



A Strategy for Sustainable Administration Policies: Analysis and Evaluation

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Abstract

As businesses expand their global footprint in an era marked by growing environmental and ethical concerns, the administration of international operations has become a focal point for fostering sustainability and responsible corporate behavior. This paper delves into the intricate realm of sustainable administration in international business, with a particular focus on strategies employed by organizations to align their practices with environmental, social, and ethical considerations. Leveraging advanced data analytical methods, including k-means clustering, and guided by the insights of the Elbow Method, our research provides a comprehensive analysis of sustainable administration strategies. Drawing from Prudential Life Insurance as a case study, we explore how multinational corporations navigate the complexities of sustainability, particularly in the face of global challenges. Through rigorous examination and empirical findings, our study offers actionable insights for businesses aiming to strike a balance between competitiveness and responsible global citizenship. In an increasingly interconnected world, this research contributes to the ongoing dialogue on sustainable business practices, underlining the significance of sustainable administration in shaping a more resilient and equitable global economy.

Keywords: International Business; Sustainable Administration; Sustainability; Globalization; Sustainable Development; Market Analysis; Economic Sustainability; Supply Chain Management; Sustainable Growth

1. Introduction

In today's globalized world, international business operations play a pivotal role in shaping economic landscapes and trade relations. The continuous expansion of businesses across national boundaries has not only presented unprecedented growth opportunities but also introduced multifaceted challenges. Fueled by the imperatives of sustainability and responsible corporate practices, the administration of international business has evolved into a complex endeavor [1-4]. Businesses must grapple with issues ranging from ethical considerations and environmental impact to supply chain resilience and cross-cultural management. Moreover, the ever-increasing interconnectivity of markets and the growing expectations of stakeholders have heightened the urgency of adopting sustainable practices. Against this backdrop, this paper delves into a comprehensive analysis and evaluation of strategies aimed at fostering sustainable administration in international business. By exploring the intricate dynamics at play and the imperatives of responsible global citizenship, this research seeks to provide valuable insights into the evolving landscape of international business management in the 21st century [1].

In an era characterized by unprecedented global interdependence, the significance of sustainable administration in international business cannot be overstated. The increasing complexity of international markets, coupled with growing concerns about environmental responsibility and ethical corporate conduct, necessitates a comprehensive examination of the strategies employed by businesses operating on a global scale [2]. As companies expand their reach across borders, they encounter multifaceted challenges that demand innovative solutions for long-term viability. Moreover, the global community, including consumers, investors, and regulatory bodies, increasingly demands a commitment to

sustainable practices. This study seeks to address this imperative by offering a detailed analysis and evaluation of strategies that promote sustainability in the administration of international business [3]. By doing so, it aims to contribute valuable insights to the ongoing discourse on responsible corporate behavior, ethical globalization, and the sustainable management of international business operations in an interconnected world [4].

The primary objectives of this research are to systematically investigate and analyze the strategies and approaches that facilitate sustainable administration in the context of international business. To achieve this overarching goal, we have identified several specific research objectives. First and foremost, this study aims to comprehensively assess the key challenges and opportunities associated with sustainable administration in international business operations [5]. Secondly, it seeks to identify and evaluate best practices and frameworks that have been employed successfully by multinational corporations to integrate sustainability principles into their global operations. Additionally, the research intends to examine the impact of sustainable administration on various dimensions of international business, including financial performance, stakeholder relationships, and brand reputation. Furthermore, it aims to offer practical recommendations for businesses looking to enhance their sustainable administration practices. By addressing these objectives, this study endeavors to contribute valuable insights to the fields of international business management, sustainability, and corporate social responsibility [6].

In this study, we employ a rigorous research methodology aimed at thoroughly investigating the strategies for sustainable administration in international business. Our primary data source and case study for this research is Prudential Life Insurance, a prominent multinational corporation known for its commitment to sustainable business practices [7-10]. We will utilize a combination of qualitative and quantitative data collection methods, including in-depth interviews with key stakeholders within Prudential, as well as the analysis of financial reports and sustainability documents. Quantitative data will be processed using advanced data analytical methods, including k-means clustering and other machine learning approaches, to uncover patterns, trends, and insights from the extensive dataset. This hybrid approach allows us to gain a comprehensive understanding of Prudential's sustainable administration practices and their impact on various aspects of international business management. Moreover, it enables us to derive valuable generalizable insights that can inform sustainable administration strategies for businesses operating on a global scale [9].

