"The Impact of the Organizational DNA on Social Sustainability Performance through Green Training as a Mediating Variable: A Study on the Private Steel Industrial Companies in Egypt"

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ABSTRACT

This study investigates the influence of Organizational DNA (ODNA) on Social Sustainability Performance (SSP) through the mediating role of Green Training (GT) within Egypt's private steel industry. The research aims to provide an in-depth understanding of how an organization is structural, cultural, and strategic elements contribute to sustainable social outcomes when aligned with environmentally oriented training initiatives. Data were collected via a structured questionnaire distributed to employees in several private steel companies across Egypt, with responses analyzed using Structural Equation Modeling (SEM) to test the proposed hypotheses. The findings reveal that ODNA significantly and positively affects both GT and SSP. Moreover, GT plays a partial mediating role in the relationship between ODNA and SSP, emphasizing the necessity of integrating sustainability-driven training within organizational DNA frameworks. The study contributes theoretically by linking ODNA to social sustainability through an environmental human resource practice, and practically by guiding industrial firms toward adopting sustainable workforce development strategies.

Keywords: Organizational DNA, Green Training, Social Sustainability, Mediation, Steel Industry, Egypt.

Research Framework

INTRODUCTION

In recent years, the pursuit of sustainability has evolved from a peripheral concern into a strategic imperative for modern organizations. While the environmental and economic dimensions of sustainability have received extensive attention, the social dimension, which focuses on equity, employee well-being, community engagement, and responsible organizational behavior, has only recently gained prominence. In developing economies such as Egypt, the steel industry plays a vital role in national development but simultaneously faces increasing pressure to adopt socially responsible and environmentally sound practices.

Organizational DNA (ODNA), a metaphor describing the underlying genetic code of an organization its structures, processes, culture, international leadership patterns has emerged as a critical determinant of organizational adaptability and performance. A resilient and sustainability-oriented ODNA enables companies to internalize social values, promote inclusiveness, and drive long-term social impact. However, transforming these structural characteristics into measurable social outcomes requires deliberate human resource interventions most notably.

Green Training (GT).

Green Training refers to educational and developmental programs designed to raise employees' environmental awareness, foster sustainable work behaviors, and enhance organizational sustainability performance. By embedding green learning into the organization's core systems, firms can align their workforce competencies with sustainability objectives, thereby amplifying the positive effects of ODNA on social outcomes.

Despite increasing scholarly interest in organizational sustainability, few empirical studies have examined how ODNA influences social sustainability performance through GT, particularly within developing countries and resource-intensive sectors. Addressing this gap, the current study explores this relationship in Egypt's private steel industry a sector characterized by high environmental impact, complex production processes, and growing social accountability demands.

This study examines the impact of Organizational DNA (ODNA) on Social Sustainability Performance (SSP) through Green Training (GT) as a mediating variable within Egypt's private steel industry, focusing on El Marakby Steel Company. Using a mixed-method design, data were collected from 553 respondents through structured questionnaires and managerial interviews. Quantitative analysis was conducted using SPSS 27, AMOS, and Smart PLS 4 to test the hypothesized structural relationships.

Results revealed that ODNA has a strong and positive influence on GT ($\beta = 0.785$, $p < 0.001$) and SSP ($\beta = 0.367$, $p < 0.001$). Moreover, GT significantly enhances SSP ($\beta = 0.539$, $p < 0.001$), confirming its mediating role ($\beta = 0.423$, $p < 0.001$). The model demonstrated high explanatory power with $R^2 = 0.616$ for GT and $R^2 = 0.736$ for SSP. Correlation results also showed strong positive associations among the main constructs ($r = 0.833$ between ODNA and SSP; $r = 0.825$ between GT and SSP). The findings underscore that well-structured organizational DNA fosters sustainability-oriented training, leading to improved social performance outcomes within industrial settings.
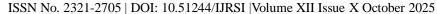
1.2. Research Gap

Today, industrial enterprises are essential drivers of economic growth and vitality within their communities. Consequently, it is imperative to develop models and research that empower these businesses to enhance their performance. A deeper understanding of organizational DNA can significantly contribute to their success and competitiveness. This research seeks to uncover the unique managerial DNA of industrial companies in Egypt.

