УДК: 338.242:311(575.1)

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STATISTICAL EVALUATION OF ENTREPRENEURIAL EFFICIENCY AND INSTITUTIONAL CHALLENGES IN SMALL AND MEDIUM BUSINESS DEVELOPMENT

Abstract. This study investigates the economic and institutional factors affecting business efficiency among small and medium business and private entrepreneurship entities in Bukhara region. The research aims to evaluate the influence of managerial, demographic and institutional variables on entrepreneurial performance using statistical and econometric approaches. The study is based on survey data collected from 1001 entrepreneurs operating in different sectors of the regional economy. Descriptive statistics, Karl Pearson pairwise correlation analysis and Ordinary Least Squares (OLS) regression models were applied to analyze the relationships between business efficiency and explanatory variables. The empirical findings indicate that establishment year, manager age and education level have positive and statistically significant effects on business efficiency. In contrast, institutional problems such as corruption, nepotism, unstable decisions and lack of trust in government institutions negatively affect entrepreneurial performance. The results demonstrate that institutional quality and human capital are important determinants of sustainable business development. The study contributes to regional entrepreneurship literature by providing econometric evidence from Bukhara region and offers scientific recommendations for improving institutional reforms, entrepreneurial education and business competitiveness.

Keywords. Small and medium business, private entrepreneurship, business efficiency, econometric analysis, institutional problems, Bukhara region.

1. Introduction

Small and medium business and private entrepreneurship play a crucial role in ensuring sustainable economic growth, increasing employment opportunities and strengthening regional competitiveness in modern economies. In many developing countries, including Uzbekistan, small and medium businesses serve as one of the main drivers of economic diversification, innovation and income generation. In recent years, the government of Uzbekistan has implemented a number of reforms aimed at improving the entrepreneurial environment, reducing administrative

barriers and expanding financial support mechanisms for business entities. Despite these reforms, many entrepreneurs still face institutional, financial and managerial challenges that negatively affect business efficiency and long-term sustainability. Therefore, identifying the main determinants influencing business performance has become an important scientific and practical issue in regional economic research.

Bukhara region represents one of the strategically important economic territories of Uzbekistan, where small and medium business and private entrepreneurship significantly contribute to regional gross domestic product, employment and service sector development. However, the effectiveness of entrepreneurial activities in the region is influenced by multiple factors, including managerial experience, education level, institutional quality, access to financing and labor resources. Institutional problems such as bureaucracy, corruption, unstable decisions and lack of trust in government institutions may reduce business confidence and limit entrepreneurial development. At the same time, human capital factors, particularly managerial age, educational background and business experience, may positively affect business efficiency by improving strategic decision-making and resource management capabilities. Consequently, analyzing these factors using empirical and econometric approaches is essential for understanding entrepreneurial dynamics within the regional economy.

This study aims to evaluate the economic and institutional factors affecting business efficiency among small and medium business entities in Bukhara region using statistical and econometric methods. The research is based on survey data collected from 1001 entrepreneurs operating in different sectors of the economy. Descriptive statistics, Pearson correlation analysis and Ordinary Least Squares (OLS) regression models are employed to examine the relationships between business efficiency and explanatory variables. The study contributes to the existing literature by providing empirical evidence on the interaction between managerial characteristics and institutional barriers in the context of regional entrepreneurship development. Furthermore, the findings of the research may serve as an important scientific basis for developing effective business support policies, institutional reforms and innovation-oriented entrepreneurial strategies in Uzbekistan.

2. Literature review

Joseph Schumpeter emphasized that entrepreneurship and innovation are the main driving forces of economic development. According to Schumpeter, small and medium businesses contribute to economic growth through technological innovation, market competition and resource reallocation [1]. His theory suggests that innovative entrepreneurs increase productivity and improve business efficiency within regional economies.

Peter Drucker argued that entrepreneurship is closely linked with innovation and managerial capability. Drucker explained that educated and strategically

oriented entrepreneurs are more likely to achieve sustainable business performance and organizational efficiency [2]. This perspective supports the importance of managerial education in small and medium business development.

Michael Porter highlighted that competitive advantage depends on institutional quality, cluster development and innovation capacity [3]. Porter's theory indicates that business competitiveness improves when enterprises operate within supportive economic and institutional environments.

