STAKEHOLDER ENGAGEMENT EVALUATION OF ENVIRONMENTALLY SUSTAINABLE PACKAGING IN FOOD SUPPLY CHAIN

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ABSTRACT – The main objective of the project Stakeholder management involves facilitating the project manager's ability to take actions appropriately to the characteristics and level of interest that stakeholders have in the project's success. However negative consequences can occur, due to ineffective stakeholder management from the initial planning stage. Forty-seven stakeholders were identified as the most crucial stakeholders of the project by the experts' opinions and validated the stakeholder identification through the mapped packaging supply chain. They also finalized the 10 attributes to evaluate the intensity of each stakeholder. Every cluster possesses distinct qualities that empower the project manager to execute appropriate actions as required during the project's phases, based on the attributes employed for analysis. Finally, the importance of stakeholders' role identification is determined by five key facts: developing targeted stakeholder management strategies, optimizing resource allocation and prioritization, Proactive risk management, stakeholder collaborative decision-making, and developing strategic partnerships.

Keywords: *Sustainable Packaging, Stakeholder Management, Stakeholder Theory, Stakeholder, Classification, Unsupervised Learning*

1. INTRODUCTION

The present study suggested the effectiveness of applying unsupervised machine learning techniques to improve stakeholder management practices, thereby addressing the limitations associated with traditional stakeholder classification approaches. The manual power-interest matrix is a frequently employed tool for classifying stakeholders according to their levels of power and interest concerning the project.

However, the traditional methods have consisted of some drawbacks as simplification, the dynamic nature of the stakeholders, and the lack of differentiation. In comparison to these methods, the adoption of clustering algorithms using machine learning leads to a different and more customized perspective of analysis, whole traditional classification considers few attributes. Furthermore, the utilization of machine learning algorithms for stakeholder classification holds advantageous implications for companies.

There exists a lack of study conducted in this domain. A limited number of scholarly articles have put forth the utilization of unsupervised machine learning methodologies for stakeholder classification, thereby highlighting avenues for future research (1 & 2 & 3).

The existing body of literature has identified specific gaps in the representation of stakeholder participation within the context of sustainable supply chain management methods (2). Initially, there existed a lack of adequate representation of the significance of stakeholder engagement (3). Furthermore, although stakeholders have a significant role in project implementation, their influence might be much more delivered, underscoring the necessity for additional investigation (4).

The primary aim of this study is to achieve three key objectives connected with stakeholder management in sustainable supply chain management (SSCM) practices, with a particular focus on sustainable food and beverage packaging within the supply chain. The primary objective is to categorize stakeholders according to their characteristics concerning the achievement of project success, to strategically position the stakeholder group, and to evaluate the importance of comprehending the stakeholder's function within an organizational framework. To accomplish this objective, it was essential to identify

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the main stakeholders of the chosen project and evaluate their characteristics and placement on the power-interest matrix through the utilization of an unsupervised machine learning PAM algorithm.

One potential approach to facilitating personalized engagement strategies involves classifying stakeholders into distinct groups based on their specific features or interests. This allows companies to respond effectively to the concerns of stakeholders and make decisions with the contribution of stakeholders based on their priorities.

2. MATERIALS AND METHODS

Expert interviews are used as a means of information gathering, ensuring that both internal and external experts are included to mitigate personal biases. To mitigate the challenges associated with expert interviews, alternative methods such as online and list interviews are applied (5). Four primary unsupervised machine learning methods have been identified in the available literature. These algorithms are probabilistic, density-based, hierarchical, and partitional clustering. Based on the interview conducted with experts, it has been determined that the partitional clustering method is the most suitable strategy (6). Average silhouette analysis is used to determine the optimal number of clusters within the quadrant, and the maximum silhouette coefficient equals the optimal number of clusters (7). The main objective of the Partial Partitional Medoids Clustering (PAM) method is to decrease the overall dissimilarity, as measured by a distance metric, between data points and their corresponding medoids within each cluster. The distance measure is used to evaluate this dissimilarity.

$$Data\ Points := X = \{x_1, x_2, x_3, \dots \dots x_n\}$$
$$Number\ of\ clusters: k$$
$$Medoids: M = \{m_1, m_2, \dots \dots, m_k\}$$

The objective function: J= $\in_{(i=1)}^k \in_{(x\_j\ \varepsilon C\_i)} d(x\_j,m\_j)$

- Ci represents the data points assigned to cluster i.
- d (xj, mi) is the distance between data points xj and medoids mi.

