heart its conscious awareness of what is going on around it of events, an increased awareness of the importance of this precious resource its description and expression changed over years. In past, the word "employees" or public servant was used, then workers, and the workforce, until it became today described as human capital on language of economists, human assets - in the language of accountants, and smart or intellectual capital - in the language of administrators [1].The strategic management of human resources and business organizations can reap

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many strategic benefits, such as achieving competitive advantage, which is considered a strategic goal that can be achieved by planning and drawing long-term strategies, whether at the level of the product or service provided by the organization, or at the level of production inputs of materials, customer relations and other factors.

This study lies in shedding light on the tasks and duties of human resources management and total quality management which aims to achieve competitive advantage in the organization, and since business organizations, according to systems theory, are considered an open system that affected by the surrounding environment, and interacts with it an interactive and reciprocal relationship, the since of human resources management is considered part of the organization, it forms a subsystem in addition to other departments in the organization, so that its entirety it is the total quality management system, which the organization with all departments and employees equipment and everything related to it. Accordingly, the human resources management and total quality management, when exercising its tasks and roles, takes into account the strategic objectives of the organization, as it needs to attract and appoint people with best skills and experiences from the external environment by various means in order to achieve the goals of the organization [2].

This study lies in shedding light on the tasks and duties of human resources management in the organization, which aims to achieve competitive advantage. Since the human resources department is considered part of the organization, it forms a subsystem in addition to other departments in the organization to be in its entirety the the total quality management system, which the organization with all its departments, employees, equipment and everything related to it. Accordingly, the human resources department, when exercising its tasks and roles, takes into account the strategic objectives of the organization, as it needs to attract and appoint people with the best skills and experiences from the external environment of various means in order to achieve the goals of the organization.This study also came to investigate the role of human resources management and total quality management in a number of Algerian institutions, which in turn aims to achieve a strategic goal of achieving competitive advantage and applying the best criteria for attracting appointing employees.

2. Human Resource Management

Human resource management defined as a process of necessary activities aimed at providing the organization with necessary qualified cadres in order to achieve the highest level performance [3]. Accordingly, human resources management is an organization within that practices multiple activities and processes related to the human element of workforce in the organization, the figure (1) shows the most important functions of human resources management [4].

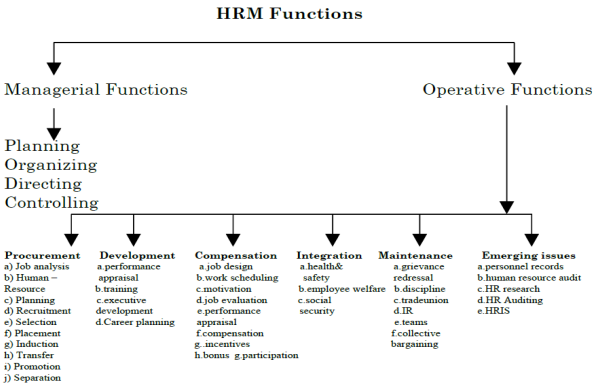

Figure 1. Functions of human resources management

Through this study, the function of human resources management is focusing on the most important functions that it performs, such as the process of recruitment, selection, appointment, etc. and its importance for the organization to achieving its goals, especially in achieving the competitive advantage.[5] Defined the recruitment process: (as group activities seeking to attract individuals who are qualified to work in the organization with the aim satisfying the desires of both parties).

While [6] defines: (the process of identifying and attracting prospective employees).

Consequently, through these previous definitions, the extent importance of the recruitment process represents a mutual reciprocal relationship between each the human resources management and organization's management, which seeks to achieve its goals through attracting and appointing best workers, in the event of convergence and harmony of the individual's expectations what he will get from the organization satisfy his needs, the organization's expectations of individual for what is presented by him to achieve this goals of organization, will be easy for the organization to follow method of enticement to attract qualified individuals, widening the scope for organization to choose best from a larger group Individuals, selecting the best them to achieve through competitive advantage that distinguishes it from other organizations.

3. Quality Assurance System

Concept of quality assurance system is emerged in the eighties of the last century in the field of quality control and the goods produced our services provided. The concept came to focus on earning customer satisfaction and increased confidence in the products presented by various organizations. We will through this requirement, addressing historical development of the concept quality assur-

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ance system and highlighting its most important principles and advantages of its application [7].

The concept of quality is attention emerged as a guarantee Methodologies for successful economics in countries during the fifties and sixties the last century, a successful organization, from their point of view, is one that meets quality standards. Who follows the movement of the evolution the quality concept, is noted that it was used for the first time during World War II, and its concept was limited at that time on detection defects after completion of the manufacturing process [8]. With the emergence of what known as mass production, represented in Individuals establishing small production units in their homes, which left behind a large proportion of Defective products, a supervisory system emerged, known as the statistical quality assurance system, which holds that quality is achieved through the control of production unit. This system underwent several developments, as other tools were used To control the quality of products such as the sample system and the control map, however, this system has shown many shortcomings, the most important of which is appearance of defective products on the market [9]. In 1946, the international organization was established the goal of standardizing product specifications and to ensure quality and upgrading (ISO) of specifications or standards production to higher levels. By the end of the sixties and beginning of seventies last century, the meaning became the real quality assurance is known more sophisticated in order to achieve a product that the customer trusts. In general the definition of terms related ISO first International Quality Standards 1986 was issued which defines ISO 9000: quality, and it was developed in 1987 with the issuance of series specifications of the properties required in the product and giving it usability, as well as determining the main elements required to met in the quality management system of the organization to ensure that its products comply with the needs of the customer, followed by several amendments at various times. In 1994, three systems of quality assurance standards were available: [10].

Related quality system in the production and service establishments whose activities are limited to ISO 9001 which is concerned with the organizations that carry out the design, production and after-sales services ISO 9002, ISO 9003 is engaged in production and installation without design and after sales services for the quality system in field of final examination of goods and their quality test. In the year 2000, it was issued Regarding the requirements of ISO 9001, a new version replaces the three so-called (ISO) systems of the quality management system, and this system has enabled more than a number of organizations of various kinds their sizes have the opportunity to obtain a certificate of quality assurance by meeting the stipulated requirements a work to achieve the standards that it raises.

Quality assurance is forefront of our life's strategic concerns in this era that some thinkers call the "era of quality"; it aims to rise professional practices, which ensures maximum utilization of resources and resources to reach high outputs the quality. This concept focuses on customer satisfaction, gaining his loyalty and increasing his confidence in products presented to him. It confirms its conformity with the approved specifications. There are many definitions that dealt with the subject Quality assurance, some of which are below: [11].

Quality assurance is defined as: "All planned and systematic actions necessary to give confidence that products have satisfied specific needs". It also defined as: "The set of activities that institution or organization takes to ensure that the standards of A predetermined set a good service that is already being accessed regularly, and the goal of these activities are avoid defects in products or services" [12].

