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Leveraging Big Data for Assessing Social Sustainability in Business

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Abstract.
Big Data (BD) technology is increasingly seen as crucial for addressing sustainability challenges. The complexity of modern business, with its interconnected stakeholders, demands a comprehensive understanding of impacts for true sustainability. This paper presents a methodology harnessing big data (BD) to examine social sustainability within businesses. Applying the methodology to a current study reveals the potential of BD to advance the social aspects of the UN's Sustainable Development Goals (SDGs).
Keywords: Big Data (BD), Big Data Analytics (BDA), Social Sustainability, Corporate Social Responsibility (CSR), Sustainable Development Goals (SDGs)

Introduction

In the ever-evolving business landscape, companies are increasingly aware of the intricate relationship between environmental, social, and economic factors, and how these elements influence their overall strategy. To navigate these complex, often conflicting issues, novel approaches to business intelligence are essential. Today, the ability to extract valuable data from reliable sources is considered the most critical factor in gaining a competitive advantage.

Big Data Analytics (BDA) technology equips businesses with powerful tools for analysing vast datasets. These sophisticated tools allow companies to unlock valuable insights and guide their sustainability efforts, impacting both their own operations and their sustainable supply chains (SC). BDA, for example, can assist in identifying potential issues associated with specific companies, such as links to local pollution, human rights abuses, or child labour. Furthermore, BDA holds the potential to predict and prevent risks, thereby fostering innovation and fostering social development within businesses and their broader communities.

However, despite the promising outlook, research on the full potential of BDA in achieving corporate sustainability and conducting comprehensive sustainability analysis (SA) is still in its early stages. A deeper understanding is needed regarding how to effectively leverage BDA technology to address social sustainability concerns. Additionally, businesses need to find ways to integrate the United Nations' 'Sustainable Development Goals' (SDGs) into their practices, particularly with a focus on benefiting vulnerable individuals within society. This crucial step towards integrating the SDGs requires more than just awareness; it necessitates a shift in the current approach to utilizing the Big Data ecosystem to prioritize the well-being of all stakeholders, especially society's most vulnerable populations. By embracing BDA and strategically integrating the SDGs into their operations, businesses have the potential to become not only economically competitive but also responsible corporate citizens, actively contributing to a more sustainable future for all.

BD and BDA

Big Data: Unlocking the Power of Information for a Sustainable Future

In today's era of rapid technological advancement, data has become the lifeblood of modern businesses. However, managing and extracting value from this ever-growing deluge of information presents a significant challenge. This is where **Big Data (BD)** comes into play, revolutionizing how companies approach business intelligence and navigate the complexities of the contemporary business environment.

BD encompasses vast quantities of structured, semi-structured, and unstructured data that traditional data management systems struggle to handle effectively. This data, characterized by its **five Vs**: **volume**, **velocity**, **variety**, **veracity**, and **value**, presents both challenges and opportunities for businesses. The sheer volume of data requires robust processing capabilities, while its velocity necessitates real-time or near real-time analysis . Variety refers to the diverse formats of data, such as text, images, video, and sensor readings, demanding flexible analytical tools. Veracity emphasizes the importance of data source reliability and quality to ensure trustworthy insights. Finally, value highlights the ultimate goal of transforming data into actionable knowledge that drives informed decision-making.

Big Data Analytics (BDA) emerges as the game-changer, providing businesses with the tools to unlock the immense potential hidden within BD. BDA encompasses a set of technologies and methodologies designed to process, analyze, and extract meaningful insights from this complex data landscape . By leveraging BDA, businesses gain a deeper understanding of their operations, customers, and market trends, empowering them to make informed choices and develop effective strategies.

The benefits of BDA extend far beyond traditional business metrics, playing a crucial role in achieving **corporate sustainability**. In a world facing growing environmental and social challenges, businesses are increasingly called upon to operate responsibly and contribute positively to society. BDA empowers companies in several key ways:

Identifying and addressing social sustainability challenges: By analyzing data from various sources, including social media sentiment analysis, supply chain audits, and environmental impact reports, BDA helps identify issues like human rights violations, child labor, or local pollution linked to specific companies or their suppliers. This enables businesses to take proactive measures like ethical sourcing, fair labor practices, and investments in sustainable technologies to address these concerns.

