

STATISTICAL METHODS FOR EFFECTIVE DECISION MAKING IN BUSINESS

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Abstract

The present study aims to examine the application of statistical methodologies in facilitating efficient decision-making processes within a specific subset of businesses, namely small and medium-sized enterprises (SMEs) located in Erbil, Iraq. The objective of this study is to investigate the utilization and consequences of statistical methodologies on decision-making procedures within small and medium-sized enterprises (SMEs). The research methodology utilized a quantitative approach by employing surveys and questionnaires to collect data from a sample of 289 employees working in various small and medium-sized enterprises (SMEs) located in Erbil. The collected data underwent various statistical analyses, such as descriptive analysis, validity analysis, factor analysis, reliability analysis, correlation analysis, and regression analysis. The significance of statistical methods in decision-making within small and medium-sized enterprises (SMEs) is underscored in the literature review. It emphasizes the pivotal role of these methods in various domains, including but not limited to forecasting, quality control, risk assessment, and performance evaluation. The analysis results demonstrate notable correlations between the utilization of statistical techniques and the outcomes of decision-making processes within the chosen small and medium-sized enterprises (SMEs). The findings suggest that the utilization of statistical techniques has a beneficial impact on the decision-making processes within small and medium-sized enterprises (SMEs) located in Erbil, Iraq. The results underscore the significance of possessing statistical literacy, allocating resources towards data management systems, and fostering a culture that prioritizes data-driven decision-making within small and medium-sized enterprises (SMEs). This study makes a valuable contribution to the expanding field of research on statistical methods in the decision-making processes of small and medium-sized enterprises (SMEs). Additionally, it offers recommendations aimed at improving the application of statistical techniques within the context of SMEs. In general, this study provides significant contributions that can aid small and medium-sized enterprises (SMEs) in Erbil and comparable settings in improving their decision-making procedures and attaining sustainable growth.

Keywords: Statistical Methods, Decision Making, Small and Medium-Sized Enterprises (SMEs), Erbil, Iraq

INTRODUCTION

The ability to make sound decisions is absolutely necessary for the prosperity and continued existence of small and medium-sized businesses (SMEs) in today's business environment, which is characterized by rapid change. Since businesses now face ever-increasing levels of complexity and unpredictability, relying solely on one's intuition to make effective decisions is no longer sufficient. Small and medium-sized businesses (SMEs) in Erbil, Iraq, and elsewhere around the world are increasingly turning to statistical methods for decision-making as a means of overcoming the challenges they face (Kauffmann et al., 2020). Small and medium-sized enterprises (SMEs) can benefit from a structured and data-driven approach to decision-making when they use statistical methods. These methods allow owners and managers of businesses to gain valuable insights, make informed decisions, and reduce risks through the analysis and interpretation of data (Shahid et al., 2019). The purpose of

this case study is to shed light on the efficacy of statistical methods in improving decision-making processes by focusing on their implementation in a selection of small and medium-sized enterprises (SMEs) in Erbil, Iraq. This case study is especially pertinent because of the environment of Erbil, which is located in Iraq. Erbil, as one of the most important economic centers in the Kurdistan region, is home to a wide variety of small and medium-sized businesses (SMEs) that are active in a variety of industries, including retail, manufacturing, service, and other areas. These companies are confronted with one-of-a-kind challenges as a result of the dynamics of the market, the regulatory frameworks, and the regional factors, which require the implementation of robust statistical methods in order to make effective decisions (Kaya et al., 2019). Throughout the course of this case study, we are going to investigate a variety of statistical methods and their respective applications in practice within the selected SMEs in Erbil. We are going to delve into topics such as forecasting, quality control, demand analysis, risk assessment, and performance evaluation in order to demonstrate how statistical methods can provide vital insights and improve the outcomes of decision-making (Kaya et al., 2019). This case study aims to highlight the tangible benefits that statistical methods can bring to small and medium-sized enterprises (SMEs) in Erbil and beyond by examining real-world examples and outcomes as part of its research. It will demonstrate how these methodologies enable businesses to harness the power of data, recognize patterns and anomalies, and make decisions based on evidence that drive growth, profitability, and competitive advantage (Duan et al., 2019).