The 2000 version, you defined it as: "Part of the ISO 9000 as for International Organization for Standardization according to the standard quality management focuses on providing confidence that quality requirements will be assured [13].Quality assurance is also defined as: "a procedure that allows for confidence of stakeholders through outputs meets and their expectations minimum requirements. [14]

4. Competitive Advantage

Competitive advantage means that the organization has advantages through the available resources, capabilities and skills that other competing organizations cannot imitate or match, and it is natural for this competitive advantage to be sustainable and accessed through multiple sources, the human element is its most important source, so how to manage human resources in the organization, creating high motivation among workers, developing the organization's culture to stimulate individual's motivation, encouraging creativity and innovation, increasing the degree of employee loyalty to the organization, all contribute effectively to achieving competitive advantage [15].

The capabilities of organization are considered one of most important manifestations of effectiveness in resource management. Some authors believe that achieving competitive advantage is by building a pyramid that includes resources capabilities so that resources are at the first level of the pyramid, and by combining them, the capabilities that come at the second level of the pyramid are created, as they are considered the basis for achieving Competitive advantage, which comes in the third level of this pyramid [16]. Michael Porter has indicated, one of the first scholars who applied economics in solving administrative prob-

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lems, especially the strategies of organizations, indicated that organization can achieve a competitive advantage and enables for outperform. [17]

There are other concepts competitive advantage, A. Cost leadership: For the organization to provide goods services at lowest prices. B. Differentiation: It means the organization's ability to excel in providing goods services with high specifications, and of great benefit to the consumer in terms of the characteristics of the commodity or service product, and the after-sales service. C. Concentrated differentiation: focusing a specific commodity or market, such as focusing on selling clothing to large sizes. Jeffrey Fifer indicated, the definition of competitive advantage from the perspective of human resources is unique, as he says, "The competitive advantage is achieved when the organization has human resources in which the member is not able to replace him with any alternative, and he is rare and unique, and he has the ability to add a value that is difficult to emulate or imitate" [18].

5. The Present Study

The importance of this study lies in terms of the importance of Human Resource Management and Quality Assurance System to achieve Competitive Advantage in business organizations, the fact that the human resource is the basic element in the success or failure of the organization, so whatever the organization possesses technology and funds, and its human resources are not qualified, unable or unwilling to work, it will inevitably be responsible to failure and then demise, any organization without individuals is nothing more than a group of machines, equipment, buildings and some money, in which there is no life and no movement in it, because individuals are most important asset or resource, which gives life to organizations, and clearly contributes to achieving the desired goals.

Based on the foregoing, the problem of this study is to determine the extent of the importance attached by Mobilis Telecom Company to the management of Human Resource Management and Quality Assurance System to achieve Competitive Advantage through its reliance on the recruitment and appointment criteria used by the organization and the extent of this impact on achieving competitive advantage, and based on this, the problem of this study aims to answer questions The following: What the procedures adopted by the human resources department in our Company through the standards of recruitment and employment affect the achievement of competitive advantage?. And what the qualities of human resources in Mobilis Telecom Company to achieving the competitive advantage?.

6. Methodology

6.1 Participants

The sample of this study was selected Mobilis Telecom Company. Total number of samples involved in this study was 200; (50 Females and 150 Males), the aged 30-45 years (mean = 35.9, SD = 5.6) took part in the study. The experience between 02 - 10 years (mean = 5 years, SD = 5.6).

6.2 Measurement

All constructs have been adapted, with slight modifications regarding the existing literature. The measurement of the constructs has been achieved via a seven-point Likert scale ranging from "1-strongly disagree" to "7-strongly agree". For the constructs a scale consists of a (50questions) was used to serve the objectives of this study according to those variables identified in the figure 01.

7. Results

Through the data contained in Table 1 shows that important variable for Human Resource Management and

Table 1. Variables of Human Resource Management and Quality Assurance Systemand competitive advantage indicators

Variables \ Statistical significance	Mean	SD	1	2	3	4	5	6	7	8	9	10
Managerial Functions	4,22	0,43										
Operative Functions	4,23	0,59	,59**									
Planning Organizing	3,7	0,72	,59**	,63**								
Directing Controlling	4,45	0,39	0,15	0,18	0,02							
Procurement	4,52	0,29	,27*	,28*	,54**	,47**						
Development	4,66	0,49	,61**	,73**	,72**	,44**	,59**					
Compensation	4,37	0,35	,69**	,43**	,53**	,51**	,57**	,68**				
Integration	4,63	0,49	,52**	,37**	,83**	0,16	,60**	,53**	,56**			
Maintenance	4,41	0,33	,48**	,26*	,53**	,60**	,83**	,50**	,74**	,57**		
Emerging issues	3,52	0,44	,23*	,46**	,56**	,55**	,73**	,70**	,54**	,39**	,61**	-

** Correlations significant at $p < 0.01$.

* Correlations significant at $p < 0.05$.

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Quality Assurance System: as well as the competitive advantage of indicators that depend on the organization in reaching its goals.

As of the variables for Human Resource Management and Quality Assurance System: It was Managerial Functions that a database of job seekers according to the qualifications required by the new job that the institution needed, and this leads to speed ease of attracting new employees, then Operative Functions as many Companies require obtaining Students of specializations related to work in our field, and this requires training in our field for engineering to complete their academic qualifications, and this in turn leads to the discovery of talented employees, whom the companies seeks to employ after their graduation from the companies, and Planning Organizing as planning which is represented in seeing the largest possible number of job seekers, which will increase the number of qualified applicants for the job, which gives the organization a greater opportunity to choose from them, and thus attract the best applicants, and Directing Controlling that is carried out by the companies, and this database allows the companies to attract employees who match their qualifications with the required function, as those requests are arranged and classified in a special database, in a way that leads to a speedy recovery of their data easily and easily, in terms of importance it is in attracting the employees that the organization needs, and often reliance on this source is widely spread, which may lead to unqualified persons applying to fill the required job, which allows the advantage of diversity in job applicants.

As for the indicators of Competitive Advantage: the first terms of achieving the institution's competitive advantage from the point of view of the study sample, It is considered a terms Procurement is considered a basis for providing unique and distinct services to those dealing with the company, followed by almost equal importance each of (Compensation, Integration, Maintenance, Emerging issues), and in general the indicators of development, as a result of achieving a competitive advantage, was of great importance from the point of view of the study sample, as the total mean value of (4.66).

8. Discussion

Through the Correlation Coefficient (R) that we used in order to test objectives of the this study, and the results showed that there is a statistically significant correlation between the variables for Human Resource Management and Quality Assurance System adopted by the Human Resources Department at Mobilis Telecom company and their achievement of competitive advantage, that is, there is a relationship between the sources of recruitment used in the Mobilis Telecom Company and corporation's achievement of competitive advantage. This also applied to the existence of a statistically significant correlation between the quality of Human Resources Management and Quality Assurance System in parallel the indicators adopted by the organization in achieving competitive advantage, meaning that the type of employees that the organization recruits and employs in Mobilis Telecom Company has great importance in achieving competitive advantage through those indicators adopted by Mobilis Telecom Company, these are: (Procurement, development, Compensation, Integration, and Maintenance, Emerging issues).