Predicting and mitigating risks: BDA allows businesses to anticipate potential sustainability risks, such as the impact of climate change on resource availability or extreme weather events on supply chains . This proactive approach enables companies to develop mitigation strategies, invest in disaster preparedness, and adapt their business models to ensure long-term resilience.

Achieving the UN's Sustainable Development Goals (SDGs): BDA can be used to track progress towards achieving the SDGs, a global framework for addressing interconnected social, environmental, and economic challenges. By monitoring key metrics and identifying areas of improvement, businesses can contribute to a more sustainable future, fostering social good while maintaining economic viability.

However, realizing the full potential of BDA requires addressing existing challenges:

Data security and privacy: Ensuring the ethical and secure handling of large amounts of personal and sensitive data remains a critical concern. Businesses need to implement robust security measures, comply with data privacy regulations, and prioritize transparency in how they collect, store, and use data.

Integration with existing systems: Integrating BDA with existing business systems and infrastructure can be complex and require dedicated resources. Businesses need to develop robust data pipelines, invest in technology infrastructure upgrades, and create workflows that seamlessly integrate BDA insights into core business operations.

Skilled workforce: Utilizing BDA effectively requires a skilled workforce capable of understanding, managing, and interpreting the insights derived from the data. Businesses need to invest in training programs and recruit individuals with expertise in data science, analytics, and information technology.

Despite these challenges, BDA holds immense potential for transforming businesses and driving them towards a more sustainable future. By embracing this powerful technology and addressing the existing hurdles, businesses can gain a competitive edge, enhance their sustainability performance, and contribute positively to society. Additionally, collaboration amongst businesses, governments, and academia can foster the development of ethical frameworks, technological advancements, and educational initiatives to ensure BDA is used responsibly and effectively for a more sustainable future for all.

Methodology

Big Data Analytics Methodology for Assessing Social Sustainability of Enterprises

This research proposes a methodology utilizing Big Data Analytics (BDA) to assess the social sustainability impacts of enterprises operating across diverse activity sectors. The core objective is to analyse how these enterprises influence society through their environmental and economic activities.

Data Source and Selection

Dataset: We leverage the Corporate Environmental Impact (CEI) dataset from Harvard Business School, which provides monetized measures of environmental impact for various business operations. This monetization, achieved through the combined expertise of established academic databases, facilitates a clear understanding of the financial implications of environmental impact.

Selection Criteria:

Sample Size:549 enterprises

Sector Representation: 10 different activity sectors

Geographic Scope: 59 countries around the globe

Selection Basis: Total environmental cost (TEC) of each activity sector

Variables and Measurement

Environmental Impact Variables:

- **Fish Production Impact Cost (FC):** This variable reflects the environmental impact associated with fish production, encompassing factors like habitat destruction and pollution.
- **Crop Production ImpactCost (CPC):** This reflects the environmental cost associated with agricultural practices, including land-use change, water usage, and chemical application.
- **Meat Production Impact Cost (MPC):** This captures the environmental impact of meat production, considering factors like greenhouse gas emissions, deforestation, and resource depletion.
- **Water Consumption and Impact Cost (WCC):** This reflects the environmental cost associated with water usage and its impact on ecosystems and surrounding communities.

Social Impact Measurement:

Social impact is measured through their correlation with relevant Sustainable Development Goals (SDGs) established by the United Nations. These goals encompass a wide range of social and environmental objectives, allowing us to assess the potential social consequences of different enterprises' activities.

Data Analysis Techniques

Descriptive Statistics:

Calculate mean, standard deviation, minimum, and maximum values for each variable to understand data characteristics and distribution.

Correlation Analysis:

Assess the strength and direction of relationships between:

- Environmental impact variables (FPC, CPC, MPC, WCC)
- Social impact variable in terms of sustainable development goals (SDGs)
- Utilize Pearson correlation coefficients to quantify the relationships.

Discount Rate Sensitivity Analysis:

Analyze the impact of different discount rates (e.g., 0% and 3%) on the monetized environmental costs.

This helps account for the time value of money when evaluating future environmental impacts.

Big Data Analytics Framework

Apache Spark: This platform will be employed due to its:

Advanced execution engine supporting in-memory computing and acyclic data flow.

Resilient Distributed Datasets (RDDs) for efficient parallel processing across cluster nodes.