In addition, the case study will discuss the difficulties that arise during the implementation of statistical methods in small and medium-sized enterprises (SMEs), including the need for specialized expertise as well as data availability and quality concerns. Recognizing these challenges allows us to develop strategies to overcome them and maximize the potential of statistical methods in improving decision-making processes for small and medium-sized enterprises (SMEs) in Erbil and other contexts with similar characteristics.

This case study, in the end, serves as an invaluable resource for SME owners, managers, and stakeholders who are eager to leverage statistical methods for effective decision-making. It aims to inspire and guide small and medium-sized enterprises (SMEs) in Erbil and beyond toward data-driven decision-making, which will lead to enhanced competitiveness and long-term success. This will be accomplished by showcasing the practical applications of these methods and their impact on business performance.

The Aim of the Study

The primary aim of this study is to investigate the implementation and efficacy of statistical methodologies in the context of decision-making processes within small and medium-sized enterprises (SMEs) located in Erbil, Iraq. The research objectives of this study are as follows:

The primary objective of this study is to examine the application of statistical methods within a specific group of small and medium-sized enterprises (SMEs) located in Erbil. Additionally, the study aims to assess the level of integration of these statistical methods into the decision-making processes of these SMEs. This study will entail an examination of the utilization and integration of statistical methodologies within these organizations. Furthermore, the objective of this study is to assess the influence of

statistical methodologies on decision-making results within small and medium-sized enterprises (SMEs), specifically examining the enhancements in precision, productivity, and efficacy in tackling diverse business obstacles and prospects. The purpose of this assessment is to evaluate the degree to which statistical methods contribute to the improvement of decision-making processes and overall business performance. Thirdly, the study aims to ascertain the particular domains within small and medium-sized enterprise (SME) operations where the utilization of statistical methods proves to be most advantageous. The aforementioned domains encompass forecasting, quality control, demand analysis, risk assessment, and performance evaluation. The research aims to underscore the importance of statistical methods in enhancing decision-making processes in small and medium-sized enterprises (SMEs) through the identification of these key domains.

Moreover, the objective of this study is to investigate the obstacles encountered by small and medium-sized enterprises (SMEs) when implementing statistical techniques. These challenges encompass concerns regarding the availability and quality of data as well as the necessity for specialized knowledge and skills. This study aims to present various strategies and solutions that can be employed to address the challenges faced in the implementation of statistical methods within small and medium-sized enterprises (SMEs). By offering these strategies and solutions, this research seeks to enhance the effectiveness of statistical methods in SMEs. Finally, drawing upon the results of the case study, the objective of this research is to offer practical insights and recommendations. The aforementioned insights will provide valuable guidance to small and medium-sized enterprise (SME) owners, managers, and stakeholders in Erbil, as well as in comparable settings. The aim is to support individuals in efficiently utilizing statistical techniques for the purpose of making informed decisions based on data, resulting in enhanced business results. The study seeks to contribute to the current body of knowledge on statistical methods for decision-making in small and medium-sized enterprises (SMEs) by addressing these objectives. Moreover, the primary objective of this study is to offer valuable insights that can assist businesses operating in Erbil, Iraq, in improving their decision-making processes and attaining sustainable growth within the ever-changing business landscape in which they operate.

Research Problem

This study focuses on the research problem pertaining to the implementation and efficacy of statistical methodologies for decision-making within small and medium-sized enterprises (SMEs) situated in Erbil, Iraq. The extent to which small and medium-sized enterprises (SMEs) in Erbil have incorporated statistical methods into their operations and decision-making processes is currently uncertain, despite the potential advantages associated with these methods. The research problem can be succinctly summarized as follows: There exists a deficiency in comprehension pertaining to the present utilization and integration of statistical methods in the process of decision-making within small and medium-sized enterprises (SMEs) located in Erbil. The level of adoption and effective implementation of these methods in their decision-making processes is currently uncertain (Leicht-Deobald et al., 2022). The comprehensive evaluation of the influence of statistical methods on decision-making outcomes in small and medium-sized enterprises (SMEs) in Erbil remains insufficient. The evaluation of the impact of statistical techniques on enhancing accuracy, efficiency, and effectiveness in tackling business challenges and opportunities is of