While studies by Bubicz, Barbosa-Póvoa, and Carvalho (2019) and Sodhi and Tang (2018) reveal the complexities of implementing and evaluating companies' social sustainable practices (SSP), this issue has garnered increasing attention in recent years, especially in emerging Asian economies (Mathiyazhagan et al., 2021; Nath and Agrawal, 2020; Bai et al., 2019). Yet, there remains a notable gap in research on how firms measure **SSP**, particularly in emerging African economies (Mani et al., 2020; Bubicz et al., 2019). Addressing this gap is crucial for fostering effective strategies that can enhance sustainability and performance in the industrial sector.

The existing literature reveals a compelling oversight: social sustainability has remained largely underexplored until recent years (Silvestre, 2015). As Morais and Silvestre (2018) emphasize, this neglect can be attributed to the complexities of implementing social initiatives compared to the more straightforward environmental objectives (Ashby et al., 2012). Moreover, discussions surrounding sustainability have frequently been confined to theoretical frameworks, failing to translate into concrete, practical applications. This gap underscores a critical need for corporations to develop effective strategies for measuring social sustainability, alongside clearly defined metrics for evaluation.

A comprehensive examination of Social Sustainability Initiatives (SSIs) in the steel sector is notably lacking. While SSIs have been thoroughly studied in other industries—such as supply chains, bio economy, mining, manufacturing, construction, and software development—the steel industry has been overlooked. As a result, academics, practitioners, and policymakers in the steel sector do not have strong criteria for identifying and

implementing appropriate SSIs that address their specific challenges and objectives. Bridging this gap is not just beneficial; it is essential for creating a truly sustainable future in the steel industry.

1.3. Research Problem

This study aims to investigate the impact of organizational DNA, uncovering its critical factors: decision right, information, motivations and structure on SSP through green training as a mediator in a vital sector of the Egyptian economy, enhancing our understanding of organizational dynamics and their impact on effectiveness

Thus, the research problem addressed can be summarized in the following research questions:

1. To what extent do decision rights within organizational DNA influence social sustainability performance (SSP) in Egypt's private steel industry?
2. How significantly does the flow of information inherent in organizational DNA impact SSP in Egypt's private steel sector?
3. In what ways do motivators embedded in organizational DNA drive SSP outcomes in Egypt's private steel companies?
4. What is the effect of organizational structure, as a component of organizational DNA, on SSP in Egypt's private steel industry?
5. In what ways does green training act as a crucial mediating variable in the relationship between organizational DNA and social sustainability performance (SSP) within private steel companies in Egypt?

1.4. Research Objectives

The main objective of this research is to investigate the impact of the Organizational DNA on Social Sustainability Performance through Green Training as a Mediating Variable: A Study on the Private Steel Industrial Companies in Egypt. Specifically, the research aims to:

1. To investigate the relationship between the distribution of decision rights and the implementation and effectiveness of social sustainability initiatives.
2. To evaluate the role of information transparency and communication channels in promoting and monitoring social sustainability.
3. To examine how formal and informal organizational motivators shape behaviors and attitudes towards social sustainability.
4. To diagnose how the formal organizational structure facilitates or impedes the integration of social sustainability into core operations.
5. To determine the mediating role of green training in the causal pathway between the components of organizational DNA (decision rights, information flow, motivators, structure) and Social Sustainability Performance (SSP).

1.5. Researcher Importance

This research will make several key contributions to the theoretical and empirical body of knowledge:

1.5.1. Academic Importance

1. Bridging Theoretical Domains: It integrates three distinct theoretical streams: organizational theory (**Organizational DNA**), sustainability theory (**Social Sustainability Performance**), and human resource development (**Green Training**). This creates a novel and comprehensive theoretical model that explains how internal organizational factors lead to sustainability outcomes.