Improved computational efficiency compared to traditional methods.

Compatibility with Scala, Python, and R programming languages.

Machine Learning (MLlib): This library within Apache Spark allows for:

Building models that learn from data and potentially predict future social impacts.

Table 1 Statistics Summary for Key Metrics Across Variables

Summary	TEC	WC	FPC	CPC	MPC	WPCC
Count	4136	4136	4136	4136	4136	4136
Mean	-1.64856172128682E9	-1.00358424736829E9	-310086.93672090216	-1.245727332024189E7	-2789991.3537682267	-4.654193526752256E8
Stddev	5.000021193808253E9	2.8991938047000713E9	824189.7063848815	3.450558119883396E7	7761911.215669795	4.810333329461172E9

Min	-1.56228944661009E11	-3.20592624219893E10	-7956851.29063824-3.48480458785937E8 7.78934932986797E7	--	1.30597121892545E11
Max	1.47277465251449E10	3.86720080034559E9	155444.9191888251.08174513802071E8 2.32701455270569E7		2.11511873032397E10

SDG1	SDG2	SDG3	SDG4	SDG5	SDG6	SDG8
4136	4136	4136	4136	4136	4136	4136
-4.015290996439707E8	-2.659472157266567E8	-2.6562817032300606E8	-3114306.6953909346	-3114365.0299417847	-4.332214437519523E7	-5014844.605026698
1.1155910922003942E9	7.024148533706778E8	7.01636079155351E8	8626086.788805913	8626193.61239161	1.140725920022496E8	6.118088521736656E7
-1.11702004162576E10	-6.85387387240512E9	-6.84788779515546E9	-8.7120178612542E7	-8.71201786464842E7	-1.12053698691694E9	-1.37263909821984E9
3.26504894592947E9	2.87052319292295E8	2.8697818801901E8	2.70439238308939E7	2.70396385538954E7	4.5485275113638E7	0.0

Table 2. SDGs definitions forms

SDG	Definition
SDG1	Target of 2030, *building the resilience* of people in vulnerable situations and *minimize their exposure and vulnerability* extreme events relating to climate, social, and environmental shocks and disasters.
SDG2	Target of 2030, *ending hunger by providing food security*, specifically the poor and people in vulnerable situations, including infantsall year round.
SDG3	Target of 2030, *end each and every malnutrition*, including addressing, by 2025, the internationally agreed targets on wasting of children under 5 years of age, and *addresses the nutritional needs* of adolescent girls, pregnant and lactating women, and older persons.
SDG4	Target of 2030, *doubles theproductivity relating to agriculture in all forms and also double the incomes of small food producers*, in particular women working on farms, family farmers, pastoralists, and fishers, including through secure and equal access to land, other productive resources, and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.
SDG5	Target of 2030, *ensuring sustainable food is produced and implementation of resilient agricultural practices* that will inherently increase productivity and, help maintain ecosystems, strengthening the capacity for adaptation in regard to climate change, drought, flooding, and other disasters, and progressively improve land and soil quality.
SDG6	Target of 2030, *ends the epidemics which are related with AIDSand HIV, tuberculosis, malaria, water-borne diseases, and other communicable diseases which are generally not treatable due to non-access of resources.*
SDG8	Target of 2030, *reducing substantially the number of deaths and illnesses which are derived from hazardous chemicals use along with air, water, and soil pollution and contamination.*

Expected Outcomes

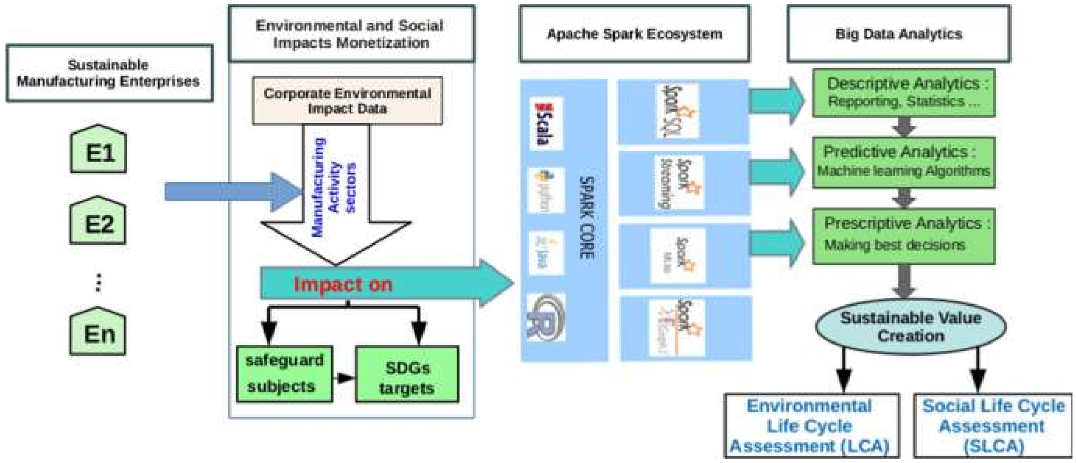
Identify significant relationships between environmental impacts and social outcomes.