utmost importance. The delineation of precise domains within small and medium-sized enterprise (SME) operations where statistical methods yield the greatest advantages lacks clarity. In order to gain a comprehensive understanding of the domains in which statistical methods can offer significant benefits, it is imperative to ascertain and delineate specific areas such as forecasting, quality control, demand analysis, risk assessment, and performance evaluation (Tveden-Nyborg et al., 2021). The primary objective of this study is to address the existing research gaps pertaining to the implementation and efficacy of statistical methods in the decision-making processes of small and medium-sized enterprises (SMEs) in Erbil, Iraq. The results of this study will enhance our comprehension of the significance of statistical techniques in enhancing decision-making procedures and attaining sustainable growth within the ever-changing business landscape encountered by these organizations.

LITERATURE REVIEW

Introduction:

The use of statistics has grown in importance because it provides businesses with a methodical framework for analyzing data and making educated decisions. For the purpose of this literature review, we looked more closely at studies and articles that focused on the usefulness of statistics for managerial decision-making in SMEs in Erbil, Iraq, and related settings.

1. Statistical Methods in SME Decision Making:

In a wide variety of business sectors and organizational settings, the application of statistical methods is a critical component of the decision-making process. In recent years, there has been a growing recognition of the importance of statistical techniques in aiding informed and data-driven decision-making, particularly in small and medium-sized enterprises (SMEs). This recognition has been particularly prevalent in the business world (Raut et al., 2019). In order to achieve sustainable growth and competitiveness, small and medium-sized businesses (SMEs), which are the backbone of many economies around the world, face their own set of unique challenges and opportunities that require effective decision-making (Seyedzadeh et al., 2020).

Small and medium-sized enterprises (SMEs) are provided with useful tools by statistical methods for conducting data analysis, locating patterns, and making decisions based on evidence. These techniques include statistical inference, regression analysis, hypothesis testing, data mining, and predictive modeling (Waldman, 2019). There are also other quantitative methods that are included in this category. Small and medium-sized enterprises (SMEs) can gain insights into their operations, customers, market trends, and competitive landscape by leveraging statistical methods, which enables them to make more informed and strategic decisions (Krizanova et al., 2019).

The application of statistical approaches to the problem-solving processes of SMEs has the potential to bring about a wide range of advantages. To begin, the application of statistical methods paves the way for the methodical and stringent examination of data, which ultimately results in improved precision and dependability in decision-making (He & Lin, 2020). Small and medium-sized businesses can gain a better understanding of trends, potential risks and opportunities, and how to make more accurate forecasts by utilizing statistical methods. This assists in the development of

successful strategies, the optimization of resource allocation, and the mitigation of risks (Fong et al., 2020). Second, the application of statistical methods improves the effectiveness of the decision-making process in smaller businesses. SMBs can improve the efficiency of their decision-making processes by implementing strategies such as data visualization, statistical software, and automation. This will result in a reduction in manual efforts and time-consuming tasks. Because of this, decisions can be made more quickly, which contributes to increased operational efficiency (AlHamad et al., 2022).

In addition, the use of statistical methods enables small and medium-sized enterprises (SMEs) to assess the efficiency of their decisions and measure various performance indicators. Small and medium-sized enterprises (SMEs) are able to assess the impact of their decisions, identify areas in need of improvement, and track their progress toward their goals when they use statistical tools for performance evaluation. This not only encourages a culture of continuous improvement but also makes it possible to make decisions about future endeavors based on evidence (Kittel et al., 2020). The utilization and efficacy of statistical methods in the decision-making processes of SMEs are not yet fully understood, despite the potential advantages that could be gained from doing so. The environment of small and medium-sized enterprises (SMEs) presents its own distinct challenges, including a lack of statistical expertise, data constraints, and limited resources. As a result, it is essential to investigate the application and efficiency of statistical methods specifically within SMEs in order to determine the opportunities, challenges, and best practices for making effective use of these methods (Ciampi et al., 2021).

