

The Role of Green Digital Learning Orientation and Big Data Analytics in the Green Innovation–Sustainable Performance Relationship

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Abstract—Green innovation, digitization, and sustainability have garnered significant attention in recent years due to their potential to transform organizations. This study examines the relationship between green innovation and sustainable performance and the role of green digital learning orientation and big data analytics in that relationship. Grounded in the resource-based view, this investigation analyses the direct effect of green innovation on sustainable performance, the moderating role of green digital learning orientation in that relationship, and the three-way interaction effect of green innovation, green learning orientation, and big data analytics on sustainable performance. The study collected 567 valid questionnaires from managers in manufacturing and service businesses in Iraq. The findings indicate that green innovation is positively related to sustainable performance and this relationship is stronger when green digital learning orientation is high. Additionally, the study found that big data analytics has a significant three-way interaction effect on sustainable performance. Overall, this study emphasizes the importance of green innovation, green digital learning orientation, big data analytics, and sustainable performance. The contributions of this work can be valuable to startups and traditional organizations seeking to explore or seize opportunities in green innovation and digitization.

Index Terms—Big data, digitization, green digital learning orientation (GDLO), green innovation, sustainable performance.

I. INTRODUCTION

ENVIRONMENTAL concerns related to climate change, resource scarcity, and other global environmental risks have prompted many warnings about sustainability [1]. To address these challenges, firms are implementing more sustainable strategies that focus on environmentally responsible actions that have a positive economic impact [2], [3]. Sustainable business success is a relatively new concept, studied in the context of integrating sustainable practices at social, economic, environmental,

and international levels. As a result, companies are now looking for ways to reduce, reuse, and recycle to grow and survive. This requires top management to seek out sustainable procedures and raw materials [4], [5].

In today's rapidly changing business environment, firms need to make effective strategic, functional, and tactical decisions to remain competitive in the global market [6]. Increasingly, industry experts are interested in using large-scale data for decision-making [7], [8]. However, relying on data-driven businesses also requires the development of tangible resources and labor capabilities for sustainability, which requires further research investigation [9], [10]. In this digital age, businesses also face external pressures from government and industry practitioners. For example, the Department of Trade and Industry places significant pressure on businesses to cooperate and implement the nation's digital plan [11]. Many nations have developed their own technology solutions to promote digital programs [12], [13]. As technology investments establish clear objectives and performance benchmarks to enhance business capabilities in the digital age [3], [14], customer demands are driving suppliers to use digital technology to develop their resources and capabilities [5], [15]. Therefore, these institutional demands have a positive impact on the availability, obligation, and infrastructure of tangible resources [11], [16].

Based on the theory of the resource-based view, various resources are vulnerable to simple copying by rivals. Thus, businesses must exercise caution and select resources that are challenging for firms to reproduce [11]. There are indeed sophisticated resources such as practice-based knowledge and workforce skills, which can be considered as implicit resources because they are acquired through practice and learning but are not immediately apparent [17]. Therefore, in this era of climate change, sustainability, and digitization, knowledge of green issues and big data analytics is critical, as effective application depends on workforce implicit capabilities. By employing specialists or changing human resource policies, firms may enhance such competencies [18], [19]. In this sense, green innovation forces businesses to reconfigure significant resources (tangible resources and workforce skills) to develop green capabilities that create competitive advantages through reducing, reusing, and/or recycling materials.

The increase in the global population is placing further tension on natural resources due to the amplified need for food, water, and energy [20], [21]. This concern is getting worse because

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