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National productivity award model to accelerating sustainable practices in the mining industry

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ABSTRACT

The mining industry significantly impacts national economies. However, there is a lack of industry-specific productivity frameworks that support sustainable development in this sector. This study aims to fill that gap by creating a national productivity award model tailored to Iran's mining industry. Using a methodological synthesis, the research begins with an analysis of key success factors and a comparison of national and international productivity evaluation systems. The resulting framework comprises three main components of productivity drivers with a maximum obtainable score of 200 points, focusing on leadership, culture, strategy, and governance. Productivity enablers with a maximum score of 350 points as the second component focus on critical resources and capabilities such as staff management to facilitate productivity. The last component is the consequences of productivity with a maximum obtainable score of 450 points, paying attention to the assessment of both perceptual and operational achievements. These 3 main components are built on ten core values, such as intelligent production, systems thinking, sustainable development, and leadership. This model not only fosters continuous improvement but also addresses challenges with minimal resistance, enabling sustainable transformation in the mining sector. Measuring drivers like workforce efficiency, skill level, and technology use can reveal specific gaps where productivity is hindered. Strengthening workforce competencies through continuous training and safety protocols. The consequences of productivity, boosting long-term profitability, and environmental compliance could be mentioned. Adopting sustainable mining practices not only aligns with regulatory compliance but can reduce waste and enhance corporate reputation.

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1. Introduction

Sustainable development requires a balance between socioeconomic progress and environmental protection, particularly in industries that operate within the upstream supply chains of many other sectors. The mining industry, a critical supplier of raw materials for various industries, is often perceived as being at odds with sustainability due to its inherent nature of resource depletion (Zhou, 2023). However, this perception oversimplifies the potential for sustainability within mining. As the global economy shifts towards more responsible energy production and storage, the demand for materials like zinc, lithium, and graphite essential for renewable energy technologies—underscores the need for a sustainable mining approach (Humphreys, 2020). Beyond supplying raw materials, mining operations are under increasing pressure from various stakeholders to minimize waste, reduce energy consumption, and improve environmental management practices. Achieving a sustainable

transformation requires the implementation of comprehensive strategies and tools that optimize the entire mining value chain (Amoako et al., 2023). This transition towards sustainability also can lead to productivity framework through resource efficiency and cost savings, contributing to both environmental stewardship and operational efficiency (Hasanuzzaman et al., 2024). A well-structured productivity framework would provide decision-makers with a roadmap to manage these changes while enhancing the industry's social responsibility (Zhironkina and Zhironkin, 2023). Mining also plays a key role in the realization of plans aimed at achieving the green energy transition. However, concerns have arisen about the sustainability of productivity in such industries, prompting the investigation of factors that support this phenomenon (Humphreys, 2020; Mishra et al., 2023). Similar to other manufacturing sectors, mining requires a rigorous focus on productivity to assure performance quality (Zhou, 2023). In this context, productivity is closely linked with quality. Quality Management (QM) is defined as a management philosophy that emphasizes the continuous improvement of organizational processes, culture, products, and services to meet or exceed customer expectations Business Excellence Models (BEMs), such as the European Foundation for Quality Management (EFQM), are widely recognized frameworks that guide organizations in implementing quality management, especially in the pursuit of productivity goals (Sousa et al., 2023). The EFQM Excellence Model is a QM framework with a strong emphasis on stakeholder management and aims to create a sustainable future. The 2012 version of the EFQM model was used for performance assessments until 2021, but its approach toward sustainable development goals lacked clarity (Mehrani et al., 2019; Menezes et al., 2022). However, the 2020 version of the EFQM model has evolved into a more comprehensive and updated business model, incorporating sustainability and the pillars of Industry 4.0. While the EFQM model aids in transforming and enhancing organizational performance, its theoretical and practical foundations are not fully aligned, a gap that should be addressed in the further development of BEMs (Fonseca et al., 2021).

Governments and companies worldwide are increasingly recognizing the importance of quality as essential for achieving competitive advantage on the international stage. This has led many organizations to seek guidance in establishing and implementing quality programs. National quality awards serve as a tool to promote quality awareness at the national level. In the short history of quality development, three awards have played a pivotal role in the quality revolution in Japan, Western Europe, and the United States: the Deming Award, the European Quality Award, and the Malcolm Baldrige National Quality Award. The success of these awards in improving performance and enhancing the global competitiveness of industries has garnered international attention. Some of the most notable quality awards, inspired by these three, include the Argentina National Quality Award (1996), Egypt Quality Award (1997), National Quality Award (1997), the European Quality Award for Small Medium Enterprises (1998), Aruba Island Quality Award (2000), Australian Business Excellence Award (2000) and Chile, European Quality Award (2001), among others (Oon et al., 2021).