Douglass North focused on the role of institutions in economic development. He argued that weak governance systems, corruption and unstable regulations negatively affect entrepreneurial growth and business sustainability [4]. This theoretical approach directly explains the negative effects of institutional problems identified in the study.

Hernando de Soto emphasized the importance of formal institutions and property rights in supporting small and medium business development [5]. He argued that excessive bureaucracy and weak institutional trust reduce entrepreneurial motivation and investment activity.

Muhammad Yunus demonstrated that access to financing and microcredit significantly improves entrepreneurial opportunities and business performance among small enterprises [6]. His findings support the importance of financial accessibility for business sustainability.

Robert Kaplan and David Norton developed the Balanced Scorecard framework, emphasizing that business efficiency should be evaluated using both financial and non-financial indicators [7]. Their approach contributes to multidimensional business performance assessment.

Philip Kotler explained that modern business competitiveness increasingly depends on customer orientation, innovation and digital marketing strategies [8]. He argued that enterprises capable of adapting to changing market demands achieve higher efficiency and sustainability.

Thomas Davenport highlighted the importance of business analytics and data-driven decision-making in improving organizational efficiency [9]. His studies demonstrate that firms using analytical technologies and data science tools gain stronger strategic advantages.

Erik Brynjolfsson and Andrew McAfee argued that digital transformation, artificial intelligence and automation significantly improve business productivity and operational performance [10]. Their research suggests that technology adoption has become an important determinant of modern entrepreneurial competitiveness.

3. Methods

This study employs a quantitative research approach to examine the determinants of financial stability in agro-clusters, using long-term assets as the

dependent variable. The analysis is conducted based on cross-sectional data and applies the Ordinary Least Squares (OLS) regression model to estimate the relationships between long-term assets and key explanatory variables, including workers, depreciation coefficient, validity coefficient, and current assets. Prior to regression, Karl Pearson pairwise correlation analysis is used to assess the strength and direction of relationships among variables. To ensure model reliability and validity, several diagnostic tests are performed, including histogram analysis for normality of residuals and the Breusch–Pagan / Cook–Weisberg test for heteroskedasticity. Additionally, a reliability test using Cronbach's alpha is conducted to confirm the internal consistency of the selected indicators. All statistical analyses are carried out using Stata software.

4. Results

The descriptive statistics results provide an overview of the main demographic, institutional and business-related characteristics of small and medium business entities included in the study. The average business efficiency score is 71.155, with a relatively high standard deviation of 19.877, indicating noticeable differences in performance among enterprises. The minimum value of 5 and maximum value of 100 show that some businesses operate with very low efficiency while others achieve extremely high performance. The average establishment year variable is 5.993 years, suggesting that most enterprises are relatively young businesses. However, the maximum value of 50 years indicates that several firms have long-term market experience. The average manager age is 37.054 years, implying that most business owners belong to the economically active and productive age group. Education level has an average of 13.293 years, demonstrating that many entrepreneurs possess secondary specialized or higher education qualifications. Meanwhile, the average number of workers is 8.855 employees, confirming that the majority of firms operate as small-scale enterprises.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Business eficiency	1001	71.155	19.877	5	100
Establishment year	1000	5.993	4.48	1	50
Manager age	1001	37.054	8.952	15	71
Education level	1001	13.293	2.38	10	30
Number of workers	1001	8.855	10.851	0	200
Gender	.	.	.	.	.
Female	1001	.368	.482	0	1
Male	1001	.632	.482	0	1
Institutional Problem	.	.	.	.	.
Bureaucracy	1001	.213	.409	0	1
Corruption	1001	.12	.325	0	1
Lack of trust in goverment	1001	.277	.448	0	1

Nepotism	1001	.251	.434	0	1
Unstable decisions	1001	.14	.347	0	1

The gender distribution shows that male entrepreneurs constitute 63.2% of respondents, while female entrepreneurs account for 36.8%, indicating that business activity remains relatively male-dominated. Institutional problems also represent important factors affecting entrepreneurial performance. Among these issues, lack of trust in government institutions has the highest proportion (27.7%), followed by nepotism (25.1%) and bureaucracy (21.3%). Unstable decisions account for 14.0% of respondents, while corruption represents 12.0%. These findings suggest that institutional and governance-related barriers continue to create challenges for small and medium business development and business efficiency. In particular, bureaucracy, weak institutional trust and informal relationship-based practices may negatively affect business sustainability, investment confidence and entrepreneurial growth in the region.