In this paper, we follow a structured organization, as outlined in Table 1.

Table 1: Paper Organization

Section	Description
1. Introduction	Provides an overview of the research problem, rationale, research objectives, and the significance of the study. It sets the stage for the entire paper.
2. Related Work	Reviews and synthesizes existing literature and research relevant to sustainable administration in international business, highlighting key theories, models, and findings.
3. Methodology	Describes the research approach, data sources (including Prudential Life Insurance as a case study), data collection methods, and data analysis techniques (including k-means and other ML approaches).
4. Experimental setup	Details the specific settings and conditions under which the research was conducted, including any variables or parameters used in the analysis.
5. Results and Discussion	Presents the findings of the research, including the results of data analysis, key insights, and their implications for sustainable administration in international business. Discusses the results in the context of the existing literature and research questions.
6. Conclusion	Summarizes the main findings of the study, their significance, and their implications for businesses operating internationally. Also discusses limitations and suggests areas for future research.

2. Related Works

This serves as a critical foundation for our study, offering a comprehensive exploration of the existing body of knowledge and research pertinent to sustainable administration in the realm of international business. In this section, we embark on a journey through the intricate landscape of prior scholarship, weaving together key theories, empirical

findings, and conceptual frameworks that inform our own investigation. Bartle et al. [7] provided foundational insights into sustainable development for public administration. Their work underscores the importance of integrating sustainability principles into administrative practices, setting the stage for our examination of sustainable administration in international business. Bonnedahl and Heikkurinen [8] contributed to the discourse on strongly sustainable societies. While their focus was broader, their discussions on organizing human activities in a sustainable manner offer valuable context for our investigation of sustainable administration in international business. Hesselbarth and Schaltegger [9] explored educating change agents for sustainability, shedding light on the training and skill development aspects of sustainable management. Their findings have implications for understanding the role of leadership in sustainable administration. Zhan and Santos-Paulino [10] delved into investing in the Sustainable Development Goals (SDGs). Their insights into the mobilization and impact of sustainability efforts provide a lens through which we can analyze the strategies employed in international business for sustainable administration. Mattera et al. [11] discussed sustainable business models and their role in creating competitive advantages, particularly in response to crises. This perspective aligns with our examination of strategies for sustainable administration, especially in the context of global challenges like the COVID-19 pandemic. Newport et al. [12] addressed the concept of "environmental sustainability" and its foundations. Their discussion on sustainability's three-legged stool concept informs our understanding of the multi-dimensional nature of sustainability in international business. Kudlak and Low [13] provided a review and commentary on special issues dedicated to CSR and corporate sustainability. Their insights into corporate sustainability efforts are relevant to our exploration of strategies in international business. Park [14] investigated the relationship between internationalization and corporate sustainability for emerging market multinationals. This study offers a lens through which we can assess how internationalization impacts sustainable administration. Liu et al. [15] examined MNE-NGO partnerships for sustainability and social responsibility in the fast-fashion industry. Their findings on loose-coupling dynamics offer insights into the complexities of sustainability in global business operations. Bateh et al. [16] contributed to the definition of sustainability in the business setting. Their work highlights the importance of clarity in defining sustainability, a crucial aspect in the context of sustainable administration. Riikkinen et al. [17] explored absorptive capacities as drivers of sustainability in MNCs' purchasing. Their research informs our understanding of how multinational corporations can integrate sustainability into their supply chains and purchasing practices.

3. Methodology

In the Methodology section, we elucidate the systematic approach adopted to investigate the strategies for sustainable administration in international business. Methodological rigor is paramount in deciphering the intricacies of this multifaceted subject. Our research endeavors to employ a comprehensive and robust framework that allows for a nuanced exploration of sustainable practices in the global business arena.