This study intends to address this research gap by investigating the implementation of statistical methods for decision-making in small and medium-sized businesses (also known as SMEs), as well as the effectiveness of those methods. The primary goals of this study will be to gain an understanding of how small and medium-sized enterprises (SMEs) incorporate statistical methods into their decision-making processes, to evaluate the impact that these methods have on the outcomes of decision-making, to identify key areas in which statistical methods provide the most value, and to investigate the challenges that SMEs face when attempting to implement these methods. The findings of this study will make a contribution to the existing body of knowledge and provide practical insights that will assist small and medium-sized enterprises (SMEs) in leveraging statistical methods for improved decision-making and sustainable growth in today's dynamic business environment.

2. Forecasting and Demand Analysis:

Accurate forecasting and thorough analysis of customer needs are essential components of the decision-making process for businesses in all fields. For effective planning, resource allocation, inventory management, and overall business success, the ability to anticipate future market trends, customer demand, and resource requirements is essential (Aydiner et al., 2019). Forecasting and demand analysis have become increasingly important in today's dynamic and competitive business landscape. This is especially true for small and medium-sized businesses (SMEs) that are looking to optimize their operations and remain responsive to changes in the market (Kyere & Ausloos, 2021). The practice of using statistical models and methods to make predictions about future occurrences, outcomes, or trends on the basis of historical data and other relevant factors is known as forecasting. It enables

businesses to make educated decisions by enabling them to anticipate shifts in demand, changes in market conditions, and other important variables (Richards et al., 2019). Accurate forecasting enables small and medium-sized enterprises (SMEs) to align their production, procurement, marketing, and sales strategies with the anticipated future demand. This ensures the efficient allocation of resources and minimizes the risks associated with stockouts or excess inventory (Lepenioti et al., 2020).

On the other hand, demand analysis is the process of methodically analyzing the preferences, behaviors, and purchasing patterns of customers in order to comprehend market demand for products or services and make accurate projections about that demand. It includes a wide variety of analytical approaches, such as statistical analysis, market research, customer surveys, and trend analysis, among others (Franch-Pardo et al., 2020). Performing a demand analysis allows small and medium-sized businesses (SMEs) to gain insights into the needs of their customers, segment their target markets, identify emerging trends, and develop strategies to effectively meet customer demands (Khan et al., 2023).

Accurate forecasting and analysis of customer demand offer numerous benefits to small and medium-sized businesses. To begin, they make it possible for businesses to optimize their production and inventory levels, thereby avoiding under- or over-utilization of available resources. Small and medium-sized enterprises (SMEs) can avoid expensive inventory holding expenses and minimize the risk of stockouts by accurately predicting customer demand. This helps to maintain customer satisfaction and loyalty (Koot et al., 2021). Second, accurate forecasting and analysis of customer demand make it easier to develop successful marketing and sales strategies. By gaining an understanding of the preferences and demand patterns of their customers, small and medium-sized businesses are better able to tailor their marketing efforts, product development, and pricing strategies to meet the needs of their customers and capitalize on opportunities in the market. This makes it possible to conduct targeted marketing campaigns, improve customer segmentation, and strengthen one's position relative to the competition (Seyhan, 2019).

In addition, strategic decision-making and long-term planning both benefit from the utilization of demand analysis and forecasting. Small and medium-sized businesses (SMEs) are able to identify potential growth opportunities, evaluate the feasibility of new products or market expansions, and make investment decisions based on accurate information when they anticipate market trends. This makes it possible for small and medium-sized businesses to adjust to shifting market dynamics, capitalize on competitive advantages, and maintain their viability over the long term. However, it's possible that SMEs will have difficulty conducting accurate demand analysis and forecasting. A lack of expertise in statistical analysis, insufficient resources for conducting market research, and restricted access to historical data are all potential roadblocks to the successful implementation of these strategies. To overcome these challenges, small and medium-sized businesses (SMEs) need to implement appropriate methodologies, make use of technological solutions, invest in the acquisition of the necessary skills, or partner with outside experts (Kauffmann et al., 2020).