Table 2. Tabulation of Institutional_Problem

	Freq.	Percent	Cum.
Bureaucracy	213	21.28	21.28
Corruption	120	11.99	33.27
Lack of trust in government institutions	277	27.67	60.94
Nepotism	251	25.07	86.01
Unstable decisions	140	13.99	100.00
Total	1001	100.00	

The tabulation results indicate that institutional problems remain one of the major barriers affecting business activities and entrepreneurial efficiency. Among the identified issues, lack of trust in government institutions represents the highest proportion, accounting for 27.67% of respondents, suggesting that institutional confidence and governance quality remain significant concerns for entrepreneurs. Nepotism is the second most frequently reported problem with 25.07%, indicating that informal relationships and favoritism may negatively affect fair competition and business opportunities. Bureaucracy accounts for 21.28%, demonstrating that excessive administrative procedures and documentation continue to create operational difficulties for business entities. Unstable decisions represent 13.99% of responses, implying that inconsistent policies and regulatory uncertainty reduce business predictability and investment confidence. Corruption has the lowest proportion at 11.99%; however, it still remains an important institutional challenge influencing entrepreneurial sustainability and economic performance.

The sequence plot indicates an overall increasing trend, suggesting growth in asset values over observations, while the first-difference plot highlights fluctuations and potential volatility between consecutive periods. The residual versus fitted plot shows no strong systematic pattern, implying that the model fit is reasonably appropriate, although some dispersion exists. The histogram and boxplot reveal a right-skewed distribution with possible outliers, indicating that a few observations have significantly higher asset values. Additionally, the normal quantile plot suggests partial deviation from normality, especially in the tails.

The graph illustrates the relationship between manager age and business efficiency rank across female, male and total entrepreneur groups. The fitted regression lines indicate a generally positive relationship between manager age and business efficiency, suggesting that older and more experienced managers tend to achieve higher business performance levels. This positive trend appears slightly stronger among female entrepreneurs, where business efficiency increases more noticeably with age. Male entrepreneurs also demonstrate a positive association, although the slope is relatively moderate. The total sample confirms the overall upward tendency between managerial age and business efficiency. At the same time, the wide dispersion of observations indicates that age alone does not fully determine business success, and other factors such as education, experience, institutional environment and financial resources also influence entrepreneurial performance. (Figure 1).