Extensive support in the literature highlights the positive impact of adopting excellence frameworks and related awards on organizational sustainability and business outcomes (Castilla-Gomez and Herrera-Herbert, 2015; Zapletalova, 2022; Carlos Sa et al., 2023). However, some scholars have identified limitations in the conceptualization and operationalization of excellence, particularly regarding the lack of integration and cultural support for excellence (Dahlgaard et al., 2013). Research into causal relationships within Business Excellence Frameworks (BEFs) often outlines pathways toward exemplary performance and results (Boiral and Heras-Saizarbitoria, 2013). Nevertheless, it is crucial to recognize that contextual factors can significantly influence the effectiveness of these models, and they should be updated to reflect contemporary global approaches, such as the concept of sustainability (Zelenyuk, 2023). The volatility, uncertainty, complexity, and ambiguity of today’s business environment necessitate organizational agility (Carvalho et al., 2021). The Fourth Industrial Revolution has brought new challenges and opportunities, while intensifying existing ones, thus underscoring the need to revise Business Excellence Models to focus on sustainability

principles and the integration of technology (Goecks et al., 2020; Samadhiya et al., 2024).

Some previous scholars have explored mining sustainability from various perspectives. Deveci et al. (2023) pointed out that Europe aims to establish a digital economy by 2050. To achieve this goal, they emphasize the need to increase the capacity for environmentally friendly mining, and to focus on sustainable mining techniques for manufacturing, reuse, and recycling. Naturally, other countries will also need to adapt to this trend, emphasizing sustainability in their mining processes and financial systems. Tang and Qin (2024) also explored economic and financial dimensions, examining the impact of environmental tax revenues and the green finance market on CO_2 emissions in BRICS countries from 2000 to 2020. Their findings highlight the crucial role of financial backing in supporting eco-friendly initiatives. Udeagha and Muchapondwa (2023) discussed the potential of Financial Technology (Fintech) to have a meaningful impact on the provision of financial services and the pursuit of carbon neutrality objectives. Therefore, any national productivity model designed for mining should consider innovative financial issues and their implications for Corporate Social Responsibility (CSR).

Mining companies often engage in CSR initiatives and invest their resources to create value for stakeholders, driven by financial market pressures and reputation concerns (Yousefian et al., 2023). CSR refers to a company's voluntary commitments to the environment and society, including providing benefits to local communities. Yousefian et al. (2023) showed that while Europe's mining industry has performed well in terms of product quality, its philanthropic efforts are below expectations and should be addressed to enhance both productivity and sustainability. Conversely, Pouresmaieli et al. (2023) emphasized the importance of clear regulations and governance to ensure that the industry operates responsibly and sustainably. Dou et al. (2023) similarly highlighted the role of governance principles in creating a sustainable, long-term supply of critical minerals. Their analysis identified risks such as geopolitical threats, uneven development, resource nationalism, and the environmental and social impacts of mining. Addressing the needs of local communities and the environment, along with a stronger focus on multinational mining companies achieving sustainable development goals, appears essential in overcoming these challenges. The study suggests that a global or national governance model for mining, especially for critical minerals, could align the interests of all stakeholders with sustainability principles.

Onifade et al. (2023) examined the high labor costs in the mining industry, noting the premium wages due to a shortage of skilled employees. They also identified aging skilled workers as a pressing issue that managers must address. Effective communication and safety monitoring procedures should be implemented within the governance system and factored into leadership practices.

Shimaponda-Nawa et al. (2023) highlighted the importance of real-time information management systems in the mining industry, asserting that timely information delivery and use are crucial for enabling dynamic and smart decision-making. They proposed a model to assess the maturity level of such systems. Onifade et al. (2023) also noted that technological innovations help optimize processes and reduce human error, which could positively impact mining productivity. Asiedu et al. (2023) observed that organizations that neglect continuous technological improvement tend to be less productive than their peers. Similarly, Pouresmaieli et al. (2023) (b) argued that integrating renewable energy technology into mining operations, despite its challenges, is essential for achieving sustainable development goals. They concluded that the technical application of renewable energy in mining should become more productive. As renewable energy creates new jobs, related knowledge management principles should be incorporated into training programs, with particular attention to change management and establishing a decent work system to upskill workers. Additionally, they noted that technological advancements may not align with decision-makers' knowledge levels and leadership skills, further emphasizing the need for thoughtful implementation. Overall, the advantages of utilizing Industry 4.0 technologies in the mining sector outweigh potential risks, and these should be considered when developing strategies.