9. Conclusion

Considering this study, as well as the results obtained and through the reality of relevant studies and research, and through be concluded that Human Resources Management and Quality Assurance System plays a very important role in achieving the Competitive Advantage of Mobilis Telecom Company, as this is evident in fact that the human resources management in the organization was very dependent on employment agencies in attracting qualified and efficient manpower, the latter that had a positive impact in achieving and enhancing the Competitive Advantage.

The adoption of the Human Resources Management and Quality Assurance System by company on the human resource from within the organization has contributed greatly to enhancing the competitive advantage of the company also adoption of the human resources on new employees who have experience in the field of work in our field has greatly affected the improvement of the quality of the employees, and then achieving the competitive advantage, and all this is evidenced by the great development achieved by Mobilis Telecom through the significant increase in number of customers and subscribers to this institution through the quality and diversity of services provided by this company to its customers.

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ARTICLE

Venture Capital Finance-Eliminating Double Sided Moral Hazards through Trade-off between Economic and Behavioural Economic Aspects-A Case Analysis

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ABSTRACT

Venture capital finance has two aspects, the economic aspect and the behavioural economic aspect. The economic aspect includes issues such as conflict of interest between the entrepreneur and the venture capitalist (VC), asymmetric information, moral hazard, and compensation issues for both the parties. The behavioural economic aspect is related to relational factors such as empathy and a feeling of fairness and trust shown by both the parties.

Therefore, while deciding the financer, entrepreneur should consider both relational aspect and value add services of the financier and strike optimal trade-off. The ensuing case analysis has been carried out focusing on elimination of double-sided moral hazards through a proper trade-off between economy and behavioural economic theories (aspects).

The performance of the venture can be enhanced by balancing both of these theories in practice. An equity distribution that represents economic reward is a source of motivation for both the parties to put optimal efforts towards the success of the venture. This was seen in the case analysis, when the parties perceived the initial equity distribution agreement as fair, the satisfaction level of all the parties increased, leading to the reduction in the possibility of double-sided moral hazard and ensuring the success of the venture. Moreover, the analysis shows that information sharing and two-way communication increases trust and improves decision quality. It further focusses on how feedback and proper work distribution results in efficiency of performance for each of the stakeholders, leading to reduced probability of double-sided moral hazards.

1. Venture Caoital Finance-Introduction

A 'start-up' is defined as an activity that involves the discovery, evaluation and exploitation of novel opportunities to introduce new goods and services based on the innovative ideas and knowledge of an entrepreneur, who is pro-active in conceiving the untapped market opportunities [1]. The entrepreneur lacks necessary capital and therefore seeks financial assistance from outsiders such as venture capitalists (VC). The VC provides financial assistance along with certain value-added services such as evaluating business opportunities, technical and managerial assistance, assistance in designing

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growth strategies, and other situation-specific corporate consultancy to leverage the success of the start-up being financed [2]. Financial support by a VC usually passes through different phases such as start-up, expansion and growth stage, and later stage. The VC specialises in minimising the cost of funds by creating a pool of funds mobilised from investors (limited partners) with the aim to invest in start-ups. Branscomb and Auerswald concluded that these start-ups face the challenge of a high rate of failure, resulting in a high level of risk for both the entrepreneur and the VC. The type of risks faced by the entrepreneur and VC include moral hazard, adverse selection and compensation issues [3].

In venture capital finance, there are two aspects, the economic aspect and the behavioural economic aspect. The economic aspect includes issues such as conflict of interest between the entrepreneur and the VC, asymmetric information, moral hazard, and compensation issues for both the parties. The behavioural economic aspect is related to relational factors such as empathy and a feeling of fairness and trust shown by both the parties.

Therefore, while deciding the financer, entrepreneur should consider both relational aspect and value add services of the financier and strike optimal trade off.

2. Review of Literature

The principal-agent theory assumes that self-interested agents work towards maximising their own wealth, which may not be in the best interest of wealth maximisation for the principal. Empirical research by Baker and Gompers suggests that earlier the relationship between the entrepreneur (agent) and the VC (principal) was assumed a pure agency relationship, which made the VC suffer from *single-sided moral hazard* [4]. However, Smith argues it is a relationship between equal parties, as both contribute towards wealth creation and are capable of contributing towards the success of the venture [5]. Therefore, there is the possibility of *double-sided moral hazard* where both parties have an incentive to *shrink*.

According to Richard Fairchild, the issue of double-sided moral hazard might exist at two different stages of the venture's journey to success. First, both the entrepreneur and the financier (VC or angel investor) contribute positively towards the success of the venture and create value for the venture; this might motivate both of them towards bilateral *effort shirking*. Second, at a later stage if the venture is successful, double-sided moral hazard might arise when both are involved in an effort to exert project *expropriation*-stealing the idea of the project[6].

Mehta discusses the issue of *hidden information*; this issue arises when the agent has access to some information that the principal has not observed, and the agent uses the information for business decisions. However, the principal only interprets that the agents used the information in their own best interest and not in the interest of principal. This happens due to lack of information sharing, absence of mutual trust and co-operation and ultimately results in conflict [7]. *Asymmetric information* about the venture influences the subjective assessment by both the parties about the future performance of the venture. The party who is privy to negative information about the future of the venture is most likely to defect by choosing short-term incentives resulting in a loss for the other party [8].

Klausner discusses that conflict of interest arise when an entrepreneur (i) fails to exercise optimal efforts, (ii) neglects opportunities, or (iii) sometimes takes very high-risk or very low-risk decisions, which results in a loss for the venture. This requires the VC to have regular monitoring of entrepreneur's functioning and decisions, resulting in increased '*agency cost*' [9].

De Bettignies and Brander discuss the *level of double-sided moral hazard*, it exists when the entrepreneur is forced to surrender some of the ownership related benefits to have the benefit of managerial inputs from the VC's expertise, thereby generating negative incentive for the entrepreneur in putting whole-hearted efforts for the success of the venture [10]. Smith discussed the bargaining power of the VC has a greater role in leading to *opportunism*-VCs can decide not to provide further funding support under staged financing agreement when the bargaining power of the entrepreneur is diminishing [11]. However, this issue does not arise in the case of a bank finance, since the entrepreneur is not required to give equity rights but instead is required to service the loan [12].

Chang and Hu discuss how behavioural biases in analysing the effect of incentives might affect moral hazard. The VC, being self-interested to maximise their profits, chooses to finance the profitable project of the entrepreneur who is in turn motivated to maximise their utility. Accordingly, an optimal contract should consider providing an appropriate share of profit for the entrepreneur, matching the level of efforts put in; otherwise, this might work as an impediment to a VC's profit maximisation [13].

Aghion and Bolton state that ventures (start-ups) yield both monetary benefits known as profit, which are verifiable, and personal benefits (benefits accruing only to entrepreneur), which are non-verifiable. The magnitude of non-verifiable benefits affects the decisions of an entrepreneur in pursuing the success of the venture, whereas the magnitude of verifiable benefits affects the actions of VC in continuing the relationship in the venture [14].