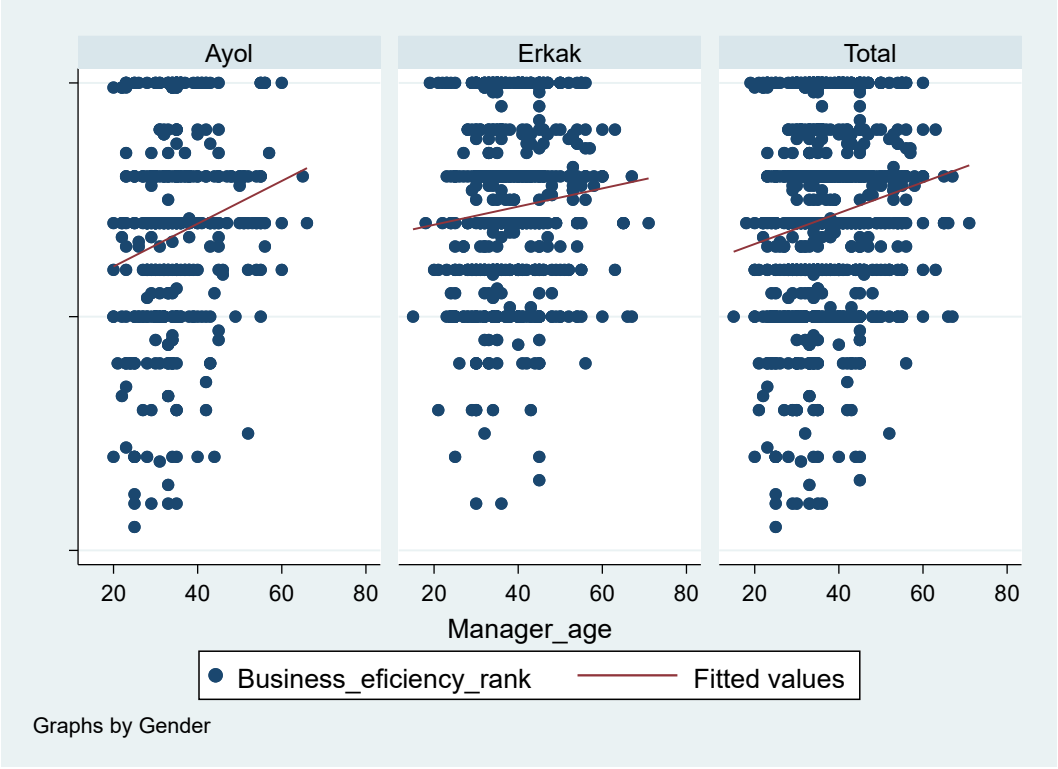

Figure 1. Relationship between manager age and business efficiency by gender

The figure presents the relationship between manager age and business efficiency rank under different institutional problems, including bureaucracy, corruption, lack of trust in government institutions, nepotism and unstable decisions. The fitted regression lines show that business efficiency generally tends to increase with manager age, indicating that older and more experienced managers are relatively more capable of coping with institutional barriers. The strongest positive relationships are observed in the categories of lack of trust in government institutions and nepotism, where business efficiency rises more noticeably with managerial age. In contrast, the relationship appears weaker under bureaucracy and unstable decisions, suggesting that these institutional issues may limit the positive contribution of managerial experience to business performance. The total graph confirms an overall positive association between age and business efficiency despite the presence of institutional constraints. However, the wide dispersion of observations indicates that institutional problems continue to create uncertainty and variability in entrepreneurial outcomes (Figure 2).

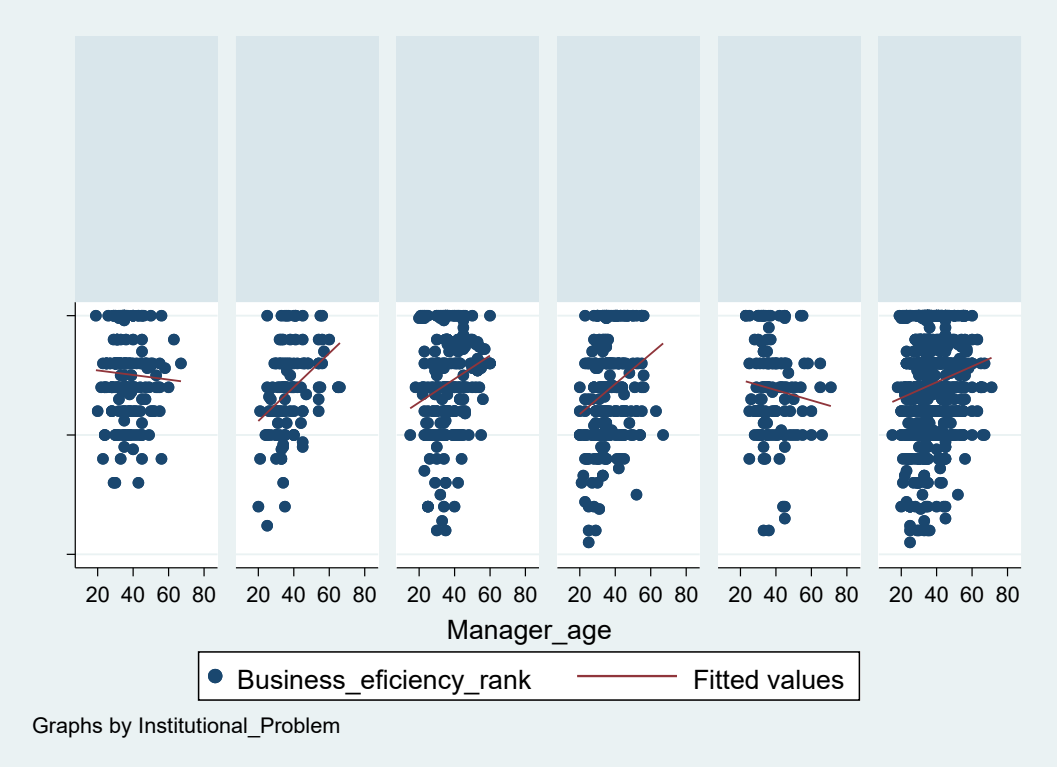

Figure 2. Relationship between manager age and business efficiency across institutional problems