El Bazi et al. (2023) focused on the Reference Architecture Model for Industry 4.0 (RAMI 4.0), developing a generic digital technology architecture framework for the sustainable

mining industry to support asset lifecycle management. Digital twin technology, a key focus of Industry 4.0, can enhance the productivity and sustainability of mining operations by enabling performance monitoring. This is another example of how technology management and the adoption of new technologies can drive productivity.

Despite the importance of productivity in industries like mining, there is a notable gap in both theoretical and practical frameworks for fostering continuous improvement. While productivity awards have successfully promoted performance improvements across different sectors, no framework has been specifically tailored to address the unique challenges of the mining industry (Alves et al., 2021). Generic productivity awards often fail to capture the nuances of industries like mining, where operational and environmental factors interact in intricate ways. This study proposes a tailored productivity award model that incorporates best practices, innovative technologies, and sustainability principles to improve productivity across the entire mining value chain (Amos, 2024).

By the importance mentioned above, this research aims to fill that gap by developing a comprehensive productivity award model specifically designed for Iran's mining sector, which, like other high-impact industries, employs a large workforce and engages in environmentally intensive activities. The core issue addressed by this research is the absence of a sector-specific productivity award that reflects the complexity and environmental challenges of the mining industry. A significant theoretical gap exists in the current literature, where studies either focus narrowly on technological solutions or address isolated operational issues without considering the holistic interaction between human and technical factors. This research seeks to bridge that gap by integrating both dimensions into a single comprehensive framework (Garcia Martinez et al., 2019; Onifade et al., 2023).

So, the primary research question guiding this study is: How can a productivity award model be designed to address the specific needs and challenges of Iran's mining industry while promoting sustainability and continuous improvement? To answer this question, the research follows a multi-phase approach. The first phase involves identifying key success factors through a comparative analysis of existing productivity awards. The second phase focuses on adapting these factors to the mining industry through qualitative research, including focus group discussions with industry stakeholders. This model integrates activators, behaviors, and consequences to form a holistic approach to productivity evaluation and improvement. In summary, this research introduces a novel productivity award model tailored to the specific requirements of the mining industry, aiming to drive both productivity and sustainability. By offering a customized framework, this study contributes to the academic discourse on productivity awards while providing practical solutions for enhancing performance in industries with significant environmental impacts.

2. Material and Methods

This research adopts a mixed-methods approach to design a comprehensive productivity award model specifically tailored to the mining industry. The process unfolded in two primary phases: comparative analysis and focus group discussions.

Phase 1: Comparative Analysis: Recognizing the growing emphasis on sustainable and productive mining, as well as the need to adapt to evolving stakeholder expectations, the scholars of the current study compiled a comprehensive systematic review of 95 pertinent research documents from diverse sources to identify Critical Success Factors (CSFs) for productive mining industries. After rigorous scrutiny, a subset of 42 articles published between 2008 and 2024 was selected for in-depth analysis. The researchers identified CSFs that have a significant impact on the productivity of the sustainable mining industry, categorizing them into dimensions related to quality awards. This classification acknowledges the intricate relationship between quality standards and productivity in the mining sector. Moreover, the current research extends beyond the work of Mohanty et al. (2021), incorporating insights from other studies that examine additional factors influencing mining productivity. This broader perspective provides a more comprehensive understanding of the complex dynamics shaping the success of mineral industries, which will be used to design a productivity model for Iran's mining industry.

These CSFs are thoroughly analyzed to determine which factors are most critical for developing an industry-specific productivity award. Table 1, therefore, represents the outcome of this literature review and forms the foundation for the research.