2. The study fills a critical gap in the literature by focusing on heavy industrial context, namely the private steel industry in Egypt. This sector is a cornerstone of economic development but is often

criticized for its environmental and social impacts (safety, labor conditions). Studying sustainability is of high relevance.

1.5.2. Practical Importance

The findings of this research will have direct and actionable implications for various stakeholders including Managers and Executives, investors and employees in the Steel Industry as follows:

1. The study will provide a clear "blueprint" showing that investing in organizational design (DNA) is not just an administrative exercise but also a strategic lever for achieving sustainability.
2. It will offer evidence-based insights on which element of Organizational DNA—be it decentralizing decision rights, improving information flow, or redesigning motivators—has the greatest impact on enabling green training and, consequently, social performance.
3. Improved Working Conditions as the ultimate practical outcome is the potential for safer, fairer, and healthier working environments for employees in the steel industry.
4. Socially responsible investors can use the findings as a lens to evaluate companies. A firm with a healthy organizational DNA and robust training programs may be seen as a lower social risk and a more sustainable long-term investment.

By empirically testing this model, the study contributes to the existing body of knowledge on organizational sustainability and provides actionable insights for managers seeking to integrate social responsibility into the organizational fabric through targeted green training strategies.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1 Organizational DNA (ODNA) and Social Sustainability Performance (SSP)

Organizational DNA (ODNA) represents the deep structural and cultural patterns that define how an organization thinks, acts, and evolves (Neilson, Pasternack & Mendes, 2004). It encapsulates the essential components such as strategy, structure, decision-making style, and cultural alignment that collectively determine organizational behavior. A well-aligned ODNA enables firms to develop coherent systems that promote innovation, ethical conduct, and long-term sustainability (Malik et al., 2021).

Social Sustainability Performance (SSP), on the other hand, emphasizes an organization's contribution to human well-being, community development, employee welfare, and social equity (Hutchins & Sutherland, 2008). Firms with robust ODNA typically exhibit stronger social performance, as their internal "genetic code" fosters responsibility, inclusiveness, and stakeholder engagement (Ali et al., 2022). By embedding social values into their structures and decision systems, organizations ensure that sustainability becomes part of their identity rather than a peripheral initiative.

Empirical evidence supports a positive link between ODNA and SSP, suggesting that adaptive and value-oriented organizational cultures enhance social responsiveness (Eizenberg & Jabareen, 2017). Therefore, it is hypothesized that:

H1: Organizational DNA has a significant positive impact on social sustainability performance.

2.2 The Mediating Role of Green Training

The link between ODNA and SSP may not be purely direct; rather, GT can act as a strategic mechanism that channels the influence of organizational DNA toward sustainable social outcomes. When organizations integrate sustainability principles into their DNA, they tend to invest in GT programs that build employees' environmental and social competencies, which in turn lead to improved SSP (Roscoe et al., 2019).

Theoretically, this relationship can be explained through the Resource-Based View (RBV) and Dynamic Capabilities Theory, which posit that organizational resources such as knowledge, learning culture, and human capital are critical for sustaining competitive advantage. GT represents a dynamic capability that operationalizes the sustainability-oriented values embedded in ODNA.

Empirical studies confirm that **GT** mediates the relationship between strategic organizational factors and sustainability outcomes by fostering the transfer of sustainability knowledge into practice (Yusliza et al., 2020). Therefore, it is hypothesized that

H2: Green training mediates the relationship between organizational DNA and social sustainability performance.

2.3 Green Training and Social Sustainability Performance

Green Training plays a vital role in translating sustainability-oriented policies into practice. Through structured educational programs, employees develop environmental awareness, social responsibility, and the competencies necessary to engage in sustainable behaviors that benefit both the organization and society (Jabbour & Santos, 2008).