The boxplot figure illustrates the distribution of business efficiency ranks across different institutional problems and strategic business dimensions, including diversification, competitiveness, industrial modernization and supply chain management (SCM), separated by gender groups. The results demonstrate that both

female and male entrepreneurs generally achieve medium to high business efficiency levels, as most observations are concentrated between 60 and 90 points. In the diversification dimension, business efficiency appears relatively stable despite institutional barriers such as bureaucracy, corruption and unstable decisions. However, wider box ranges and several outliers indicate that institutional problems create uneven business outcomes among entrepreneurs. Female entrepreneurs show slightly more stable distributions in several categories, while male entrepreneurs exhibit greater variability in efficiency levels under corruption and nepotism-related conditions.

The competitiveness, industrial modernization and SCM dimensions reveal that institutional barriers continue to influence entrepreneurial performance differently across gender groups. In particular, lack of trust in government institutions and unstable decisions are associated with broader distributions and lower minimum values, indicating increased uncertainty in business activities. Industrial modernization demonstrates relatively higher median efficiency levels, suggesting that businesses implementing modernization strategies may better withstand institutional constraints. Similarly, SCM-related activities maintain comparatively strong efficiency performance despite institutional challenges. The presence of extreme observations in several categories also indicates that some entrepreneurs are highly successful even under difficult institutional environments, likely due to stronger managerial skills, innovation adoption or better financial resources (Figure 3).

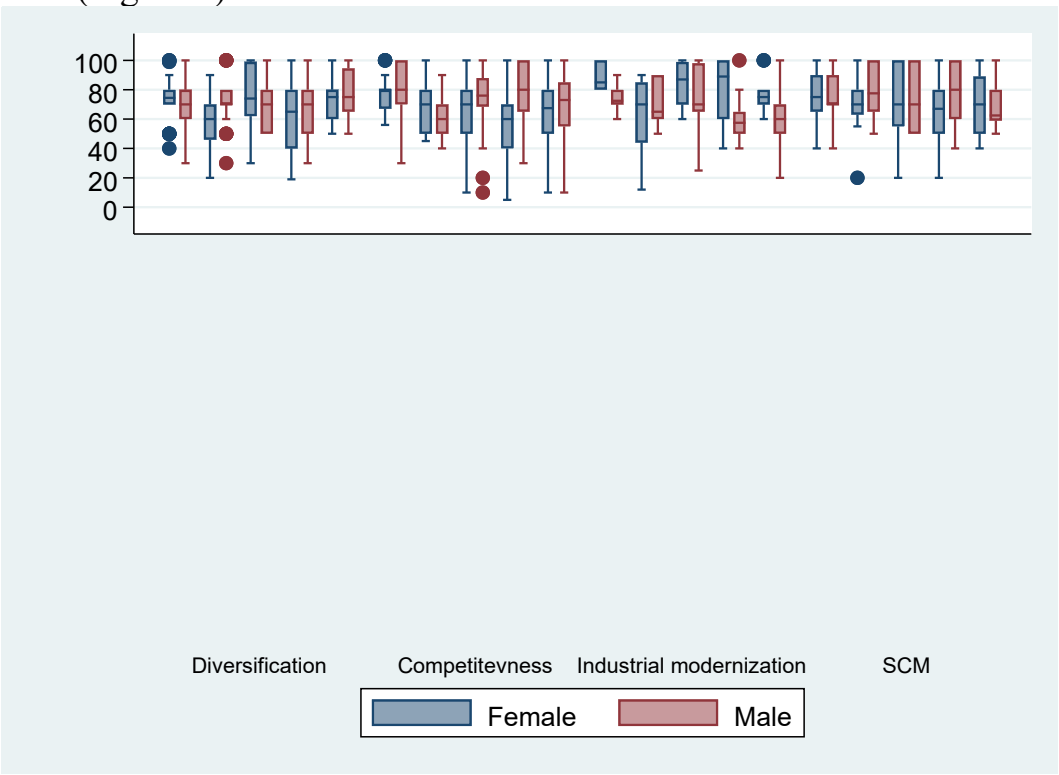

Figure 3. Business efficiency distribution across institutional problems and strategic business dimensions by gender