Following the identification of the CSFs, a comparative analysis was conducted. Comparative analysis, a widely used method in social science research, involves examining elements across different systems to uncover similarities and differences (Aguilar-Pesantes et al., 2021). In this study, the comparative analysis focused on four globally recognized quality frameworks: the Malcolm Baldrige National Quality Award (MBNQA), the European Foundation for Quality Management (EFQM), the Deming Prize, and the Iranian National Excellence Award (INEA). This analysis compared the values, criteria, scoring mechanisms, and assessment methodologies of each framework to determine which components should be integrated into the proposed productivity award model for the mining industry. The results of this comparison were crucial in shaping the initial draft of the model, offering insights into key productivity evaluation metrics and frameworks that could be adapted for the mining sector.

Table 1. Critical success factors of productive mining industry.

Criterion	Sub criterion	Authors
Strategic point of view	- Political influence - Update statements of mission, vision, and values - Making short-term and long-term challenges and opportunities balanced	(Mohanty et al., 2021) (Mohamed and Eltohamy, 2022)
Governance system	- Leadership and management style - Communication mode with suppliers, partners, and collaborators based on each category interests - Holistic point of view of society, environment with economic issues to set business model design - Determination of requirements and expectations of services by stakeholders - Business ethics and transparency - Agility and flexibility to face changes effectively and create a sustainable organization	(Groeneveld et al., 2019) (Mohanty et al., 2021) (Mohamed and Eltohamy, 2022) (Gackowiec et al., 2020) (Tan and Wei, 2023)
Transformation	- Change management principles to be in hand - Innovation in operations, products, and the organizational business model - Comparing performance with benchmarks to set the roadmap of transformation	(Hosseinzadeh et al., 2018) (Volk, 2016) (Mohamed andEltohamy, 2022) (Tan and Wei, 2023)
Work force	- Training and skill level - Working conditions and practices - Assuring that the workforce perceives the mission, vision, values and strategy, and their evaluation is based on these values - Implementation of a system of rewards and recognition to honor and motivate the workforce via policies, services, and benefits	(Groeneveld and Topal, 2011) (Bodziony et al., 2016) (Mohanty et al., 2021) (Jibir et al., 2023)
Capabilities	- Cost of input resources such as finance, fix assets, materials and natural resources in a sustainable way, and continual reducing their harms on the environment - Capacity utilization - Drill and blast efficiency - Energy management - Infrastructure (related to data management, etc.) - Machine reliability & optimality of equipment - Firm size & age - Financial leverage - Smart manufacturing by industry 4.0 technologies	(Ozdemir and Kumral, 2019) (Maheswari et al., 2020) (Bueno et al., 2020) (De Haas and Poelhekke, 2019) (Jakkula et al., 2020) (Mohanty et al., 2021) (Hosseinzadeh et al., 2018) (Ayswer et al., 2023)
Sustainable value creation	- Optimality of total supply chain - Considering indicators to assess brand image as being concerned about the environment and employees' social commitment - Indicators measuring societal performance	(Mohanty et al., 2021) (Hosseinzadeh et al., 2018) (Mohamed and Eltohamy, 2022) (Ayswer et al., 2023)
Results	- Scale of economies - Labor productivity - Service rate (Lead time, on time & full delivery)	(Sun and Anwar, 2019) (Mohanty et al., 2021) (Marinagi et al., 2023)

Phase 2: Focus Group Discussions: The second phase involved a series of focus group discussions aimed at refining the proposed model. Focus groups are an essential qualitative research method used to capture participants' insights, perceptions, and collective experiences (El Bazi et al., 2023). In this study, 20 focus group sessions were held, each consisting of at least 3 participants. The groups included 40 executives from leading mining firms and 20 academic experts specializing in mining, sustainability, and productivity.

Participants were selected based on their professional experience, decision-making authority, and expertise in mining operations or productivity management. This diverse mix of professionals ensured that both operational and academic perspectives were incorporated into the model's development. Each focus group meeting was structured to encourage open discussion on specific components of the draft model. Participants provided critical feedback, recommendations, and suggestions for refinement. The discussions centered on identifying gaps in the initial draft, validating the CSFs identified in Phase 1, and ensuring the model was aligned with the unique characteristics of the mining industry. The higher-than-usual number of participants in this phase was deliberate, as it was essential to include key stakeholders from across the industry to minimize resistance and ensure broad acceptance of the final model. The involvement of these decision-makers was crucial in establishing a strong foundation for the model's implementation at a national level.