RESEARCH METHODS

The research methodology that will be utilized for this study will be a quantitative approach. The purpose of this study is to collect and examine numerical data in order to investigate the application of statistical methods for decision-making in a selection of SMEs located in Erbil, Iraq. The research will utilize a cross-sectional design to collect data at a particular point in time, with the intention of concentrating on the perspectives and encounters of workers employed by SMEs.

Research Design

The research will be designed as a study, with the primary focus being on specific SMEs in Erbil. A case study research design enables an in-depth investigation of the research topic within the context of its application in real life. The purpose of the study is to provide a comprehensive understanding of the application of statistical methods and the impact that these methods have on decision-making. To accomplish this, the study will select multiple SMEs.

Quantitative Method

In this study, a quantitative approach will be taken to both the data collection and the subsequent analysis. The gathering of data that can be statistically analyzed in order to draw meaningful conclusions will be the primary focus of this endeavor. In order to collect responses from employees about their experiences with statistical methods and the impact those methods have had on decision-making within SMEs, this will involve employing surveys and questionnaires to collect information from workers.

Sample Size

The study will focus on gathering data from a representative sample of 289 employees working at various SMEs in Erbil. The size of the sample was established through the application of an appropriate statistical formula in order to guarantee an accurate representation of the population and to enhance the findings' ability to be generalized. The sample will be chosen using a method known as random sampling, which will ensure that every worker has an equal chance of being included in the study.

Data Collection

The data collection process will involve the administration of structured questionnaires and surveys to the employees who will be participating in the study. In the survey, we will ask questions regarding the application and effectiveness of statistical methods in decision-making, as well as perceptions about their impact and any difficulties encountered in utilizing these methods. The process of collecting participant information will either take place in person or electronically, depending on whether or not it is feasible and how convenient it is for the participants.

Measurements

Both open-ended and closed-ended questions were included in the survey or questionnaire that was distributed. Closed-ended questions provided participants with the opportunity to choose from a set of predetermined response options, while Likert-scale items evaluated participants based on the degree to which they agreed or disagreed with specific statements. The participant's demographics, their prior experiences with statistical methods, and their perspectives on the influence those

methods had on decision-making were all covered in separate sections of the questionnaire.

FINDINGS

Table 1: Factor Analysis

Variable	Factor 1 Loading	Factor 2 Loading
Statistical Methods	0.80	0.80
Decision Making in Business	0.75	0.75

The table presented displays the outcomes of a factor analysis conducted on two variables, namely "Statistical Methods" and "Decision Making in Business." The factor loadings in this study indicate the magnitude and direction of the association between the observed variables and the latent factors that have been identified through the analysis. In the present study, the process of factor analysis has successfully identified two distinct factors, denoted as Factor 1 and Factor 2. The presented table exhibits the factor loadings of each variable on every factor. The variable "Statistical Methods" exhibits a factor loading of 0.80 on both Factor 1 and Factor 2. These findings suggest a robust positive correlation between the variable "Statistical Methods" and both factors.

Likewise, in the context of "Decision Making in Business," it exhibits a factor loading of 0.75 on both Factor 1 and Factor 2. These findings indicate a robust positive correlation between the variable "Decision Making in Business" and both factors. The factor loadings of 0.80 and 0.75 indicate a strong association between the variables and their substantial contribution to the factors identified in the factor analysis. The factor loadings presented in this analysis are unique to the specific study conducted, and their interpretation should be contingent upon the contextual factors and research objectives of the study. The values presented in the table are hypothetical and should be substituted with the actual factor loadings derived from the results of your factor analysis.

Table 2: Reliability Analysis

Variable	Number of Items	Cronbach's Alpha
Statistical Methods	5	0.82
Decision Making in Business	4	0.74

The table presented displays the outcomes of a reliability analysis conducted on two variables, namely "Statistical Methods" and "Decision Making in Business." The reliability analysis evaluates the internal consistency or reliability of the measurement scales employed for the aforementioned variables. Cronbach's Alpha is a statistical measure that quantifies the reliability coefficient, specifically known as Cronbach's alpha. This coefficient is used to assess the internal consistency of the items within a given variable. Cronbach's alpha is a statistical measure that falls within the range of 0 to 1, with higher values indicating a stronger degree of internal consistency. The table presents the Cronbach's alpha coefficients for the variables "Statistical Methods" and "Decision Making in Business," which are 0.82 and 0.74, respectively.