The Karl Pearson pairwise correlation matrix results demonstrate the existence of several statistically significant relationships between business efficiency and the selected explanatory variables. Business efficiency shows a positive and significant correlation with establishment year ($r = 0.124$, $p < 0.01$), indicating that firms with longer operational experience tend to achieve better business performance. Similarly, manager age has a positive correlation with business efficiency ($r = 0.149$, $p < 0.01$), suggesting that older and more experienced managers are more capable of improving enterprise efficiency. Education level also reveals a positive and statistically significant relationship with business efficiency ($r = 0.104$, $p < 0.01$), confirming the importance of human capital and managerial knowledge in entrepreneurial success. Gender demonstrates a positive association with business efficiency ($r = 0.133$, $p < 0.01$), implying that gender-related managerial characteristics may influence entrepreneurial outcomes. In contrast, institutional problems have a negative and significant correlation with business efficiency ($r = -0.098$, $p < 0.01$), indicating that institutional barriers reduce business performance and entrepreneurial sustainability.

The correlation matrix also reveals important relationships among the explanatory variables themselves. Establishment year is positively associated with manager age ($r = 0.400$, $p < 0.01$), showing that older managers are more likely to operate long-established businesses. Number of workers has positive correlations with establishment year ($r = 0.227$, $p < 0.01$), manager age ($r = 0.110$, $p < 0.01$) and education level ($r = 0.109$, $p < 0.01$), indicating that larger firms are generally managed by more experienced and educated entrepreneurs. Gender also exhibits positive relationships with establishment year and manager age, suggesting structural demographic differences among business owners. However, most correlations among independent variables remain relatively low, implying the absence of serious multicollinearity problems within the model.

Table 1. Karl Pearson pairwise correlations matrix test

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Business_eficiency	1.000						
(2) Establishment_year	0.124*	1.000					
	(0.000)						
(3) Manager_age	0.149*	0.400*	1.000				
	(0.000)	(0.000)					
(4) Number_of_workers		0.227*	0.110*	1.000			
	(0.671)	(0.000)	(0.001)				
(5) Education_level	0.104*			0.109*	1.000		
	(0.001)	(0.118)	(0.523)	(0.001)			
(6) Gender	0.133*	0.194*	0.155*			1.000	
	(0.000)	(0.000)	(0.000)	(0.068)	(0.897)		

(7) Institutional_problem	-0.098*						1.000
	(0.002)	(0.224)	(0.352)	(0.334)	(0.150)	(0.090)	

*** p<0.01, ** p<0.05, * p<0.1

The first-stage OLS regression results demonstrate a very strong overall model fit, with an R-squared value of 0.988, indicating that approximately 98.8% of the variation in long-term assets is explained by the included independent variables. The model is statistically significant (Prob > F = 0.000), confirming that the explanatory variables jointly have a meaningful impact on long-term assets. This suggests that the selected financial and operational indicators are highly relevant in explaining asset formation within agro-clusters.

Table 2. First stage OLS regression model

Equation	**Obs**	**Parms**	**RMSE**		**R-sq**	**F**	**P>F**
Business efficiency	1,000	9	19.41455		0.0535	7.000219	0.0000
Variables	Coefficient	Std. Error	t	P>|t|	95% Lower	95% Upper	Sig
Establishment year	0.348	0.154	2.260	0.024	0.046	0.649	**
Manager age	0.277	0.075	3.680	0.000	0.129	0.424	***
Education level	0.790	0.262	3.020	0.003	0.277	1.304	***
Number of workers	-0.068	0.059	-1.150	0.250	-0.183	0.048	
Corruption	-6.770	2.232	-3.030	0.002	-11.150	-2.390	***
Lack of trust in government	-4.093	1.774	-2.310	0.021	-7.575	-0.612	**
Nepotism	-5.766	1.824	-3.160	0.002	-9.345	-2.188	***
Unstable decisions	-7.174	2.120	-3.380	0.001	-11.335	-3.013	***
Constant	53.327	4.485	11.890	0.000	44.527	62.128	***

Business_efficiency=53.327+0.348(Establishment year)+0.277(Manager age)+0.790(Education level)−0.068(Number of workers)−6.770(Corruption)−4.093(Lack of trust in government institutions)−5.766(Nepotism)−7.174(Unstable decisions)+ε

The first-stage OLS regression results demonstrate that several demographic and institutional variables significantly influence business efficiency among small and medium business entities. The overall model is statistically significant, as indicated by the F-statistic value of 7.000219 with a probability value of 0.0000. The R-squared value of 0.0535 implies that approximately 5.35% of the variation in business efficiency is explained by the independent variables included in the model. Although the explanatory power is relatively modest, the regression model still provides important evidence regarding the determinants of entrepreneurial performance. The RMSE value of 19.41455 suggests moderate variation between predicted and observed business efficiency scores.