Behavioural economists consider that certain psychological factors such as feelings of trust, fairness, and

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empathy affect the relationship between the VC and the entrepreneur [15-17]. A shared feeling of fairness affects the commitment of the parties to a given decision, and is the critical success factor influencing the performance of the venture [18-19]. Relational rents can be created by enhancing trust and communication between the VC and the entrepreneur [20]. Thus, the agency problem will be mitigated[21]. Empathy, which is perceived as an important factor for the success of the venture, can boost mutual trust, which is helpful in reducing double-sided moral hazard during the development of the venture. Therefore, empathy results in increased payoff for both the parties [22].

The interaction within the entrepreneurial team members is another important factor affecting the performance of the venture. Nicola Breugst et al. discuss that the equity distribution representing economic reward affects the level of interaction and communication between the members of the entrepreneurial team. Justice in equity distribution is perceived as one of the factors that increases team attraction in creating value for the venture and reduces team repulsion [23]. Team cohesion and intra-team trust enhances team attraction; on the contrary, social distancing and relationship conflict can lead to team repulsion arising out of team's negative thoughts, feeling and behaviour. Research shows that team satisfaction, team decision quality and venture performance has a negative correlation with relationship conflict [24].

The feeling of the dyad is the trigger point for co-operation and mutual trust between entrepreneur and VC, which is necessary for the success of the venture. Shepherd and Zacharakis proposed that the entrepreneur can establish trust with the VC by showing signs of commitment and being fair in their dealings, this can work in the other direction. They also emphasised the importance of open and frequent communication between entrepreneur and VC. They support that frequent and transparent communication between entrepreneur and VC can increase the feeling of fairness and trust thereby helping in weeding out agency problems[25]. Frequent interaction and information sharing promotes co-operation between entrepreneur and VC, which is critical for the success of the venture [26-27].

Study done by Utset explains about perception of fairness, bargaining power and retaliation. Incidence of retaliation by one of the parties is the result of their individual perception about each other's actions. Perceiving the offer to be unfair, the responder may proceed to engage in sabotage. Entrepreneur may engage in retaliation when encountered with an unfair offer under behavioral assumption of reciprocal fairness. If an entrepreneur retaliates against an unfair offer, they gain some utility even though the net monetary returns are negative [28].

To regulate behaviour and ensure the rights and obligations of both the parties, a legal contract is necessary between VC and entrepreneur. The contract is to state the regulations regarding control rights, cash flow rights, liquidation rights and related issues. Contracting and performance of the venture is affected by the legal system, corporate governance and culture Bruton et al. concluded that the performance of a venture is positively correlated with the *strength of the legal system* governing the venture capital financing[29]. Allen and Song found that there is a negative correlation between the venture capital contract and rule of law. Hence the countries with weak '*law and order*' have higher levels of venture capital financing because the level of co-operation and performance of the venture are more dependent on the implicit relationship between VC and entrepreneur than the explicit contract [30].

Venture performance is largely dependent upon the strength of the contract and the *level of governance* induced by the *legal system*. A strong legal system combined with a strong contract leads to a fear of punishment for failure, which thereby increases the entrepreneur's performance in a venture. However, *empathy and co-operation* are jeopardised due to the strong contract. Therefore, due to weak legal systems, there is not much scope for a strong contract; hence, empathy, trust and co-operation can be a substitute for governance. The researcher found that, when the governance and legal system are well developed and combined with low *culture closeness* a tough contract is more desirable. On the other hand, when the governance and legal system are not so developed, and culture closeness is high then a soft contract is optimal.

Most venture financing contracts provide *multi-level measures* to protect the investment of the VC. The initial agreement is relatively tough compared to the subsequent agreement; this is to protect the VC if the entrepreneur has over-stated the business opportunity. The protection requirement for the VC diminishes with the passing of time, as the VC is aware about the business and the outcome of the venture. Smith concluded that to maximise the value of the venture and to avoid the problem of shirking and opportunism the contract should have the provision for adequate incentives for the VC [31].

The existence and execution of an *optimal contract* comprising of pure equity financing is feasible only when total social surplus is greater than threshold limit. Furthermore, they also suggest that within the optimal contract set there is a scale (range) of joint debt-equity financing that addresses the issue of double-sided moral hazard [32]. Moreover, researchers suggest that an optimal venture capital financing contract should include a fixed payment to the VC and residual claim to the entrepreneur. This will

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reduce *agency cost* and conflict resulting due to economic aspects [33]. While discussing optimal financing contracts Hellman suggested two propositions, (i) to ensure increased entrepreneurial efforts, the entrepreneur should be given equity compensation, and (ii) granting the *control rights* to VC if the benefits from replacing the entrepreneur are very high [34].

Kaplan and Stromberg discussed measures of cash flow rights, control rights- liquidation rights. Accordingly, there should be a perfect correlation between these rights and performance of the venture. When the venture is showing continued improved performance, the optimal contract should provide for maintaining VC's cash flow rights and the relinquishing of control rights by VC in favour of entrepreneur. On the contrary, the VC is to be given full control (liquidation rights) of the venture if it shows poor performance [35]. Klausner and Litvak discuss the topic of control rights (the right to hold board seats and the right to veto certain major managerial decisions) and state these rights should be aligned to the incentives accruing to VC and any type of misalignment should be dealt with through financing contract [36].

3. Case Analysis

The success of start-ups financed by VC is dependent upon harmonious relationship, mutual co-operation and trust between the entrepreneur and the VC, but how these factors can be inculcated is a matter of research. In the analysis, it has been shown how mutual trust, sharing of information, and fairness of contracts between all the stakeholders of the venture can help in the success of the venture.

3.1 Background of the Venture

Alphanzo Greens is a start-up financed through venture capital financing. The start-up is in the green energy sector with following objectives:

(1)Promote the use of non-conventional sources of energy,

(2)Provide assistance to rural masses in setting up solar power plant (solar panel) at the roof of their residence/ commercial premises.

The availability of conventional energy is depleting day-by-day, and this source is having certain environmental issues-environment pollution. To overcome the ill effects of using conventional energy sources, awareness among masses is must about non-conventional sources of energy. The use of non-conventional sources of energy is further helpful in reducing the dependence on conventional sources of energy and help the overcoming the shortage of electricity supply. The probability of success of the start-up was very high as it was set up in the desert of Rajasthan, where direct Sun-Light is available for about 9-10 months in a year, therefore setting up of solar power station and solar power panel on the roof of residential/ commercial premises can help in generating enough solar power throughout the year. The start-up has five co-owners (entrepreneurs) and it has been financed jointly by Mr. Vishnu and Ms. Laxmi (henceforth referred as investors) using the pattern of venture capital financing. Apart from providing financial support, the investors have supported the venture by providing certain value-added services.

3.2 Financing Decision Dilemma and Trade-off

At the time of decision making about the source of financing for the start-up, the entrepreneurs were in a state of confusion. One option was to get funding support extended by rural development bank. The second option was investors, who proposed to provide financial support along with certain value-added services, like helping the venture (entrepreneurs) by providing managerial support such as identifying premium location for the venture, construction of the business premises and providing managerial decision support. The entrepreneurs arrived at a trade-off between the commercial services of rural development bank and the value-added services offered by the investors and finally decided to accept the funding proposal of the investors. This was an example of *striking a trade-off between value-added services and commercial aspects*.