2.1. Data Analysis

To ensure rigor in the analysis, the qualitative data from the focus group discussions were coded and analyzed thematically. Key themes emerged, such as operational efficiency, environmental responsibility, and stakeholder engagement, which were subsequently integrated into the final productivity model. The discussions also provided valuable insights into the intersection of technical and human dimensions in productivity enhancement, addressing a gap in the literature that had previously focused solely on isolated operational aspects (Garcia Martinez et al., 2019; Onifade et al., 2023). The final phase of this research involved synthesizing the feedback from the focus groups into a refined productivity award model. This model was specifically designed to meet the unique needs of the mining industry, offering a comprehensive framework for evaluating productivity that balances technical, operational, and sustainability factors. See the methodology steps in Fig. 1.

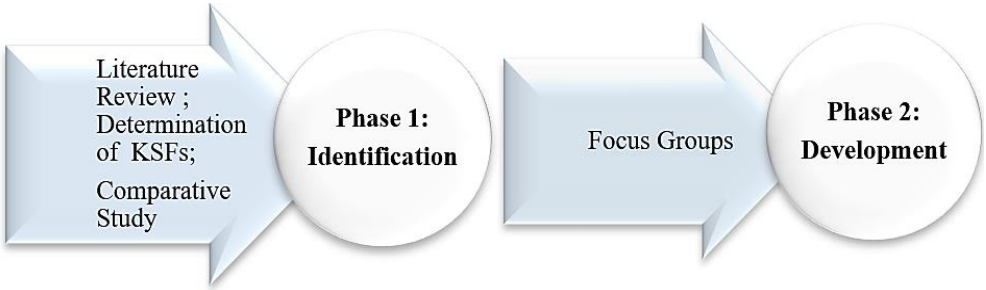

Fig. 1. Methodology steps of this study-the productivity award design journey.

3. Results and discussion

In alignment with the methodology, this section presents the outcomes of the research conducted in two distinct phases. Phase 1 focused on identifying and analysing productivity factors in the mining industry, while Phase 2 cantered on designing a refined productivity model tailored to the specific needs of Iran's mining sector.

Phase 1: Identification of Key Success Factors: The research began with an extensive literature review to identify the key factors that enhance productivity in the mining industry. As detailed in Table 1, these success factors were further explored through expert interviews, which provided nuanced insights into how leadership,

strategic decision-making, and innovation drive productivity. While traditionally, input costs, energy management, and infrastructure were viewed as primary drivers, this study revealed that they now play a secondary role compared to strategic workforce management and leadership adaptability. Contrary to conventional expectations, factors such as value creation, which are often overlooked, emerged as critical for gaining a competitive advantage. The study underscores a shift in focus towards intrinsic value, redefining success beyond simple production metrics. This realignment challenges the mining industry to innovate and adapt in an increasingly dynamic and competitive landscape.

Phase 2: Comparative Study of Global Productivity Models: In this phase, the research compared global productivity models, including the Malcolm Baldrige National Quality Award (MBNQA), the EFQM Excellence Model, the Deming Prize, and the Iranian National Excellence Award (INEA), with a focus on their applicability to Iran's mining industry. A comparative study protocol consisting of 14 questions was used to scrutinize these frameworks based on their core principles, criteria, and sub-criteria. The comparative analysis revealed 53 key lessons (see Table 2), which informed the refinement of a productivity model specifically designed for the mining sector. The study proposes a new three-part model titled the "ABC of Productivity," covering the antecedents of productivity, behaviour's related to value creation, and the consequences of productivity (see Table 2).

Table 2. Comparative Study of excellence models with features of ABC of productivity.

Award Descriptor	**Values**
MBNQ	- Visionary leadership - Focus on success and innovation. - Management by fact - Delivering value and results - Customer focused excellence - Valuing people - Organizational learning - Agility and resilience - Societal contribution - Ethics and transparency
EFQM	- Adding value for customer - Creating a sustainable future - Developing organizational capability - Harnessing creativity and innovation - Leading with vision, inspiration, and integrity - Managing with agility - Succeeding through the talent of people - Sustaining outstanding results
Deming Prize	- Systematic activities - Carrying out by the entire organization effectively and efficiently - Organization's objectives Provide. - Products and services - Quality - Customers
INEA	- Visionary leadership - System approach - Value creation - Learning, improvement, and innovation - Employee engagement - Developing partnerships - Development of organizational capabilities - Agile management - Social Responsibility - Enduring results
ABC of Productivity	- Intelligent Result orientation - Visionary leadership - Creating value for customers - Efficient and dedicated employees - Process orientation, agility and resilience - Learning, creativity and innovation - Capacity building and sustainable supply - Sustainable development and social responsibility