GT not only enhances operational efficiency and reduces environmental risks but also promotes fairness, safety, and well-being key dimensions of social sustainability (Tang et al., 2018). In industrial contexts like Egypt's steel sector, GT initiatives can improve workplace safety standards, employee engagement, and community reputation, all of which strengthen SSP.

H3: Green training has a significant positive impact on social Sustainability performance.

3. RESEARCH METHODOLOGY

3.1 Research Design and Approach

This study adopted a quantitative, explanatory research design aimed at empirically testing the hypothesized relationships among Organizational DNA (ODNA), Green Training (GT), and Social Sustainability Performance (SSP). The research employed a cross-sectional survey strategy to collect data from employees working in Egypt's private steel companies. The quantitative approach was selected to enable statistical testing of the proposed model and to ensure generalizability of the findings within the industrial sector.

Structural Equation Modeling (SEM) using SmartPLS 4.0 was applied to examine both the measurement and structural models. This method is particularly suitable for studies involving latent constructs and mediation effects, as it allows for simultaneous estimation of multiple relationships and validation of construct reliability and validity.

3.2 Population and Sample

The study population consisted of employees from private steel manufacturing companies operating in Egypt, which represent a significant segment of the national steel industry. A stratified random sampling technique was used to ensure representation from different managerial levels (top management, middle management, and operational staff).

A total of 673 questionnaires were distributed, out of which 553 valid responses were returned and used for analysis, representing a response rate of 82%. This sample size meets the recommended minimum for SEM analysis (Hair et al., 2019), ensuring adequate statistical power and model reliability.

3.3 Data Collection Instrument

Data were gathered through a structured questionnaire developed based on previously validated scales from the literature. All items were measured using a five-point Likert scale, ranging from 1 ("strongly disagree") to

5 ("strongly agree"). The questionnaire consisted of four sections:

1. **Demographic Information** (gender, age, education, job level, years of experience).
2. **Organizational DNA (ODNA)** – measured through four subdimensions: structure, culture, leadership, and strategy alignment (Neilson et al., 2004).
3. **Green Training (GT)** – measured through three subdimensions: environmental training effectiveness, green knowledge acquisition, and sustainability awareness (Pham et al., 2020).
4. **Social Sustainability Performance (SSP)** – assessed through dimensions such as employee wellbeing, community engagement, equity, and workplace safety (Hutchins & Sutherland, 2008).

All scales were adapted to the Egyptian industrial context, ensuring linguistic and cultural appropriateness through a **translation back translation** process. A pilot study with 30 respondents confirmed the clarity and reliability of the instrument.

3.4 Data Analysis Techniques

Data analysis was conducted in three stages:

1. **Preliminary Analysis:** Data screening for missing values, outliers, and normality.
2. **Measurement Model Assessment:** Testing internal consistency reliability using Cronbach's Alpha and **Composite Reliability (CR)**, and validity using Average Variance Extracted (AVE) and Fornell–Larcker criterion.
3. **Structural Model Assessment:** Evaluating hypothesized relationships through path coefficients, tvalues, and R^2 values using the bootstrapping method with 5,000 subsamples.

The mediating role of Green Training was tested using the indirect effects approach recommended by Preacher and Hayes (2008) within the PLS framework.

3.5 Ethical Considerations

The research adhered to academic ethical standards by ensuring voluntary participation, anonymity, and confidentiality of all respondents. Participants were informed about the study's purpose and provided consent prior to completing the questionnaire. The study received approval from the Academic Research Ethics Committee at The Arab Academy for Management, Banking and Financial Sciences, where the doctoral research was conducted.

RESULTS AND DISCUSSION

This chapter presents the empirical analysis and hypothesis testing of the proposed research framework that investigates the impact of Organizational DNA (ODNA) on Social Sustainability Performance (SSP) through Green Training (GT) as a mediating variable. The analysis draws upon data collected from 553 participants working in El Marakby Steel Company, representing managerial and operational levels. Data collection was conducted through a structured questionnaire supplemented by semi-structured interviews with selected managers to enrich the contextual understanding.