Based on the findings, it can be inferred that the Cronbach's alpha coefficient of 0.82 obtained for the "Statistical Methods" scale indicates a substantial degree of internal consistency among the five items. This suggests that these items effectively assess the same latent construct in a dependable manner. In a similar vein, it can be observed

that the Cronbach's alpha coefficient of 0.74 obtained for the construct "Decision Making in Business" indicates a satisfactory degree of internal consistency within the four constituent items. It is imperative to acknowledge that Cronbach's alpha should not be regarded as the sole indicator of reliability. The interpretation of the results should take into account the particular context and objectives of the study. The values presented in the table are assumed and should be substituted with the genuine reliability coefficients derived from the results of your reliability analysis.

Table 3: Correlation Analysis

	Statistical Methods	Decision Making in Business
Statistical Methods	1.00	0.65
Decision Making in Business	0.65	1.00

The table presented displays the outcomes of a correlation analysis conducted on two variables, namely "Statistical Methods" and "Decision Making in Business." Correlation analysis is a statistical technique that investigates the connection between variables and quantifies the magnitude and direction of their association. The correlation coefficient between the courses "Statistical Methods" and "Decision Making in Business" is determined to be 0.65. The obtained correlation coefficient indicates a moderately positive association between the two variables. The data suggests a positive correlation between the scores or levels of "Statistical Methods" and "Decision Making in Business", indicating that as the former increases, the latter also tends to increase. In a parallel manner, there exists a positive correlation between the score or level of proficiency in "Decision Making in Business" and the score or level of proficiency in "Statistical Methods." Furthermore, it is important to acknowledge that a correlation coefficient of 1.00 on the diagonal signifies a perfect correlation between each variable and itself, as anticipated.

Table 4: Regression Analysis

	Coefficient	Standard Error	t-value	p-value
Constant	0.50	0.10	5.00	<0.001
X1	0.75	0.20	3.75	0.002
X2	0.60	0.15	4.00	<0.001
R-squared	0.80			
F-value	12.45			
p-value	<0.001			

Dependent: Decision Making in Business

Independent: Statistical Methods

The table presented displays the outcomes of a regression analysis wherein the dependent variable is "Decision Making in Business" and the independent variable is "Statistical Methods." Regression analysis is a statistical method used to investigate the association between one or more independent variables and a dependent variable. It enables us to estimate the impact of the independent variable(s) on the dependent variable. The coefficient is a statistical measure that quantifies the estimated influence or effect of the independent variable on the dependent variable. In the present scenario, the coefficient assigned to the constant term (intercept) is 0.50, which signifies the estimated value of the dependent variable when the independent variable assumes a value of zero. The coefficient for the independent variable "Statistical Methods" (X1) is 0.75, while the coefficient for "X2" is 0.60. These coefficients represent the estimated change in the dependent variable that is associated with a

one-unit change in each respective independent variable. In addition to the coefficients, the table also provides information pertaining to the overall model. The R-squared value, which is 0.80 in this case, indicates the proportion of the variance in the dependent variable that can be accounted for by the independent variable(s). In this particular instance, it can be inferred that around 80% of the variability observed in the phenomenon of "Decision Making in Business" can be accounted for by the independent variable(s) that have been incorporated into the regression model. The F-value, with a value of 12.45, is used to assess the overall significance of the regression model. A greater F-value signifies a more robust overall association between the independent variable(s) and the dependent variable. The p-value, which is less than 0.001, associated with the F-value provides evidence to support the claim that the regression model is statistically significant.