According to the stakeholder registration, the project's power interest matrix encompassed a collective of 47 stakeholders. The aforementioned stakeholders were carefully chosen to serve as representatives for various departments and roles inside the organization. Quadrant 1, known as the "minimal effort", is characterized by low power and interest. The stakeholders were assigned to the quadrant labelled "keep satisfied" (quadrant 2), which is defined as high power and low interest. Quadrant 3, known as the "Key Players" quadrant, consisted of a significant number of stakeholders who held a crucial role and actively participated in the project. Quadrant 4, stakeholders labelled as "kept informed", shows a high level of interest and a low level of interest. Together stakeholders were categorized as needing to provide minimal effort, keeping stratified, key players within the project scope, and needing to be kept informed about the concerns and updates regarding the project

3. RESULTS AND DISCUSSION

Based on the analysis conducted, it was determined that Quadrant 4 consisted of a single stakeholder. Therefore, there was no reason for grouping the stakeholders inside Quadrant 4. Quadrants 1, 2, and 3 were required to determine the appropriate number of clusters inside each quadrant. The average silhouette analysis is used to ascertain the number of clusters in each quadrant.

Determine the significance of the stakeholder's role in establishing the basis for the organization's achievement. The significance of identifying stakeholders' roles is determined by five crucial factors to develop targeted stakeholder management strategies, optimize resource allocation and prioritization, engage in proactive risk management, facilitate stakeholder collaborative decision-making, and establish strategic partnerships.

Following that, the organization implemented the PAM algorithm to determine the most suitable quantity of medoids for each quadrant. The aforementioned stage facilitated the recognition of

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stakeholder groups distinguished by distinct characteristics and requirements, hence offering useful perspectives for the development of stakeholder engagement and management strategies.
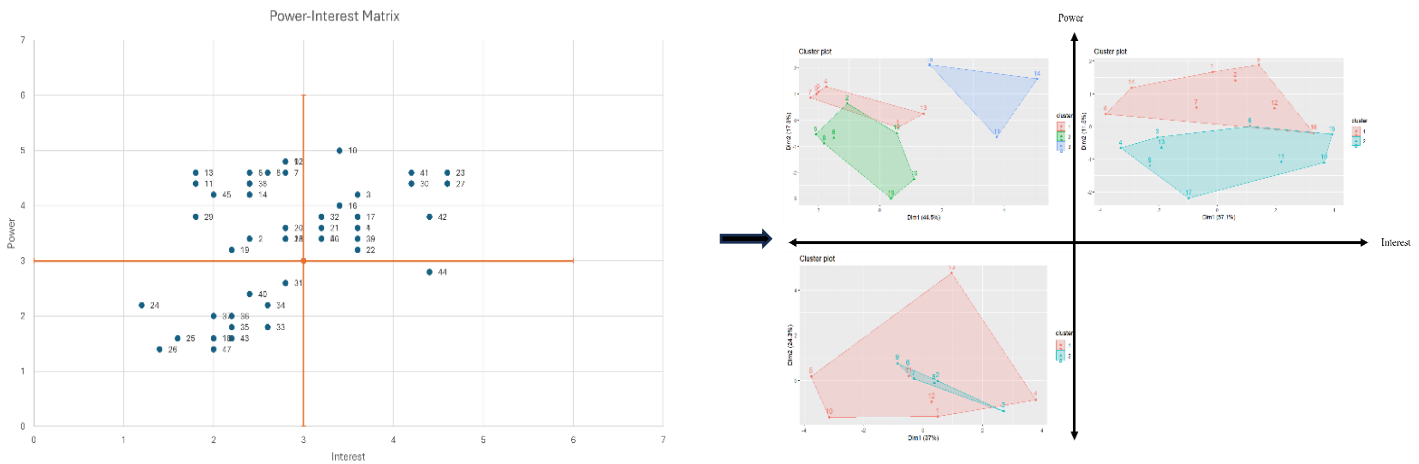

Figure 1. Stakeholder Classification Transformation from Traditional to Modern

4. CONCLUSION

The overall objective of this study is to evaluate the significance of understanding the role of stakeholders within the context of the organization. The study was limited to a sample size of 47 stakeholders involved in a particular project within the FMCG business. The distribution is somewhat constrained and is confined to a mere three quadrants of the power-interest matrix. There is a lack of study on the evolution of stakeholder classification across the lifecycle of a project, as well as not enough discussions regarding the comparison between before and after implementing the stakeholder classification. Additionally, sustainable packaging can benefit the organization by reducing environmental impact, enhancing brand reputation, and fostering stronger stakeholder relationships.

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