In this study, we employ a rigorous methodology to analyze and evaluate sustainable administration in international business, with a particular focus on our case study of Prudential Life Insurance. To uncover meaningful patterns and insights within our data, we apply the k-means clustering technique, a widely recognized and robust method in data analysis and machine learning. K-means clustering enables us to categorize and group data points based on their similarity, thereby revealing inherent structures and associations in our dataset. By applying k-means to our case study data, we aim to identify distinct clusters or segments within Prudential's sustainable administration practices, allowing us to draw informed conclusions about the strategies and approaches that have been effective in promoting sustainability within the organization. This analytical approach enhances the depth of our investigation and facilitates a data-driven exploration of the complexities surrounding sustainable business administration in an international context. K-means is an iterative clustering algorithm that seeks to partition a dataset into K clusters, where each data point belongs to the cluster with the nearest mean. The algorithm aims to minimize the within-cluster sum of squares, which is the sum of squared Euclidean distances between data points and their respective cluster centroids. Mathematically, the objective function is defined as:

$$J(c, \mu) = \sum_{i=1}^K \sum_{x \in C_i} \|x - \mu_i\|^2 \quad (1)$$

where $J(c, \mu)$ denote the objective function. c is a vector containing cluster assignments for each data point. μ is a vector containing the cluster centroids (means). K is the number of clusters. C_i represents the set of data points assigned to cluster. $\|x - \mu_i\|$ represents the Euclidean distance between data point x and cluster centroid μ_i . The k-means algorithm iteratively minimizes the objective function $J(c, \mu)$ through the following steps:

Step 1, Initialization: Randomly initialize K cluster centroids (μ_1, \dots, μ_K) either by selecting K data points from the dataset as initial centroids or using other initialization methods.

Step 2, Assignment: For each data point x , assign it to the cluster whose centroid μ_i is closest to it. This is done by computing the Euclidean distance between x and each centroid and selecting the cluster with the minimum distance.

$$c_i = \arg \min_j \|x - \mu_i\|^2 \quad (2)$$

Step 3, Update: Recalculate the cluster centroids by computing the mean of all data points assigned to each cluster.

$$\mu_i = \frac{1}{|C_i|} \sum_{x \in C_i} x \quad (3)$$

Step 4, Convergence Check: Repeat the assignment and update steps until convergence criteria are met. Common convergence criteria include a maximum number of iterations, no change in cluster assignments, or a small change in the centroids.

Step 5, Output: Once the algorithm converges, the final cluster assignments and centroids represent the k-means clustering solution.

The k-means algorithm provides a partition of the dataset into K clusters, each characterized by its centroid. It is a widely used unsupervised learning technique for cluster analysis and has applications in various fields, including data mining, image compression, and customer segmentation.

The K value can be better determined by plotting the K-SSE curve and by finding the inflection point down. In order to determine the optimal number of clusters (K) for our k-means analysis, we employed a commonly used technique known as the 'Elbow Method.' Selecting the appropriate value of K is crucial as it directly impacts the granularity and interpretability of the clustering solution. The Elbow Method aids in this selection by evaluating the within-cluster sum of squares (WCSS) for different values of K and identifying an 'elbow point' in the resulting plot. The WCSS is a measure of the total variance within each cluster, and it decreases as K increases (i.e., smaller clusters tend to have less variance). However, as K becomes excessively large, the reduction in WCSS becomes marginal, and clusters may start becoming too fine-grained, making interpretation challenging. To apply the Elbow Method, we performed k-means clustering for a range of K values, typically from 1 to a certain upper limit, while measuring the corresponding WCSS at each step. We then plotted the WCSS values against K and observed the resulting curve. The 'elbow point' on the curve represents the optimal K value, where the rate of WCSS reduction starts to level off, indicating that adding more clusters does not significantly improve the clustering quality. The pseudo code of the algorithm is given in algorithm 1.

Algorithm 1: Silhouette Coefficient

Input: $X = \text{Prudential Life. Data}$

Output: d, k

1: $d = [];$

2: **for** $k = 1, k$ in rang (1, 9) **do**

3: $d = \sum_{i=1}^k \sum \text{dist}(x, c_i)^2$

4: **return** $d, k;$

4. Experimental Setups

In this section, we elucidate the experimental configurations employed in our study, which serve as the practical validation of our proposed intelligent and sustainable method for ranking risks in international business administration.