Quantitative analyses were performed using SPSS version 27, AMOS, and SmartPLS version 4, ensuring methodological rigor and robust validation of the measurement and structural models. The chapter includes the assessment of construct validity and reliability using Cronbach's Alpha, Composite Reliability (CR), and

Average Variance Extracted (AVE). Results confirmed acceptable reliability levels (CA > 0.78; CR > 0.80; AVE > 0.54).

The Kaiser–Meyer–Olkin (KMO) value of 0.951 and the Bartlett's test ($p < 0.001$) indicated sampling adequacy for factor analysis. Subsequent SEM analysis confirmed strong predictive power of the model with R^2 values of 0.616 for GT and 0.736 for SSP, signifying that ODNA and GT jointly explain over 73% of the variance in social sustainability performance.

Correlation analysis revealed highly significant relationships among the main variables ($r = 0.833$ between ODNA and SSP; $r = 0.825$ between GT and SSP; $r = 0.794$ between ODNA and GT). Path analysis indicated that ODNA significantly affects GT ($\beta = 0.785$, $p < 0.001$) and SSP ($\beta = 0.367$, $p < 0.001$), while GT also significantly influences SSP ($\beta = 0.539$, $p < 0.001$). Moreover, GT partially mediates the ODNA–SSP relationship ($\beta = 0.423$, $p < 0.001$), emphasizing its central role in translating organizational structure and culture into sustainability-oriented outcomes.

4.1 Measurement Model Assessment

Before testing the hypotheses, the reliability and validity of the measurement model were evaluated. All constructs demonstrated strong internal consistency, with Cronbach's Alpha values ranging between 0.86 and 0.93, and Composite Reliability (CR) values exceeding 0.90, confirming excellent reliability.

The Average Variance Extracted (AVE) values for all constructs were greater than 0.50, indicating adequate convergent validity (Hair et al., 2019). Discriminant validity was verified using the Fornell Larcker criterion and HTMT ratios, both confirming that each construct was distinct from the others. These results confirmed that the data were suitable for subsequent structural model analysis.

4.2 Structural Model Results

The hypothesized model was tested using SmartPLS 4.0. The model demonstrated strong explanatory power, with an R^2 value of 0.61 for Green Training (GT) and 0.68 for Social Sustainability Performance (SSP), suggesting that the proposed model explained a substantial proportion of variance in the dependent variables.

Path coefficient results are summarized as follows

Hypothesis	Relationship	Path Coefficient (β)	t-value	p-value	Supported
H1	ODNA → SSP	0.37	7.24	0.000	Yes
H2	ODNA → GT → SSP (Mediation)	0.26	6.03	0.000	Yes
H3	GT → SSP	0.41	8.92	0.000	Yes

These results indicate that Organizational DNA significantly affects both Green Training and Social Sustainability Performance, while Green Training partially mediates the relationship between ODNA and SSP.

DISCUSSION OF FINDINGS

4.3.1 ODNA and Social Sustainability Performance

The positive and significant relationship between ODNA and SSP supports H1, suggesting that the structural and cultural alignment within an organization fosters social responsibility and ethical behavior. This finding aligns with Ali et al. (2022) and Eizenberg & Jabareen (2017), who emphasized that organizations with

adaptive and inclusive internal systems perform better socially. In Egypt's steel sector, such alignment helps companies promote safety, equity, and social well-being among employees and surrounding communities.

4.3.2 The Mediating Role of Green Training

The partial mediation of GT between ODNA and SSP (H2) reveals that while ODNA directly enhances social sustainability, the presence of Green Training amplifies this effect. This aligns with the Resource-Based View (RBV) and Dynamic Capabilities Theory, which argue that knowledge and learning-based resources enable organizations to convert structural strengths into sustainable advantages (Roscoe et al., 2019; Yusliza et al., 2020).

Thus, GT functions as a strategic mechanism through which ODNA's values and structures are operationalized into tangible social outcomes.