3.3 Equity Distribution

At the early stage of financing, to keep both the parties motivated in exerting optimal efforts for the success of the venture, the parties discussed very clearly and honestly the equity distribution – representing economic reward. The equity distribution was properly aligned on the basis of (1) level of efforts put in by each of the parties, (2) time spent by each of the party in managing the business activities of the venture, (3) premium/reward for contributing ideas for the business, and (4) assisting in advancing the business of the venture. All the parties perceived the equity distribution as justified and fair, resulting in satisfaction for all the parties leading to the minimisation of the probability of double-sided moral hazard.

3.4 Legal System and Protection of Stakeholders' Interest through Contracting

The kind of legal system and cultural closeness or familiarity of parties with each other are the pillars of venture financing contracts. Research has propounded that the

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presence of strong legal system combined with low cultural closeness requires a strict contract to safeguard the interest of all the parties. Whereas, when the legal system is not so strong and cultural closeness is high then a less stringent provision in the contract helps in developing the feeling of trust and mutual co-operation. In the country of this venture, the second proposition would have been appropriate but due to lack of familiarity between all the parties the initial contract contained strong provisions to avoid the misuse of the resources and opportunity by either of the parties. However, this initial contract was not effective and created a feeling of mistrust and lack of confidence between the parties, which lead to dissatisfaction. These tough provisions created hurdles in managerial decision-making, leading to poor performance and delays in making decisions. Upon considering these challenges, a meeting of all the parties helped in understanding each other better. To show this greater degree of familiarity, and restore the trust and mutual co-operation, the tough provisions of the contract were relaxed, which helped in developing mutual trust, co-operation and achieving better results for the venture.

3.5 Conflict between the Parties Due to Information Asymmetry and Lack of Feedback System

At a subsequent stage of the venture, two types of conflicts were encountered, (1) among the members of the entrepreneur team, and (2) between the entrepreneur team and the VC. An analysis of the root causes of the conflicts helped in identifying factors such as role ambiguity, lack of clarity of work distribution and poor communication between all the stakeholders were responsible for the conflict. These conflicting situations led to ineffective decision-making, resulting in an adverse impact on the performance of the venture.

By means of repeated discussions and information sharing between the stakeholders, all the parties unanimously agreed for a formal written agreement containing the provisions of work distribution, authority, and responsibility of each of the parties to the venture. This honest effort by all the parties in resolving the conflicts helped in arriving at a proper work distribution to avoid role ambiguity, and the conflicts were resolved resulting in improvement in the performance of the venture.

This experience shows that clear work distribution, a regular feedback mechanism and optimal contract helped in developing mutual trust between the parties and improved decision quality. This meant that now both the entrepreneur and the VC could make more efficient decisions and execute them with more freedom and without any controversy with other members of the venture.

4. Conclusion

Venture capital finance has two theories-economic theory and behavioural theory. The performance of the venture can be enhanced by balancing both of these theories in practice. An equity distribution that represents economic reward is a source of motivation for both the parties to put optimal efforts towards the success of the venture. This was seen in the case analysis, as when the parties perceived the initial equity distribution agreement as fair, the satisfaction level of all the parties increased, leading to the reduction in the possibility of double-sided moral hazard and ensuring the success of the venture.

The analysis further shows that the optimal contract should balance the legal aspects and cultural closeness to establish mutual trust and co-operation, which helps in removing the conflict between parties, increasing satisfaction and enhancing decision making.

Moreover, the analysis shows that information sharing and two-way communication increases trust and improves decision quality. It further focusses on how feedback and proper work distribution results in efficiency of performance for each of the stakeholders, leading to reduced probability of double-sided moral hazards.

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ARTICLE

Impact of Exchange Rate Threshold Level on Stock Market Performance-Evidence from Ghana

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ABSTRACT

The exchange rate plays a significant role in an economy and also the purpose of this study is to examine the impact of exchange rate threshold level on the capital market performance. The study used a Threshold Autoregressive model introduced by [24] and [12]. The study used quarter-time series data for thirty years from 1990 to 2019. The capital market performance was measured by the value of shares traded; market turnover; market capitalization and all-shares index. However, the results unconcealed the subsequently estimated threshold level of exchange rate for every performance indicator: 7.94%; 25.33%; 25.33%, and 7.80% respectively. In all, the threshold level of the exchange rate estimated was 8 and 25 percent. The findings suggest that a low rate is performance-enhancing. Additionally, the exchange rate above the threshold level is harmful to the capital market performance. The findings of this investigation may be helpful to the government of Ghana and policymakers as they decide on an exchange rate target to implement to avoid the prejudicious effects of high exchange rates whereas getting the growth advantages of the low exchange rate. The finding of the study shows that the exchange rate impacts the economy more than inflation however, not many works in the subject area have been done in Sub-Saharan Africa. Therefore, I suggest that more threshold studies ought to be meted out on the exchange rate in the other sectors of the economy to determine its impact on the economy.

1. Introduction

Goods and services are trade among nations. Trading globally creates an opportunity for shoppers to encounter goods and services that are not available in their country or more expensive domestically. For the trading to be effective, the consuming country has to convert its currency into another nation's currency at a charge. This expense is term as an exchange rate. In finance, an exchange rate could also be a rate at that one currency is listed for others. It is additionally viewed, as the estimation of one nation's currency concerning completely different currencies. An exchange rate can likewise mean a price of one currency expressed in terms, of another currency or against a basket of various currencies. An exchange rate can likewise mean a price of one currency expressed in terms, of another currency or against a basket of various currencies. In a very skimming exchange rate system, the unit is set by the powers of demand and provide within the unfamiliar with the trade market.

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High exchange rate affects the economy wherever import of products and services is dominated than the export of products and services, in the sense that each one producing corporations and different businesses that interact business with their foreign counterpart got to carry an outsized sum of the native currency for few foreign currencies in other to do their business. These high expenses, however, apportion to merchandise and services and creating them expensive to afford. The exchange rate is that the money value for credit and foreign currencies. It affects resource allocation, production, levels, price, and gain. Ultimately, fluctuation during this reflects in share value as an indicator of market performance [17]. they have additionally seen real exchange rate depreciation as an element that would additionally result in capital flight thereby depriving the domestic economy of its investable money resource.

According to [5], exchange rate instability has real monetary prices that influence price stability, firm profit, and a nation's steadiness. Exchange rate unpredictability has implications for the financial arrangement of a nation notably the stock market. Yet, an outline of the available literature uncovers disparate views on analysts on the issue of whether or not unacquainted with exchange rate fluctuation impacts stock market unpredictability [9, 21-23] exchange rate volatility consequence is unhealthy for companies as a result of it affects the important output of a country. The share costs of corporations are eventually influenced due to the changes within the current and future money flows of the firm.