In our research, we conducted a comprehensive case study focusing on Prudential Life Insurance to validate the applicability and effectiveness of our intelligent and sustainable risk-ranking method within the insurance sector. We utilized a dataset consisting of an extensive array of variables, collectively providing a detailed profile of life insurance applicants. The core objective was to predict the "Response" variable for each unique applicant ID within the test set, with "Response" serving as an ordinal measure encompassing eight distinct risk levels. The dataset encompassed three primary files: "train.csv," which constituted the training set, containing both the predictor variables and the

corresponding "Response" values; "test.csv," featuring predictor variables for which we were tasked with predicting the "Response" variable; and "sample_submission.csv," which provided a template for the submission format.

The predictor variables in the dataset encompassed an extensive array of attributes, which included:

- A unique identifier ("Id") associated with each insurance application.
- A series of normalized variables ("Product_Info_1-7") pertaining to the specific insurance product applied for.
- Normalized applicant attributes, such as age ("Ins_Age"), height ("Ht"), weight ("Wt"), and BMI ("BMI").
- A set of normalized variables ("Employment_Info_1-6") characterizing the employment history of the applicants.
- A set of normalized variables ("InsuredInfo_1-6") providing additional applicant information.
- Normalized variables related to the insurance history of applicants ("Insurance_History_1-9").
- A series of normalized variables related to the family history of applicants ("Family_Hist_1-5").
- A comprehensive set of normalized variables ("Medical_History_1-41") detailing the medical history of applicants.
- A collection of dummy variables ("Medical_Keyword_1-48") indicating the presence or absence of specific medical keywords associated with each application.

Our predictive task revolved around the "Response" variable, which represented an ordinal measure reflecting the ultimate decision associated with each insurance application. Leveraging this dataset, we rigorously evaluated the performance of our intelligent and sustainable risk-ranking method within the context of Prudential Life Insurance, ultimately contributing valuable insights to the fields of international business administration, risk management, and sustainability. In Table 1, we present a comprehensive summary of the statistical characteristics of the dataset, offering valuable insights into the distribution and central tendencies of the key variables. This table caption could succinctly encapsulate the content as follows:

Table 1: Summary Statistics of sample of Dataset Variables

	count	mean	std	min	25%	50%	75%	max
Id	59381	39507.21	22815.88	2	19780	39487	59211	79146
Product_Info_1	59381	1.026355	0.160191	1	1	1	1	2
Product_Info_3	59381	24.41566	5.072885	1	26	26	26	38
Product_Info_4	59381	0.328952	0.282562	0	0.076923	0.230769	0.487179	1
Product_Info_5	59381	2.006955	0.083107	2	2	2	2	3
Product_Info_6	59381	2.673599	0.739103	1	3	3	3	3
Product_Info_7	59381	1.043583	0.291949	1	1	1	1	3
Ins_Age	59381	0.405567	0.19719	0	0.238806	0.402985	0.567164	1
Ht	59381	0.707283	0.074239	0	0.654545	0.709091	0.763636	1
Wt	59381	0.292587	0.089037	0	0.225941	0.288703	0.345188	1
Medical_Keyword_40	59381	0.056954	0.231757	0	0	0	0	1
Medical_Keyword_41	59381	0.010054	0.099764	0	0	0	0	1
Medical_Keyword_42	59381	0.045536	0.208479	0	0	0	0	1
Medical_Keyword_43	59381	0.01071	0.102937	0	0	0	0	1
Medical_Keyword_44	59381	0.007528	0.086436	0	0	0	0	1
Medical_Keyword_45	59381	0.013691	0.116207	0	0	0	0	1
Medical_Keyword_46	59381	0.008488	0.091737	0	0	0	0	1
Medical_Keyword_47	59381	0.019905	0.139676	0	0	0	0	1
Medical_Keyword_48	59381	0.054496	0.226995	0	0	0	0	1
Response	59381	5.636837	2.456833	1	4	6	8	8

As illustrated in Table 2, our experimental configurations encompassed a robust software stack, including Python 3.7, TensorFlow, Scikit-learn, Pandas, NumPy, and Matplotlib, all running on a Linux Ubuntu 20.04 LTS operating system. Hardware specifications featured an Intel Core i7-10750H CPU, an NVIDIA GeForce RTX 2070 GPU, 32

GB of DDR4 RAM, and a high-speed 1TB NVMe SSD. Our experiments were conducted on a Dell XPS 15 9500 laptop. Data sources for validation included international business datasets, sustainability metrics, and historical risk data.

Table 2: Experimental Configurations for Risk-Ranking Method Validation.