	Objectives
MBNQ	- To help improve - performance - practices, - To facilitate communication and sharing of best practices among US organizations - To serve as a working - tool for understanding - and managing - performance, - planning, training and - assessment
EFQM	- To stimulate and assist European organizations in improving customer and employee satisfaction, impact on society and business results, - To support European managers' - efforts to initiate total quality management and achieve global competitive advantage, - To enhance the position of - European industry and commerce - by strengthening the strategic role of quality in corporations
Deming Prize	- To evaluate and recognize - methods of company-wide - quality control for - Japanese businesses, - To recognize those - companies that have - successfully applied company-wide quality - control based on statistical control, and are likely to keep it up in the future
INEA	- Encouragement to improve efficiency and productivity in mining industries Performance evaluation and review. - Promotion of productivity culture - To Motivate toward transformation
ABC of Productivity	- To create a competitive environment for the excellence of companies and organizations. - To Encourage companies to carry out self-evaluation and recognize strengths and areas that can be improved - To create a space to exchange successful experiences of companies
	Criteria
MBNQ	- Leadership - Strategic planning - Customer and market focus - Information and analysis - Human resource focus - Process management - Business results
EFQM	- Leadership - Policy and strategy - People management - Resources - Process - Customer satisfaction - People satisfaction - Impact on society - Business results
Deming Prize	- Policies (hoshin) - Organization and its operations - Information - Standardization - Human resources - Quality assurance - Maintenance - Improvement Effects - Future plans
INEA	- Leadership - Strategy - People - Capabilities - Customers - Operations - Results
ABC of Productivity	- Leadership and productivity culture - Strategy and productivity model - People - Sustainable value creation - Resources and capabilities - Perceptual result - Financial result - Functional result

The analysis found that many traditional models, which use a linear approach, do not adequately capture the dynamic and complex nature of today's mining organizations. A dynamic double infinity model was proposed, advocating a cyclic and adaptive framework to reflect continuous improvement and the evolving nature of the industry. The proposed model emphasizes adaptability, leadership foresight, and human capital management, placing workforce development at the center of productivity strategies.

Final Model: The ABC of Productivity: Based on the comparative study, a final model was developed, structured around three core components:

Productivity Drivers (200 points)

This section focuses on leadership, organizational culture, productivity strategy, and governance.

Leadership and Organizational Values (25 points)

Productivity Culture (25 points)

Social Responsibility and Governance (25 points)

Process Management (25 points)

Productivity Enablers (350 points)

Enablers are critical resources and capabilities that facilitate productivity.

Staff Management (100 points)

Resources and Capabilities (100 points)

Sustainable Value Creation (150 points)

Consequences of Productivity (450 points)

This section assesses both perceptual and operational achievements.

Perceptual Results (150 points)

Operational Results (150 points)

Table 2 provides detailed scores and explanations for each category and subcategory, ensuring clarity in the model’s application to organizational settings.

The ABC of Productivity is designed for practical application in the mining industry. Its dynamic format allows for continuous adaptation and realignment with emerging trends such as digital transformation, environmental sustainability, and workforce empowerment. By adopting this model, mining organizations can more effectively align leadership strategies with operational realities, ensuring long-term competitiveness and productivity. The model serves not only as an evaluation tool but also as a guide for strategic decision-making and resource allocation.

This study has uncovered critical insights with wide-ranging implications for excellence awards and their application within the mining Our main discovery suggests that contrary to conventional wisdom, capabilities traditionally associated with productivity—such as cost of inputs, energy management, infrastructure, and machinery reliability—play a more subdued role and practitioners must pay detailed attention to technological innovation and transformation more than past. As Zhang and Kexue (2022) claimed, the rapid development and popularization of 5G+ intelligent mines has direct impact on the production safety, coal output, economic benefits and social benefits of coal mine enterprises (Zhang et al., 2022), this finding can strengthen assumptions regarding technological movement and their vital role on continuous improvement and productivity in mining industry (Onifade et al., 2023; Zhironkina & Zhironkin, 2023).

