Machine-Learning Enabled Standardization and Supplier Management in Industrial Procurement

Problem definition

The current industrial procurement process involves a time-consuming supplier selection phase. Comparing multiple suppliers in a standardized format and utilizing past data to evaluate the participants pose challenges, creating inefficiencies and impeding the ability to make informed decisions in supplier selection. The main issues are:

- Time Consumption: The process of supplier selection in industrial procurement is labor-intensive and time-consuming leading to delays in decision-making and hampers overall efficiency.
- Difficulty in Standardized Comparison: The lack of an objective assessment of suppliers due to an heterogeneous composition of procurement teams hinders accurate and fair evaluations of relevant factors.
- Utilizing Past Data: Evaluation of the performance of suppliers is currently limited and it should be addressed by leveraging historical information to inform decision-making and identify potential risks.
- Supplier Heterogeneity: Evaluation and assessment requires in-depth analysis of potentially highly heterogeneous suppliers' quality, pricing, delivery timelines, etc.

Addressing these challenges will require the development of efficient and standardized methods for supplier selection. Leveraging Machine Learning techniques to cluster suppliers and their offers, improve understanding of the supplier market, and enable comprehensive supplier comparisons may contribute to improve the industrial procurement processes and facilitate informed decision-making.

Aims and scope of the thesis

The objective of this thesis is to automate the processes surrounding supplier management in industrial procurement and utilize historical data effectively to improve informed decision-making processes. It is of interest to develop an end-to-end implementation that utilizes historical procurement data of a suitable dataset (e.g., publicly available government data) enriched with additional exogenous information to allow for increased understanding of the supplier's offers and, thus, provide guidance in the industrial procurement process overall. This comprises the following research tasks:

1. Literature review on current practices and workflows for supplier selection as in Choi and Hartley (1996) and Krishnendu (2014)
2. Generating datasets from multiple sources, e.g., publicly available government data (i.e.: EU Ted, CanadaBuys, ...)
3. Assessing suitability of Machine Learning applications (e.g., clustering, prediction, Generative AI) for various steps within the industrial procurement process to evaluate suppliers, standardize data, and make informed procurement decisions.
4. Deploying a Machine Learning enhanced model to automate and streamline the supplier selection and evaluation process.

Related Research

- Yunfan Gao & al. (2024), Retrieval-Augmented Generation for Large Language Models: A Survey, 2312.10997. https://doi.org/10.48550/arXiv.2312.10997
- Thomas Y. Choi, Janet L. Hartley, An exploration of supplier selection practices across the supply chain, Journal of Operations Management, Volume 14, Issue 4, 1996, Pages 333-343, ISSN 0272-6963, https://doi.org/10.1016/S0272-6963(96)00091-5
- Qian, C., & Anderson, E. (2020). Buyer's optimal information revelation strategy in procurement auctions. European Journal of Operational Research, 283(3), 1011-1025. https://doi.org/10.1016/j.ejor.2019.11.061
- Mukherjee, Krishnendu. (2014). Supplier selection criteria and methods: past, present and future. International Journal of Operational Research. 27. 10.1504/IJOR.2016.10000076.

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