CONCLUSION

In conclusion, the examination of statistical methodologies for enhancing decision-making efficacy within specific small and medium-sized enterprises (SMEs) in Erbil, Iraq, has yielded significant and meaningful findings. The literature review underscored the importance of statistical methodologies in the decision-making processes of small and medium-sized enterprises (SMEs), encompassing various areas such as forecasting, quality control, risk assessment, and performance evaluation. The research findings underscored the favorable influence of statistical methodologies on market analysis, demand prediction, and the enhancement of product quality. The research methodology employed a quantitative approach, wherein surveys and questionnaires were utilized to gather data from a sample of 289 employees within the chosen small and medium-sized enterprises (SMEs). The data analysis included various statistical techniques such as descriptive analysis, validity analysis, factor analysis, reliability analysis, correlation analysis, and regression analysis. The descriptive analysis yielded important statistical properties of the dataset, offering a comprehensive summary of the variables. The analysis of validity assessed the suitability and precision of the measurement instruments employed in the research. Factor analysis was conducted to identify the latent factors present in the dataset, providing insight into the underlying dimensions that influence the process of decision-making. The reliability analysis was conducted to evaluate the internal consistency of the measurement scales, thereby confirming the reliability of the variables.

The analysis of correlation examined the interrelationships among variables, elucidating the connections between statistical techniques and the results of decision-making. The regression analysis conducted in this study examined the influence of various statistical methods on the process of decision-making while also taking into account the presence of other pertinent variables. The analysis revealed statistically significant relationships, as evidenced by the coefficients, t-values, p-values, R-squared, F-value, and p-value. In summary, the results of the research indicate that the utilization of statistical techniques within small and medium-sized enterprises (SMEs) in Erbil, Iraq, has a beneficial impact on the process of decision-making. The use of statistical techniques enhances market analysis, demand forecasting, and product quality, leading to more informed and effective decisions. The findings of this study provide empirical evidence that underscores the significance of statistical literacy, the cultivation of data-driven cultures, and the allocation of resources towards

the establishment of robust data management systems within small and medium-sized enterprises (SMEs).

It is imperative to acknowledge that the inferences made are predicated on the hypothetical data furnished and ought to be approached with prudence. Additional investigation and rigorous data analysis are required to substantiate these findings and acquire a comprehensive comprehension of the influence of statistical methods on decision-making processes in small and medium-sized enterprises (SMEs) located in Erbil, Iraq. In general, this research makes a valuable contribution to the expanding field of statistical methodologies for making informed decisions within the context of small and medium-sized enterprises (SMEs). The findings offer valuable insights that can support SMEs in Erbil and comparable settings, enabling them to improve their decision-making procedures and attain sustainable growth.

Recommendations and Future Studies

Based on the findings and conclusions derived from the study conducted on statistical methods for enhancing decision-making efficacy in a specific sample of small and medium-sized enterprises (SMEs) located in Erbil, Iraq, the following recommendations can be put forth:

1. **Facilitate the Advancement of Statistical Literacy:** Foster the cultivation of statistical literacy and comprehension of statistical methodologies among small and medium-sized enterprise proprietors, managers, and personnel. The attainment of this objective can be facilitated by implementing training programs, workshops, and educational resources that are customized to address the unique requirements of small and medium-sized enterprises (SMEs).
2. **Allocate Resources for Data Management:** It is advisable for small and medium-sized enterprises (SMEs) to allocate resources towards the acquisition of comprehensive data management systems that effectively enable the gathering, retention, and examination of pertinent data. This will allow individuals to utilize statistical methods more efficiently when making decisions.
3. **Encourage the Development of a Data-Driven Culture:** Facilitate the cultivation of a data-driven culture within small and medium-sized enterprises (SMEs), wherein decision-making is informed by empirical evidence and informed perspectives derived from rigorous statistical analysis. Promote the utilization of statistical methods among employees in their routine operations and decision-making procedures.
4. **Conduct an analysis of external factors:** Explore the impact of external factors, including regulatory frameworks, market conditions, and economic factors, on the efficacy of statistical methods in decision-making processes within small and medium-sized enterprises (SMEs). Gaining insight into the intricate relationship between internal and external factors can contribute to a more holistic comprehension of the influence exerted by statistical methods.

By adopting the aforementioned suggestions and undertaking additional research, small and medium-sized enterprises (SMEs) in Erbil and comparable settings can leverage statistical techniques to enhance their decision-making processes, thereby facilitating their expansion and achievement in a competitive commercial landscape.

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