Gain insights into how enterprises from different sectors impact society through their environmental and economic activities.

Utilize Apache Spark platform to efficiently manage and analyze the large data volume.

Develop potential predictive models for social impacts using MLlib.

This methodology provides a valuable tool for understanding the complex interplay between the environmental and social impacts of enterprises. By analyzing these connections, businesses and policymakers can gain crucial insights to navigate towards a more sustainable future.



Framework for Sustainable Value Creation Using Big Data Analytics and Life Cycle Assessment in Manufacturing Enterprises

CONCLUSION

Results:

This research successfully established a BDA-based methodology to assess the social sustainability of enterprises across various sectors. Through analysis, the study revealed:

Strong correlation: A significant relationship exists between environmental impacts captured by TEC and social outcomes measured by SDGs. This implies that enterprises with higher environmental impact potentially have a greater influence on society, both positively and negatively.

Sectoral impact: Specific sectors, like electricity production and petroleum refining, were identified as having the highest environmental impact based on TEC calculations. These sectors are likely to have a substantial influence on social outcomes.

Environmental & social link: The study found that increasing environmental damage can worsen working conditions for vulnerable populations, potentially affecting their labor decisions and overall well-being.

Positive findings:

Transparency and collaboration: The study identified an encouraging trend of enterprises demonstrating transparency regarding their social impact and actively collaborating to achieve the SDGs agenda Target of 2030. This collaboration across sectors suggests a growing awareness of collective responsibility for societal challenges.

Prediction model: A prediction model built using TEC and safeguard subjects achieved promising accuracy in predicting the monetization of specific SDGs. This successful model development suggests the potential for BDA to proactively address social sustainability concerns.

Future Scope:

While this research provides valuable insights, further exploration is crucial for a more comprehensive understanding:

Causal relationships: The study identified correlations, but further research is needed to establish causal relationships between environmental and social factors. This will provide a clearer picture of the cause-and-effect dynamics underlying the observed social consequences.

Sector-specific analysis: Conducting a deeper analysis within individual activity sectors could reveal unique patterns and opportunities for tailored interventions to address specific social challenges arising from environmental impact.

Holistic assessment: Integrating data on additional factors like labor practices, supply chain standards, and community engagement would paint a more holistic picture of an enterprise's overall social impact, capturing both positive and negative aspects.

This BDA-based methodology offers a valuable tool for understanding the intricate relationship between environmental and social impacts of enterprises. By leveraging this framework and addressing the future research areas, businesses and policymakers can gain crucial insights to make informed decisions and work collaboratively towards a more sustainable future where environmental and social well-being go hand-in-hand.

This summary section incorporates the key findings and emphasizes the positive takeaways from the research. It also clearly outlines potential areas for future exploration, highlighting the need for further investigation to gain a deeper understanding of the complex interplay between environmental and social factors.

References

1. Sánchez-Corcuera, R., Nuñez-Marcos, A., Sesma-Solance, J., Bilbao-Jayo, A., Mulero, R., Zulaika, U., Azkune, G., & Almeida, A. (2019). Smart cities survey: Technologies, application domains and challenges for the cities of the future. *International Journal of Distributed Sensor Networks*, 15(3), 1550147719853984.

2. Yin, C., Xiong, Z., Chen, H., Wang, J., Cooper, D., & David, B. (2015). A literature survey on smart cities. *Science China Information Sciences*, 58(1), 1–18.

3. Giffinger, R., & Gudrun, H. (2010). Smart cities ranking: An effective instrument for the positioning of the cities? *ACE: Architecture, City and Environment*, 4, 7–26.