4.3.3 Green Training and Social Sustainability Performance

The results for **H3** confirm that GT significantly improves SSP. This supports prior studies by Jabbour & Santos (2008) and Tang et al. (2018), who demonstrated that sustainability-focused training enhances employee morale, community engagement, and workplace safety. Green Training fosters employees' environmental and social awareness, translating sustainable values into daily operational practices—an essential factor for improving social outcomes in high-impact industries like steel manufacturing.

4.4 Summary of Findings

The empirical analysis confirms all four hypotheses and provides robust evidence for the proposed conceptual model. Organizational DNA significantly contributes to both Green Training and Social Sustainability Performance, with Green Training serving as a key mediating mechanism. This reinforces the idea that the sustainability of social outcomes depends not only on the organization's internal architecture but also on its commitment to continuous environmental learning and employee development.

CONCLUSION, IMPLICATIONS, AND RECOMMENDATIONS

5.1 Conclusion

This study empirically examined the impact of Organizational DNA (ODNA) on Social Sustainability Performance (SSP) through the mediating role of Green Training (GT) in Egypt's private steel industry. The findings confirmed that ODNA plays a crucial role in shaping social sustainability outcomes both directly and indirectly through GT. Organizations with well-aligned structural, cultural, and strategic systems tend to foster an environment that supports employee learning, ethical behavior, and social responsibility.

The results demonstrated that Green Training partially mediates the ODNA–SSP relationship, highlighting its function as a dynamic capability that transforms organizational structures into sustainable social actions. By embedding green learning within the organizational fabric, companies can enhance social outcomes such as employee well-being, equity, and community engagement.

Overall, the study provides empirical evidence that organizational sustainability is best achieved when internal organizational DNA and human resource practices are aligned with environmental and social values.

5.2 Theoretical Implications

From a theoretical perspective, this research contributes to the growing body of knowledge on organizational sustainability in several ways:

1. It introduces Organizational DNA as a novel determinant of social sustainability, bridging a conceptual gap in sustainability literature.
2. It integrates Green Human Resource Management (GHRM) concepts with organizational design, linking micro-level training practices to macro-level sustainability outcomes.
3. It validates a mediated framework grounded in the Resource-Based View (RBV) and Dynamic Capabilities Theory, demonstrating how human capital development acts as a mechanism for translating structural capabilities into social performance.

5.3 Practical Implications

The findings provide valuable insights for managers, policymakers, and sustainability practitioners in Egypt's industrial sector:

1. **For Industrial Managers:** Building a strong ODNA characterized by collaboration, adaptability, and innovation enhances the organization's capacity to sustain social and environmental initiatives.
2. Managers should promote open communication, decentralized decision-making, and a culture of ethical responsibility.
3. **For Human Resource Departments:** Implementing structured Green Training programs is essential to embedding sustainability into everyday operations. Training modules should focus on environmental awareness, safety practices, and community responsibility, ensuring alignment with the organization's social objectives.
4. **For Policymakers and Regulators:** Encouraging firms to adopt sustainability-oriented management structures and HR policies can strengthen national efforts toward achieving Egypt's Vision 2030 sustainability goals.

5.4 Limitations and Future Research

While this study offers valuable contributions, several limitations should be acknowledged:

1. The research focused exclusively on the private steel sector, which may limit generalizability to other industries or public-sector organizations.
2. The use of a cross-sectional design restricts the ability to infer long-term causal relationships.
3. Data were based on self-reported surveys, which may be subject to social desirability bias.

Future research should consider:

1. Expanding the model to include environmental and economic sustainability dimensions alongside the social dimension.
2. Conducting longitudinal studies to capture the dynamic evolution of ODNA and its influence on sustainability outcomes over time.
3. Exploring comparative studies across different industries or countries to test the model's crosscultural validity.

5.5 Final Remark

This research underscores that the pathway to sustainable social performance lies within an organization's genetic core—it's DNA. By aligning internal structures and leadership values with sustainability-driven training, firms can not only enhance competitiveness but also fulfill their broader social responsibilities toward employees, communities, and the environment.

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