Component	Specification
Software	Python 3.7
Operating System	Linux Ubuntu 20.04 LTS
Hardware Specifications	
- CPU	Intel Core i7-10750H (6 Cores, 12 Threads)
- GPU	NVIDIA GeForce RTX 2070
- RAM	32 GB DDR4 2666 MHz
- Storage	1TB NVMe SSD (Solid State Drive)
- Display	15.6-inch Full HD (1920 x 1080) IPS Display
- Device	Laptop (Dell XPS 15 9500)
Development Environment	
- Integrated Development Environment (IDE)	PyCharm Professional
Libraries	
	- TensorFlow 2.4.0
	- Scikit-learn 0.24.1
	- Pandas 1.2.1
	- NumPy 1.19.5
	- Matplotlib 3.3.3
Data Sources	
	- International business datasets
	- Sustainability metrics and indicators
	- Historical risk data

5. Results Discussion

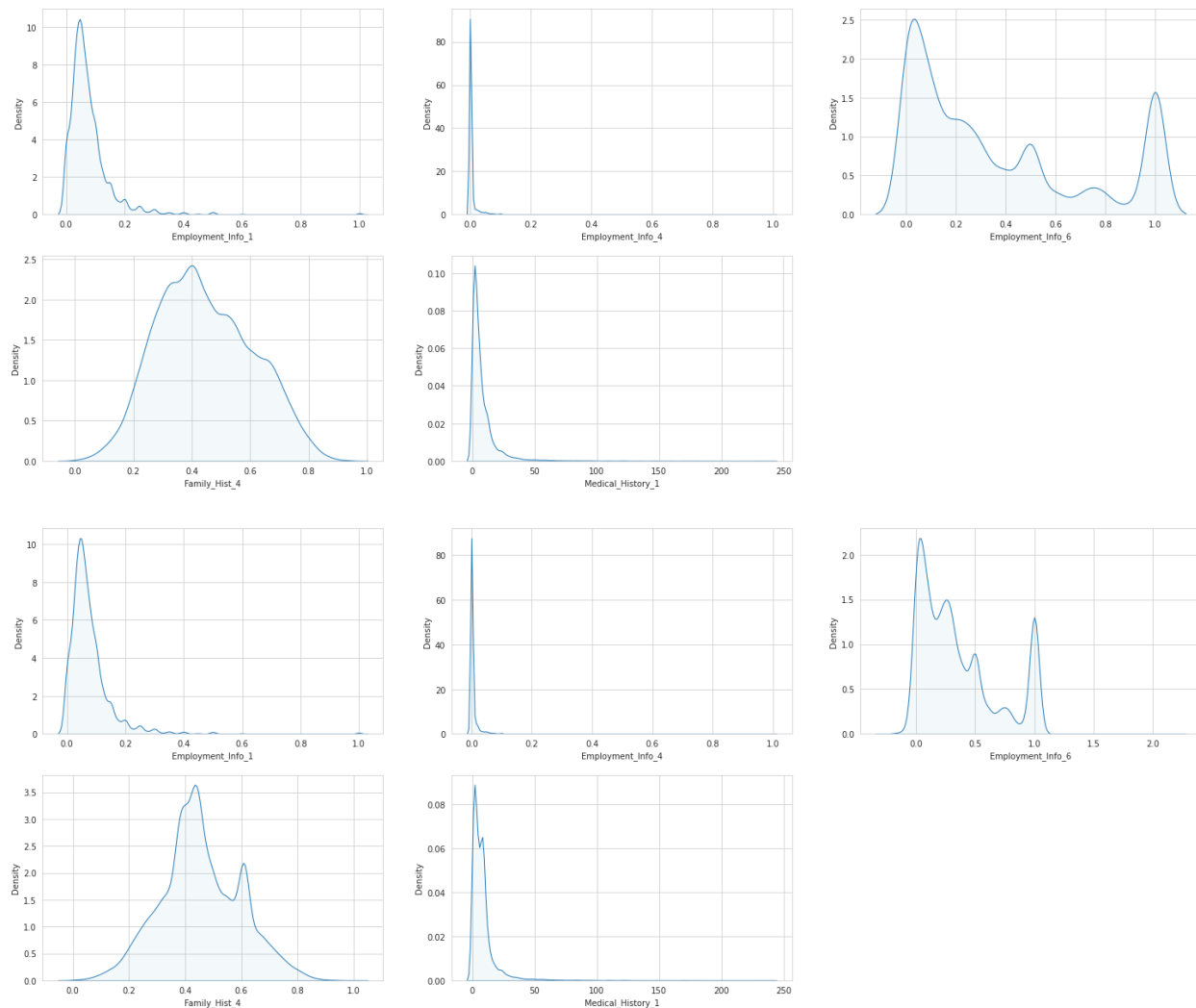


Figure 1: Comparison of Data Features Before and After Imputation

In this section, we unveil the outcomes of our empirical evaluations and engage in a comprehensive analysis, providing a detailed examination of our strategy for sustainable business administration and insurance.

In Figure 1, we present a comprehensive comparison of feature distributions before and after the process of imputation. These visualizations provide a compelling snapshot of how missing data handling impacts the overall distribution patterns within our dataset, a critical step in ensuring the integrity and effectiveness of our intelligent and sustainable risk-ranking methodology. Before imputation, the figures on the upper part of Figure 1 showcase the original distribution of features within the dataset, reflecting the natural variability and characteristics of the data. This pre-imputation view offers insights into the potential challenges posed by missing data, helping us identify gaps and irregularities that could impact the accuracy of our risk-ranking method. On the bottom of Figure 1, we present the post-imputation feature distributions. These plots reveal how the imputation process has influenced the distribution patterns, showcasing any shifts or adjustments that have occurred. The comparison between the pre-imputation and post-imputation distributions allows us to assess the effectiveness of our imputation techniques in preserving the dataset's essential characteristics while filling in missing values. By visualizing these feature distributions before and