1.2 Problem Statement

The Ghanaian economy is not left out with the exchange rate development. However, the aim of this study is to establish the link between Exchange rate and stock market performance and to estimate the extent of exchange rate above it the exchange rate would hinder the performance of the stock exchange. The paper is interested in estimating the threshold level of the exchange rate in order to find out at what level of the exchange rate would be harmful to the stock exchange as a result of most of the listed corporations on the Ghana stock exchange have their business transaction hovering round the globe.

1.3 Objectives of the Study

(1) To analyze the extent to that exchange rate fluctuations, impact the worth of shares listed.

(2) To find out the impact of the exchange rate on the market turnover ratio.

(3) To investigate the impact of exchange rate fluctuation on the capitalization of shares listed.

(4) To analyze the extent to that exchange rate fluctuations impact all-shares index.

1.4 Research Questions

This research work seeks to answer a wide range of questions and therefore the following research questions are going to be thought of during this work.

(1) what is the impact of the exchange rate on the worth of shares listed under the various exchange rate regimes?

(2) Is there a statistically vital threshold level of exchange rate above that exchange is harmful to the turnover ratio?

(3) Is there a statistically significant threshold level of exchange rate above that rate of exchange is harmful to market capitalization?

(4) Is there a statistically non-linear relationship between exchange rate and all-shares index; in other words, is there an intensity of exchange rate above that exchange rate affects all-shares index?

2. Literature Review

Post Keynesian approach assumes that currency prices are determined among the marketplace for money-capital that trade flows do not tend toward balance. It is additional assumed that gain effects are additional very important to decide the present account than price effects. Purchasing power parity theory on the other enunciates the determination of the rate of exchange between two inconvertible paper currencies. though this theory is also traced back to Phillis Wheatley and Ricardo, but the credit for developing it in an exceedingly very systematic means that has gone to the Swedish economic expert Gustav Cassel. This theory states that the equilibrium rate of exchange is set by the equality of the purchasing power of two inconvertible paper currencies. It implies that the rate of exchange between two inconvertible paper currencies is set by the internal price levels among the countries.

However, the balance of payments theory of the rate of exchange maintains that the rate of exchange of the currency of one country with the opposite is set by the factors that are autonomous of the interior price index and finances. It emphasizes that the rate of exchange is influenced, in a very important manner, by the balance of payments position of a country. A deficit within the balance of payments of a country signifies a state of affairs throughout that the demand for exchange (currency) exceeds the availability of it at a given rate of exchange. The demand for a foreign exchange arises from the demand for foreign merchandise and services. the availability of foreign

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exchange, on the contrary, arises from the availability of product and services by the home country to the foreign country.

2.1 Empirical Review

The studies reviewed thus far have indicated that the exchange rate is a major obstacle in promoting economic process, therefore, it is a necessity of policymakers to aim at mitigating the exchange rate to a lower rate. However, the question is what ought to be the target level of exchange? Once more, how low ought to be within the capital market to have a positive impact on economic growth? In other words, if a non-linear relationship exists between exchange rate and growth, then it ought to be possible to estimate the threshold, or exchange rate purpose, at that the sign of the relationship between the two variables would switch. The study concerning the relationship between inflation and economic growth had been looked at into two ways, that is a linear and non-linear model.

However, the first few studies that investigated the possibility of non-linear relationships are [8, 19]. In their studies, they found structural breakpoints. [8], found the existence of a positive relationship between long-term growth and inflation at a low rate of inflation, however at higher rates it becomes negative. Later [8] research, different studies among others [15] found threshold inflation in a developed country is 1-2% and developing country is 11-12%. [16] found 2% in industrializing countries and 17% for non-industrialized countries. [24] found 5.43% in 32 Asian countries. [4] found a 12% threshold of inflation in developing countries.

Then, [3] found 13.48%, 14.48%, 15.37%, and 40% for total gross domestic product, industrial, services, and agriculture sectors respectively; [18] found an inflation threshold of 6.7% for the total sample, 9-11 of the sub-sample of low-income countries and 6.5% for middle-income countries. Moreover, few studies have examined the threshold level and also the relationship between inflation and economic growth in Ghana. These are [10] explored threshold regression models designed to estimate the inflation thresholds rather than imposing them, have obtained 10% for Ghana whereas, [1] explored the conditional least squares technique found 11% for Ghana, lastly [2] using secondary quarter-time series data for thirty-years from 1990 to 2019 on the capital market found inflation threshold level of 3% and 4% for the Ghana Stock Market. Again, completely different thresholds or mixed results in inflation level could have been caused by exploitation of data from the various economic jurisdictions of varying economic trends and conditions. [20, 16] mention that the study of inflation and economic growth ought to be the main target in the country as a result of the economic structure of each country is completely different. Besides, some studies have examined the same country however have obtained totally different results for a different period which seemingly due to the economic structure of the country over time. It has additionally been noted that there is no specific study that has yet been undertaken on the threshold impact of exchange rate on capital market performance. Although, the capital market has been one of the sectors that form an integral part of economic growth. However, the main target of data for this study is on Ghana.

3. Research Methodology

The methodology utilized in this study relies on the threshold autoregressive (TAR) approach introduced by [24, 12]. In this model, the dependent variable is a function of its lag. Within the self-exciting threshold model, the lagged variable is employed as the threshold variable. This model specifies that individual observations can fall into distinct categories based on the value of a determined (threshold) variable. In growth theory, the main sources of growth power lie in the buildup of the factor of production, and therefore the promotion of marginal productivity and total factor productivity. The recent literature has instituted that the relationship between monetary development and economic growth does not follow a single pattern. As an example, [14, 11, 6] have found that inflation affects real variables through its impact on monetary market activities. To look at the effects of the interaction between inflation on capital market performance, the study employed the TAR model proposed by [24, 12]. In the TAR model, the classification of the variable across regimes relies on an estimate of the time series behavior that is consistent with reaching the threshold that separates the regimes. This study applies the Autoregressive model to estimate the threshold level of inflation higher than that inflation could have an effect on capital market performance. The threshold level of inflation relies on the subsequent equation:

$$Y_t = \beta_1^{'} \times_t h\left(qt \geq y\right) + \beta_2^{'} \times_t h\left(y < qt < \mathrm{y}\right) + \varepsilon_t \qquad (1)$$

Equation (1) can be re-written in a general form as:

$$\begin{aligned} \gamma_t &= \beta_1^{'} \times_t h + \varepsilon_t \qquad if\ \ q_t \leqslant \gamma \\ \gamma_t &= \beta_2^{'} \times_t h + \varepsilon_t \qquad if\ \ q_t > \gamma \end{aligned} \qquad (2)$$

Where qt is the threshold parameter that dividing the observation into two regimes (assuming the single threshold model). The regimes are split by differing regression slopes, β_1 and β_2. We now need to know whether or not

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the threshold impact is statistically significant. The null hypothesis of the threshold impact is represented by the linear constraint H_0: = β_1 and β_2. The threshold value is determined by the least square estimation proposed by the author and also the value of the threshold that decreased the total of squares residuals [13]. The likelihood ratio test is employed for the development of a confidence interval. Estimation for slope parameter β_1 and β_2 on the sample split for estimation of.