As Costa et al, (2019) described that lean management represents a complex socio-technical system where both technical and social practices should be consistently implemented and integrated in order to foster a continuous improvement culture (Costa et al., 2019), current scholars also found that excellence and productivity models should not be in a one-way mode. That is why, lean logic is modeled and designed in a three-part, dynamic and iterative model. The other implications of this study are:

- Methodology for Excellence Award Redesign and Validation: The methodology developed in this research isn't just a theoretical *concept*; it's a practical tool that offers a systematic way to upgrade excellence awards. Its applicability extends beyond the mining sector, making it a blueprint for organizations looking to continually improve their models. This contribution changes the landscape for excellence award processes.

- Customized Model for the Mining Industry: The creation of a specialized excellence model tailored to the specific needs of the mining industry addresses unique challenges and

fosters sustainability within the sector. It's a tangible solution that meets the unique challenges of mining organizations. This, in turn, fosters a culture of excellence and sustainability designed specifically for the mining sector. The contribution here is a practical one that directly affects the industry.

- Process-Oriented and Systematic Approach: The integration of a process-oriented and systematic view isn't just a theoretical shift; it's a change in how we approach excellence. It promotes a holistic understanding of organizational excellence, emphasizing the interconnectedness of processes. This is a contribution that affects how organizations think about and achieve excellence, making it more efficient and effective.
- Deficiency coverage through Comparative Study: Addressing deficiencies through comparative analysis is more than just identifying issues; it's about making excellence models adaptable in various contexts. This contribution underscores the importance of sector-specific solutions, enhancing the adaptability and robustness of excellence models.

4. Conclusion

In conclusion, the ABCs of Productivity Award not only enriches the mining industry's pursuit of excellence but also contributes to the broader literature on Business Excellence Models. This study's findings emphasize the significance of key factors such as technological transformation, strategic design, and sustainable value creation in driving mining productivity. The model's development, drawing from principles of system thinking and global frameworks like EFQM, adds depth to the existing literature on business excellence models. However, it is important to note that this study was conducted specifically within the context of the mining industry. As such, the results and model may not be directly applicable to other industries. Further research is needed to assess the generalizability and adaptability of the ABCs of Productivity Award across different sectors.

This study's primary limitation lies in its reliance on expert opinions for the model's initial validation. Future research should include longitudinal studies to track the long-term impact of the model on organizational performance. Additionally, comprehensive evaluations of the award's adoption by organizations and its effects over time will provide deeper insights into its effectiveness.

There are several limitations regarding this study that should come under attention. The productivity model is tailored specifically for the mining industry in Iran, which means it may not be easily generalizable to other industries or even to mining sectors in other countries with different economic, social, and environmental contexts. While the model is effective for the unique needs of Iran's mining sector, its broader applicability is limited, reducing its utility for other industries or regions. Also, the study faced some challenges related to the availability and quality of data, especially in terms of accessing up-to-date information on sustainability practices, resource efficiency, and productivity metrics in the mining sector. Incomplete or outdated data could hinder the accuracy and effectiveness of the model, potentially affecting its recommendations and relevance in dynamic, real-world contexts. It should be also mentioned that the study may not fully account for the potential impact of global market volatility, fluctuating commodity prices, or economic downturns, which could significantly affect the financial feasibility and priorities of sustainability-driven productivity initiatives. Economic instability can force mining companies to prioritize short-term profitability over sustainability, limiting the long-term success of the model.

Future studies should explore how the model can be adapted to address emerging trends and challenges, both within the mining industry and in other sectors. Expanding the investigation into its applicability in various contexts will help refine and enhance the model's relevance. By doing so, the ABCs of Productivity Award can continue to evolve as a dynamic tool for fostering productivity and excellence in a range of industries. Integration of Circular Economy principles seem useful in this regard. Investigation of how circular economy practices, such as waste reduction, recycling, and resource efficiency, can be integrated into

Iran's mining sector to improve productivity and sustainability. This could help reduce environmental degradation while maximizing resource utilization, aligning with global trends toward more sustainable industrial practices. It is recommended to study how renewable energy should be integrated in mining operations will reduce reliance on fossil fuels and could lower carbon emissions, decrease operational costs, and contribute to national sustainability goals. It is also fruitful to focus on public policy and sustainable mining. Public policy could drive widespread adoption of sustainable practices, creating a regulatory framework that supports productivity while safeguarding the environment. Social and environmental impact is suggested to be studied in the future. Better impact assessments can help mining companies and policymakers make informed decisions that balance economic growth with environmental preservation and social equity.

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