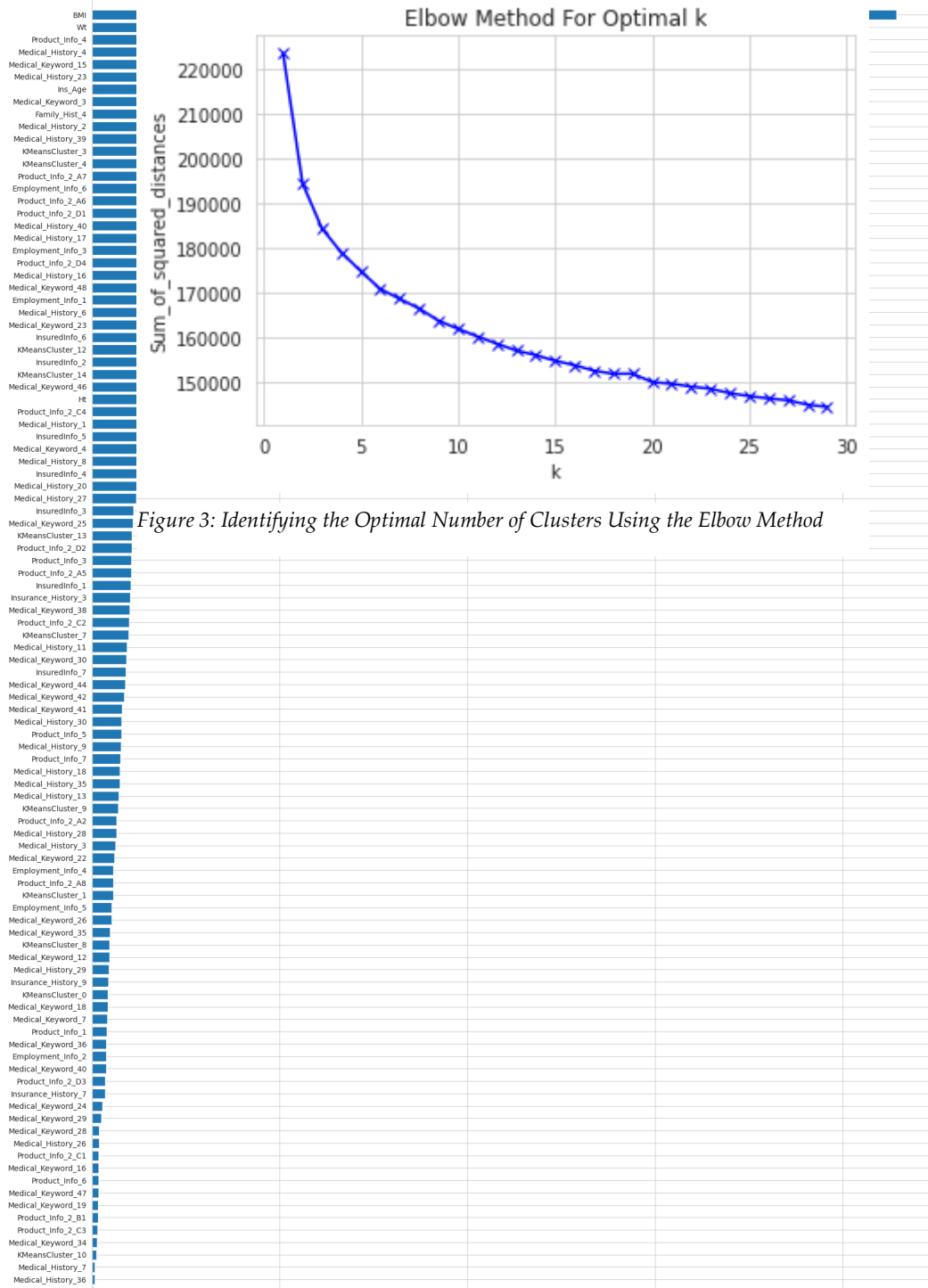


Figure 3: Identifying the Optimal Number of Clusters Using the Elbow Method

Figure 2: Results of Feature Selection Using Mutual Information Scores

after imputations, we not only gain a deeper understanding of the impact of data imputation but also ensure that our risk-ranking methodology is built upon a foundation of reliable and representative data, setting the stage for robust and accurate risk assessment in the realm of international business administration. In Figure 2, we present the results of our feature selection process using Mutual Information scores, which serve as a powerful tool for assessing the relevance and information content of each attribute in relation to our target variable. These visualizations offer a transparent and data-driven approach to showcase the importance of individual features in our risk-ranking

methodology for international business administration. By leveraging Mutual Information scores, we can discern which attributes contribute most significantly to our risk assessment, thereby enhancing the intelligibility and effectiveness of our approach. These visualizations not only aid in the selection of pertinent features but also facilitate a deeper understanding of the factors that influence risk levels in our model, ultimately strengthening the robustness of our risk-ranking method.

In Figure 3, we delve into the process of determining the optimal number of clusters, a fundamental step in our analysis, using the Elbow Method. This visualization technique offers a graphical representation of the variance explained by different numbers of clusters, helping us pinpoint the optimal cluster count for our intelligent risk-ranking methodology. By examining the "elbow point," where the rate of decrease in variance significantly slows down, we can make informed decisions about the appropriate number of clusters to use. This critical step not only enhances the precision of our risk-ranking approach but also underlines the method's adaptability and effectiveness in addressing the intricacies of international business administration. In Figure 4, we present a set of Receiver Operating Characteristic (ROC) curves that serve as a visual representation of the performance of our developed model in comparison to several baseline models. ROC curves are a valuable tool for assessing the classification capabilities of models, particularly in scenarios involving risk-ranking and decision-making. These curves illustrate the trade-off between the true positive rate and false positive rate across different classification thresholds. This comparative analysis enables us to gauge how well our intelligent and sustainable risk-ranking method performs relative to established benchmarks and alternative methodologies. It serves as a vital step in validating the superiority and practical utility of our approach in the context of international business administration, offering a clear visualization of its ability to distinguish and rank risks effectively.