4 Presentation and Analysis of Results

4.1 Introduction

This section focuses on the empirical estimation, presentation and economic interpretation of the regression results carried out using the methodology highlighted in the previous section.

Table 1. below, shows descriptive statistics of the dependent and explanatory variables that were used in the study for the thirty years from 1990 to 2019. The exchange rate is at 1.69% as compared with other explanatory variables such as inflation rate and interest rate whose rate is at 5.34% and 3.81% respectively. The average exchange rate shows in table 1 below is -0.34%.

4.2 Correlation Matrix

The correlation analysis was performed ascertain the strength and direction of the linear relationship between the two variables. In the results, the correlation between exchange rate and also the total value of shares, market turnover ratio, market capitalization, and all-shares index are 0.899, -0.258, 0.926, and 0.753 respectively, that indicates that there is a moderate positive relationship between inflation and market turnover ratio. The negative relationship between exchange rate and market turnover ratio suggests that as exchange rate decreases, dependent variables of market turnover ratio increase. The result additionally indicates the highest positive relationship between exchange rate and market capitalization, that shows that, because the exchange rate increase, market capitalization decreases.

4.3 Stationarity Tests

The stationarity or unit root test of the data employed in this study was conducted exploring the augmented Dickey-Fuller test and therefore the results are shown below. The study compared the test statistic value with that of test important value at 5% significance and considering p-value and it has been indicated that three variables (MCA, ASI, EXCH, and INT) had unit-roots. This can be as a result of absolutely the values of the ADF test statistic for each of these variables were less than absolutely the variables of the test essential values at 5-hitter. additionally, the p-values appreciate each of the ADF test statistics for these

Table 1. Descriptive statistics

	TVS	MTOR	MCA	ASI	INF	EXCH	INT
Mean	1.737178	-4.680262	6.417439	8.089632	3.925201	-0.340263	3.128361
Median	2.576422	-4.730551	7.878682	8.286252	3.892840	-0.099084	3.135494
Maximum	6.130813	-2.409566	9.730751	10.38559	5.348060	1.698443	3.806663
Minimum	-6.151633	-6.924473	-0.460449	4.850936	3.167161	-3.370668	2.564949
Std. Dev.	2.885501	0.969509	3.071229	1.394657	0.509607	1.395214	0.380704
Observations	117	117	117	117	117	117	117

Table 2. Correlation matrix

	TVS	MTOR	MCA	ASI	INF	EXCH	INT
TVS	1.000000	-0.029737	0.948914	0.811088	-0.370256	0.898864	-0.567774
MTOR	-0.029737	1.000000	-0.343614	-0.148584	0.352415	-0.258186	0.444230
MCA	0.948914	-0.343614	1.000000	0.808943	-0.459114	0.926010	-0.673671
ASI	0.811088	-0.148584	0.808943	1.000000	-0.320895	0.752875	-0.633971
INF	-0.370256	0.352415	-0.459114	-0.320895	1.000000	-0.462616	0.761616
EXCH	0.898864	-0.258186	0.926010	0.752875	-0.462616	1.000000	-0.616376
INT	-0.567774	0.444230	-0.673671	-0.633971	0.761616	-0.616376	1.000000

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variables were bigger than 5% (0.400; 0.428; 0.193 and 0.338), respectively. in this case, the null hypothesis of no unit roots within the data series could not be rejected and therefore accepted. However, the variables with unit root are transformed into initial difference to bring stationarity in these data, thereafter, the changed data were utilized in the regression model in the study.

Table 3. Result of Augmented Dickey- Fuller (ADF) stationarity tests

	ADF Test Statistics	Test Critical Value at 5%	*P - Value
TVS	3.952786	3.449020	0.013
MTOR	7.066288	3.449020	0.000
MCA	2.355441	3.449020	0.400
ASI	2.302945	3.450436	0.428
INF	4.246044	3.449365	0.005
EXCH	2.820507	3.450436	0.193
INT	2.479754	3.449365	0.338

*MacKinnon (1996) one-sided p-values.

Table 4. Result of Augmented Dickey- Fuller (ADF) stationarity tests 1st difference

	ADF Test Statistics	Test Critical Value at 5%	*P - Value
LNMCA	6.610267	3.450436	0.000
LNASI	3.934319	3.450436	0.014
LNEXCH	9.621885	3.450436	0.000
LNINT	6.162574	3.449365	0.000

4.4 Regression Analysis

The study used a Threshold Autoregression model proposed by [22, 12] to estimate the threshold level of inflation at which inflation will be harmful to the capital market performance. To achieve this objective, we continue to test for the threshold effects using annual growth of inflation as the threshold variable. This suggest that, testing the null hypothesis of the linear model against the alternative hypothesis of the two-regime model. Since the threshold parameter is being unidentified test (such as the t-test) have non-standard distribution. [13] proposed a bootstrap method to stimulate the asymptotic distribution of the likelihood ratio test of the null hypothesis.

This study, first of all, estimated the threshold number in the model. Null hypothesis H_0: $\beta_1 = \beta_2$ (No threshold impact) and also the different hypothesis is H1: $\beta_1 \neq \beta_2$ (threshold effect exist). The result reveals one threshold model for all the dependent variables are 7.94%, 25.33%, 25.33% and 7.80 respectively.

4.4.1 Test of Exchange Rate Threshold Impact and Threshold for Total Value of Shares

Table 5. Estimated result of threshold for total value of shares

Null of Hypothesis	*F* – Test	Bootstrap *P* – Value	Estimated Threshold
Null of no threshold	18.547	0.002	7.94%
Null of one threshold	80.523	0.000	

4.4.2 Test of Exchange Rate Threshold Impact and Threshold for Market Turnover

Table 6. Estimated result of threshold for market turnover ratio

Null of Hypothesis	*F* – Test	Bootstrap *P* – Value	Estimated Threshold
Null of no threshold	12.553	0.038	25.33%
Null of one threshold	17.848	0.000	

4.4.3 Test Result of Exchange Rate Threshold Impact and Threshold for Market Capitalization

Table 7. Estimated result of threshold for market capitalization

Null of Hypothesis	*F* – Test	Bootstrap *P* – Value	Estimated Threshold
Null of no threshold	19.303	0.000	25.33%
Null of one threshold	127.249	0.000	

4.4.4 Test Result of Exchange Rate Threshold Impact and Threshold for All-Shares Index

Table 8. Estimated result of threshold for all-shares index

Null of Hypothesis	*F* – Test	Bootstrap *P* – Value	Estimated Threshold
Null of no threshold	10.732	0.127	7.80%
Null of one threshold	45.045	0.000	

4.4.5 Estimated Results of Threshold Impact of Exchange Rate on Capital Market Performance

Table 9 below shows the estimated results of exchange rate impact on capital market performance and performance has been measured with four variables that are: the value of share traded; market turnover ratio; market capitalization and all-shares index. In table 9, the first column shows the results of the impact of the exchange rate on

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the value of shares traded. The result is divided into two exchange rate regimes that are low and high denoted by β_1 and β_2. In regime, one where the exchange rate is 7.94%, the coefficient value of (1.271) which is over the threshold value indicating a positive significant relationship between exchange rate and the total value of shares traded. That one percent increase in the exchange rate would lead to a reduction in the value of the total shares traded by 127.1 per cent. In regime 2 of the first column, where the exchange rate is > 7.94% the coefficient value (2.014) shows a positive relationship between exchange rate and the total value of shares traded which a percentage increase in the exchange rate would result in a reduction in the value of shares traded. However, the result of the exchange rate on the value of shares traded is statistically significant in each regime. This means that the exchange rate is detrimental to the value of shares traded in both regimes.