Among the demographic and managerial variables, establishment year has a positive and statistically significant coefficient (β = 0.348, p = 0.024). This indicates that businesses operating for a longer period tend to achieve higher efficiency levels due to accumulated experience, market adaptation and stronger managerial capacity. Manager age also has a positive and highly significant impact on business efficiency (β = 0.277, p = 0.000), implying that older and more experienced managers are better able to organize resources and make strategic business decisions. Similarly, education level demonstrates a positive and statistically significant relationship with business efficiency (β = 0.790, p = 0.003). This finding confirms the importance of human capital and managerial knowledge in improving entrepreneurial performance and competitiveness.

The number of workers shows a negative coefficient (β = -0.068), although the result is statistically insignificant (p = 0.250). This suggests that increasing the workforce size does not necessarily improve business efficiency and may even create additional operational or management costs. Institutional problems reveal strong negative effects on business efficiency. Corruption has a statistically significant negative impact (β = -6.770, p = 0.002), indicating that corruption reduces business performance by increasing uncertainty, transaction costs and unfair competition. Likewise, lack of trust in government institutions negatively affects business efficiency (β = -4.093, p = 0.021), suggesting that weak institutional confidence discourages investment and entrepreneurial sustainability. Nepotism also demonstrates a strong negative relationship with business efficiency (β = -5.766, p = 0.002), implying that favoritism and informal relationship-based systems undermine fair market competition and managerial effectiveness.

5. Discussion

The findings of this study highlight the important role of managerial and human capital factors in improving business efficiency among small and medium business entities. The positive effects of establishment year, manager age and education level indicate that entrepreneurial experience and knowledge significantly contribute to better business performance. These results are consistent with the theories of human capital and entrepreneurial management, which emphasize that educated and experienced managers are more capable of adapting to market changes, organizing resources efficiently and making strategic decisions. In particular, the strong influence of education level confirms that modern entrepreneurial success increasingly depends on managerial competencies, analytical skills and the ability to apply innovative business practices. Therefore, investment in entrepreneurial education and professional development can play a crucial role in enhancing small and medium business sustainability and competitiveness.

The study also demonstrates that institutional quality remains one of the key determinants of business efficiency. Variables such as corruption, nepotism, unstable decisions and lack of trust in government institutions all show statistically significant negative effects on entrepreneurial performance. Among them, unstable decisions have the strongest negative impact, indicating that inconsistent policies and regulatory uncertainty create serious obstacles for long-term business planning and investment activities. Similarly, corruption and nepotism reduce fair competition, increase transaction costs and weaken market confidence. These findings support institutional economic theories suggesting that weak governance structures and ineffective institutions negatively affect private sector development. Consequently, strengthening transparency, improving policy consistency and enhancing institutional trust are essential for creating a more favorable entrepreneurial environment.

Another important implication of the research is that business efficiency is influenced not only by internal managerial factors but also by the broader economic and institutional ecosystem. Although the explanatory power of the regression model is moderate, the results reveal meaningful relationships between institutional barriers and entrepreneurial outcomes. This suggests that small and medium business development policies should adopt a multidimensional approach combining human capital development, institutional reforms and business support mechanisms.

6. Conclusion

In conclusion, the study confirms that business efficiency among small and medium business entities is significantly influenced by managerial, educational and institutional factors. The empirical findings reveal that establishment experience, manager age and education level positively contribute to entrepreneurial performance, while institutional problems such as corruption, nepotism, unstable decisions and lack of trust in government institutions negatively affect business efficiency. These results indicate that sustainable small and medium business development requires not only strong managerial competencies and human capital formation but also an effective institutional environment characterized by transparency, policy stability and fair competition. Therefore, improving entrepreneurial education, strengthening institutional reforms, reducing bureaucratic barriers and promoting innovation-oriented business policies are essential for enhancing the competitiveness and long-term sustainability of small and medium businesses in the regional economy.

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