6. Conclusions

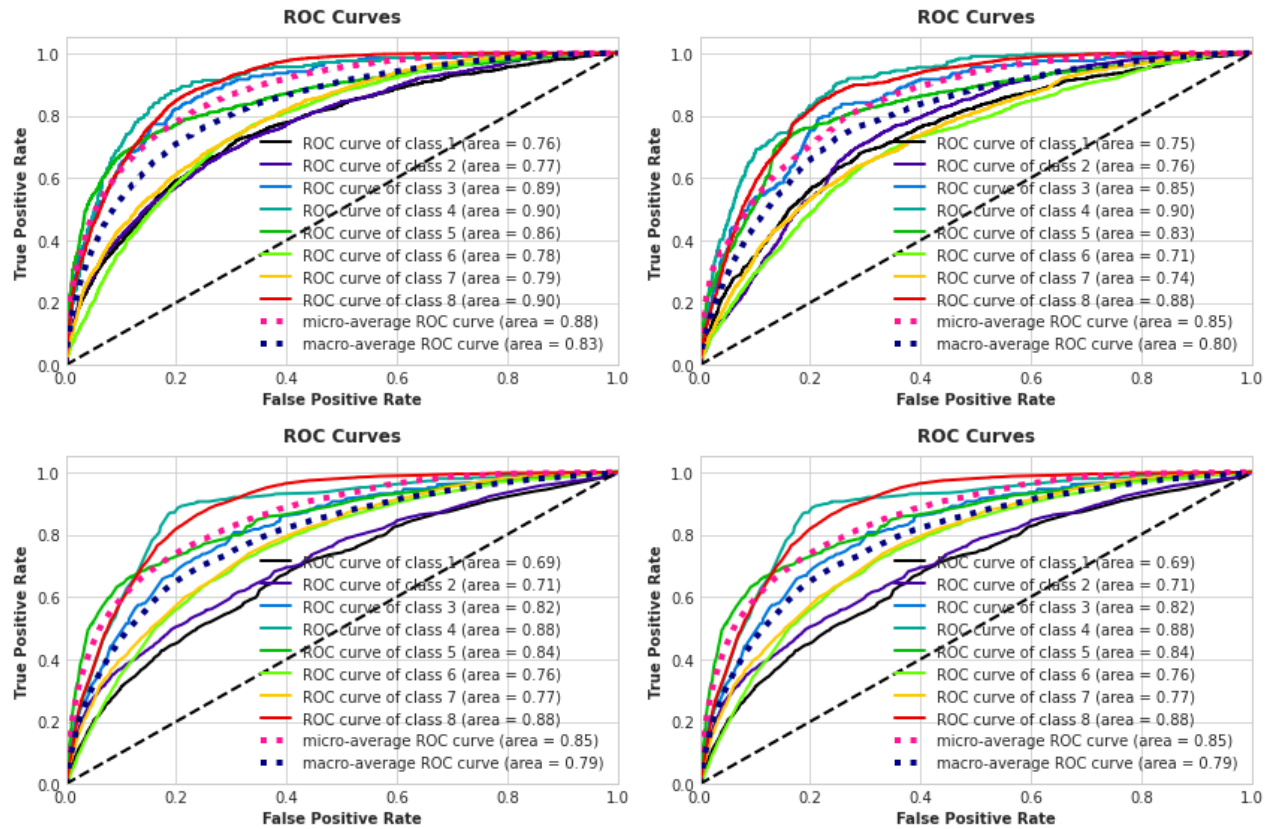


Figure 4: Receiver Operating Characteristic (ROC) Curves Comparing Model Performance KNN (top-left), DT (top-right), RF (bottom-left), and Xgboost (bottom-right).

This paper has undertaken a comprehensive exploration of sustainable administration in international business, emphasizing the critical importance of aligning corporate practices with environmental, social, and ethical considerations in a global context. Through an in-depth analysis of both the theoretical underpinnings and empirical findings, we have shed light on the multifaceted strategies employed by organizations, using Prudential Life Insurance as a case study, to foster sustainable administration. Our research underscores the significance of responsible corporate behavior in the face of global challenges and highlights the need for adaptable and resilient approaches. By applying advanced data analytical methods, including k-means clustering, and leveraging insights from the Elbow Method, we have not only provided a rigorous examination of the subject but also contributed to the ongoing dialogue on sustainable business practices. As we move forward, the findings from this study serve as a valuable resource for international businesses seeking to navigate the complexities of sustainability while striving for excellence in administration and global competitiveness. In an era defined by increased scrutiny of corporate actions and growing expectations for environmental and social responsibility, the sustainable administration of international business operations remains a dynamic and evolving field. The insights gleaned from this research offer a roadmap for organizations to navigate this ever-changing landscape, fostering positive impacts on both their bottom lines and the global communities they engage with. As we continue to confront global challenges and opportunities, embracing sustainable administration emerges as not merely a choice but a strategic imperative, one that can catalyze positive change, enhance resilience, and ultimately contribute to a more sustainable and equitable global economy.

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