The second column of table 9 shows the result of the impact of exchange rate on market turnover ratio. In the table, where the exchange rate is 25.33% the coefficient value (-0.392) shows the negative relationship between exchange rate and market turnover ratio and that a percentage decrease would result in an increase in the market turnover ratio by 39.2 percent. The result in the regime two also indicates that, where the exchange rate is 25.33% the coefficient value (0.166) indicating a positive relationship between exchange rate and market turnover ratio, this suggests that a percentage increase in the exchange rate would lead to a decrease in the market turnover ratio. The impact of the exchange rate in one regime is negative and statistically significant, but statistically insignificant in regime two. The estimated result in the third column of table 9 indicates that where the exchange is 25.33 the coefficient value (2.236) shows a strong positive relationship between exchange rate and market capitalization and that a one per cent increase in the exchange rate would result in a reduction in market capitalization by 223.6 per cent. Where exchange rate is 25.33% the coefficient value (1.766) also shows the positive relationship between inflation and market capitalization and that a one per cent increase in the exchange rate would result in a reduction in market capitalization of 176.6 percent. The result of the impact of exchange rate on market capitalization in both regimes, one and two is positive and statistically significant in both inflation regimes.

Lastly, the fourth column of the Table 9 shows that, in regime one, where exchange rate is 7.80% the coefficient value (0.196) indicates the positive relationship between exchange rate and all-shares index and that a percentage increase in the exchange rate would result in a reduction in the all-shares index by 19.6 per cent. It has also been revealed in the regime two that where the exchange rate is 7.80% the coefficient value of (0.719) shows the positive relationship between exchange rate and all-shares index that one per cent rises in the exchange rate would result in a reduction in the all-shares index by 71.9 percent. However, the impact of on all-shares index is statistically significant in high exchange rate regime that is (if qt 7.80). This implies that the exchange rate is harmful to all-shares index when it rises above the estimate threshold level.

Table 9. Impact of exchange rate on capital market performance

Effect of Inflation on Capital Market Performance	Value Traded	Turnover Ratio	Market Capitalization	All-Share Index
β'_1	1.271 (0.204)***	-0.392 (0.115)***	2.236 (0.120)***	0.196 (0.125)***
β'_2	2.014 (0.122)***	0.166 (0.215)	1.766 (0.226)***	0.719 (0.074)***

Notes: Estimation period is 1990Q4 to 2019Q4. Threshold variable is the growth rate of EXCH&. "***" levels of significance. Values in parentheses are t values.

4.4.6 The Result of Explanatory Variable and Capital Market Performance

In table 10 below, the estimated result revealed a positive significant effect of inflation on the market turnover ratio, all-shares index, and a negative significant effect of inflation on the market capitalization in the regime one of the models. The coefficient value (2.206;1.096 and -1.537). In regime two, the result also indicates a statistically significant positive effect inflation on the value of shares traded, market capitalization and a negative significant effect of on all-share index with the coefficient value (1.079; 1.891; and -651). The result shows a strong positive effect of inflation rate on capital market performance measures in both regimes suggesting that the inflation rate can equally harm the capital market performance.

The result also shows that the interest rate has a negative effect on the value of market turnover ratio and all-shares index in the regime, one with the coefficient value (-1.110 and -2.594). In regime two, the result indicated the positive effect of interest rate on market turnover ratio and a negative impact on market capitalization and all-share index with the coefficient value (3.499, -1.025 and -3.759) these results are statistically significant.

Table 10. Effect of explanatory variable on capital market performance

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Effect of Control Variables	Value Traded	Turnover Ratio	Market Capitalization	All-Share Index
Constant	20.374 (2.487)***	-8.595 (0.626)***	24.052 (1.853)***	15.017 (1.528)***
	11.459 (2.275)***	-17.467 (3.874)***	27.318 (4.071)***	9.109 (1.385)***
lnfl	-0.855 (0.518)	2.206 (0.298)***	-1.537 (0.313)***	1.096 (0.402)***
	1.079 (0.324)***	-0.651 (0.626)	1.891 (0.658)***	-0.651 (0.186)***
lnint	-0.512 (0.668)	-1.110 (0.492)***	-0.201 (0.517)	-2.594 (0.448)***
	-0.434 (0.664)	3.499 (1.181)***	-3.759 (1.241)***	-1.025 (0.398)***
R- Square	0.839	0.536	0.892	0.748
Number of Observation	50 66	89 27	89 27	49 67

Notes: Estimation period is 1990Q4 to 2019Q4. Threshold variable is the growth rate of EXCH &. "***" levels of significance. Values in parentheses are t values.

5. Conclusions

In this empirical work, the study examined the impact of exchange rate on capital market performance by considering a threshold level of the exchange rate. The study used a threshold autoregression (TAR) approach proposed by [24] and [12] to ascertain the threshold impact of exchange rate on capital market performance. The study covered the period of thirty-years from 1990-2019. so as to estimate the threshold level, the study used a growth rate of the exchange rate as a threshold variable in the model. The study estimates the threshold level of exchange rate for performance indicators from 8% to 25th that's 8% for the value of shares traded and all-shares index and 25th for turnover ratio and market capitalization. The findings of this study show that there is one exchange rate threshold value. The result indicates that the exchange rate is completely significant in both low and high exchange rate regimes for all the dependent variables, except that of the market turnover ratio that encompasses a negative significant relationship with the exchange rate in regime one and positive in regime two but not significant. The estimated results confirm the exchange rate situation in the Ghanaian economy. The empirical result further suggests that when the threshold level of the exchange rate is above 8 to 25th, the exchange rate is harmful to capital market performance. Also, capital market performance is often enhanced only when the exchange rate is below the threshold level estimated.

In conclusion, the investment into the capital market would only be improved when the exchange rate is kept at a low or moderate rate. The empirical result in this study indicates that the exchange rate threshold so exists in the relationship between the exchange rate and capital market performance. However, the policy implication derived from this study is that governments and policy-makers ought to develop and implement microeconomic and macroeconomic policies which will enhance the performance of the capital market to stimulate economic growth in Ghana and developing countries. The findings of this investigation might be useful to the government of Ghana and policymakers as they decide on an exchange rate target to adopt to avoid the harmful effects of a high exchange rates while reaping the growth benefits of the low exchange rate.

It has indicated that the exchange rate impacts the economy more than inflation in Sub Saharan Africa however, not many works in the discipline in Sub Saharan Africa. Therefore, I like to recommend that additional threshold studies have to be meted out on the exchange rate in the other sectors of the economy to establish its impact on the economy.

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