4. Alexopoulos, C., Pereira, G.V., Charalabidis, Y., & Madrid, L. (2019). A taxonomy of smart cities initiatives. In *Proceedings of the 12th International Conference on Theory and Practice of Electronic Governance* (pp. 1–10). ACM.

5. Kehoe, M., Cosgrove, M., Gennaro, S., Harrison, C., Harthoorn, W., Hogan, J., Meegan, J., Nesbitt, P., & Peters, C. (2011). *Smart Cities Series: A foundation for understanding IBM smarter cities*. IBM Redbooks.

6. Osman, A.M.S., Elragal, A., & Bergvall-Kåreborn, B. (2017). Big data analytics and smart cities: A loose or tight couple? In *Proceedings of the 10th International Conference on Connected Smart Cities (CSC 2017)* (pp. 1–6). IEEE.

7. Silva, B.N., Khan, M., Jung, C., Seo, J., Muhammad, D., Han, J., Yoon, Y., & Han, K. (2018). Urban planning and smart city decision management empowered by real-time data processing using big data analytics. *Sensors*, 18(9), 2994.

8. Silva, B.N., Khan, M., Seo, J., Muhammad, D., Yoon, Y., Han, J., & Han, K. (2018). Exploiting big data analytics for urban planning and smart city performance improvement. In *Proceedings of the 12th International Conference on Signal Processing and Communication Systems (ICSPCS)* (pp. 1–6). IEEE.

9. Lau, B.P.L., Marakkalage, S.H., Zhou, Y., Hassan, N.U., Yuen, C., Zhang, M., & Tan, U.-X. (2019). A survey of data fusion in smart city applications. *Information Fusion*, 52, 357–374.

10. Osman, A.M.S. (2019). A novel big data analytics framework for smart cities. *Future Generation Computer Systems*, 91, 620–633.

11. Alsaig, A., Alagar, V., Chammaa, Z., & Shiri, N. (2019). Characterization and efficient management of big data in IoT-driven smart city development. *Sensors*, 19(11), 2430.

12. Pérez-Chacón, R., Luna-Romera, J.M., Troncoso, A., Martínez-Álvarez, F., & Riquelme, J.C. (2018). Big data analytics for discovering electricity consumption patterns in smart cities. *Energies*, 11(3), 683.

13. Honarvar, A.R., & Sami, A. (2019). Towards sustainable smart city by particulate matter prediction using urban big data, excluding expensive air pollution infrastructures. *Big Data Research*, 17, 56–65.

14. Fiore, S., Elia, D., Pires, C.E., Mestre, D.G., Cappiello, C., Vitali, M., Andrade, N., Braz, T., Lezzi, D., Moraes, R., et al. (2019). An integrated big and fast data analytics platform for smart urban transportation management. *IEEE Access*, 7, 117652–117677.

15. Costa, C., & Santos, M.Y. (2016). BASIS: A big data architecture for smart cities. In *Proceedings of the SAI Computing Conference* (SAI) (pp. 1–8). IEEE.

16. Nandury, S.V., & Begum, B.A. (2016). Strategies to handle big data for traffic management in smart cities. In *Proceedings of the 2016 International Conference on Advances in Computing, Communications and Informatics (ICACCI)* (pp. 1–7). IEEE.

17. Psomakelis, E., Aisopos, F., Litke, A., Tserpes, K., Kardara, M., & Campo, P.M. (2016). Big IoT and social networking data for smart cities: Algorithmic improvements on big data analysis in the context of RADICAL city applications. *arXiv* Preprint.

18. Pal, D., Triyason, T., & Padungweang, P. (2018). Big data in smart-cities: Current research and challenges. *Indonesian Journal of Electrical Engineering and Informatics (IJEEI)*, 6(3), 351–360.

19. Mikalef, P., Pappas, I.O., Krogstie, J., & Giannakos, M. (2018). Big data analytics capabilities: A systematic literature review and research agenda. *Information Systems and e-Business Management*, 16(3), 547–578.

20. Souza, A., Figueredo, M., Cacho, N., Araújo, D., & Prolo, C.A. (2016). Using big data and real-time analytics to support smart city initiatives. *IFAC-PapersOnLine*, 49(1), 257–262.