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Lean manufacturing practices, corporate social responsibility and sustainability performance: An empirical study on Tunisian manufacturing companies

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Abstract: Given the significant contribution of manufacturing sectors to major environmental issues worldwide and the growing attention directed toward manufacturing SMEs in developing countries, this study investigates the impact of lean manufacturing practices (LMPs) on corporate social responsibility (CSR) activities and corporate sustainability performance (CSP) within manufacturing SMEs in Tunisia. We employed a survey questionnaire to collect data from managers and professionals working in 256 manufacturing SMEs and used Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze the data. Moreover, we examined the role played by these practices in fostering corporate sustainability. We also examined the links between LMPs, CSR activities, and CSP, considering CSR as a mediating factor between LMPs and CSP. Our findings indicate that LMPs enhance CSP both directly and indirectly through CSR practices. LMPs positively affect CSR activities within manufacturing SMEs in Tunisia. This investigation contributes to the limited body of literature on LMPs, CSR, and CSP and serves as a valuable resource for practitioners. This study provides Tunisian managers and policymakers with valuable insights to better address sustainability challenges.

Keywords: *Corporate social sustainability, Corporate sustainability performance, Lean manufacturing practices, PLS-SEM, Tunisian manufacturing SMEs.*

1. Introduction

Today, companies face pressure from various quarters to manage their businesses in an environmentally and socially responsible manner [1]. Moreover, both governments, communities, and customers are putting increasing pressure on manufacturing companies to address environmental issues such as climate change, pollution, and depletion of natural resources, while also taking into account their environmental efficiency along with their operational performance [2]. As a result, these companies seek to continually focus on environmental issues and invest strategically in cost-effective, environmentally friendly, and stakeholder-oriented initiatives [3].

In fact, manufacturing companies are confronted with the alarming problem of meeting both their economic/financial and environmental goals in the light of global challenges and environmental pressures [3]. While this sector provides a significant boost to economic growth in both developed and developing countries, it is often identified as a major contributor to the emission of harmful substances that affect the quality of life of both employees and members of society in general [4]. Similarly, Gul, et al. [5] as well as Rehman, et al. [6] indicated that the manufacturing sector represents a major source of waste and air and water pollution, and a clear contributor to climate change and depletion of natural resources. In this context, interest in corporate sustainability performance (CSP), especially those operating in industrial sectors in developing countries, has increased in recent years.

As stated by Ibikunle, et al. [7] manufacturing SMEs contribute significantly to the economic growth of any developing country. Moreover, they provide social stability by generating direct and

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indirect employment opportunities [8]. Nevertheless, these authors (i.e., [8]) reported that most SMEs in emerging countries neglect environmental and social obligations and do not pay much attention to sustainability strategies. Recently, Al-Swidi, et al. [9] as well as Dey, et al. [10], indicated that lean manufacturing practices (LMPs) and corporate social responsibility (CSR) practices, when adopted together, are expected to contribute to greater SMEs' sustainability performance by allowing for appropriate trade-offs between economic, social, and environmental criteria.

LMPs are viewed in recent literature as a comprehensive set of techniques and methods aimed at improving productivity and reducing manufacturing costs, eliminating waste from production processes, minimizing environmental impacts, enhancing the efficiency required to deliver high-quality products, and strengthening social sustainability [11, 12]. Moreover, these techniques or practices, in line with Yu, et al. [13] are primarily oriented toward pull-production systems (e.g., just-in-time), process variability reduction (e.g., statistical techniques, set-up time reduction, and total productive maintenance), quality management (e.g., proactive and continuous improvement of processes), and total employee involvement (e.g., communication and teamwork, employee motivation and empowerment, problem detection, and problem solving). However, lean manufacturing is now gaining increasing recognition among SMEs in developing countries as a successful operational model [14], helping them to enhance their sustainability performance [4, 15].

Moreover, CSR is regarded as a combination of environmental and social practices that are strategy-driven within an organization [10]. It aims to meet stakeholder expectations regarding the company's impact on society and the environment [16]. Recent studies have shown that LMPs positively impact CSR practices and activities within manufacturing SMEs [9, 10]. As specified by Chiarini et al. [1], LMPs can enhance CSR dimensions such as environmental, health and safety, and social responsibility, and there is an increasing body of research into the interest in lean manufacturing and CSR. Although there is a large body of literature on LMPs and environmental management practices [4, 17-19], few studies have examined LMPs in relation to other dimensions of CSR or CSR as a whole [1].

As maintained by Al-Swidi et al. [9], the current literature lacks a comprehensive framework linking LMPs, CSR activities, and CSP. Moreover, empirical studies examining the mediating role/effect of CSR practices on the relationship between LMPs and CSP are rare [10]. These authors also emphasized the lack of knowledge about the effect of LMPs on SMEs' sustainability performance. Other scholars (e.g., [20]) have argued that lean manufacturing poses challenges for SMEs in competing in the market due to the limited development of theoretical frameworks, including a scarcity of empirical studies focused on SMEs.

Based on existing literature, Chavez, et al. [21] reported that the literature on the implementation of LMPs and their impact on firm performance in developing countries is limited and presents a research opportunity. In addition, while previous studies have examined the relationship between LMPs and SMEs' sustainability performance in Pakistan [15], India [8, 14], Yemen [9], Ghana [4], and Portugal [22], empirical evidence from Tunisia remains very limited.

Moreover, despite the full adoption and ongoing benefits of lean sustainability by manufacturing companies in developed countries, manufacturing SMEs in developing countries lag behind Opoku, et al. [23]. Abobakr, et al. [24] stated that lean organizations in developing countries struggle to effectively integrate sustainable business functions and practices. Zaidi and Lakhal [2] and Henao and Sarache [25] both pointed out that the adoption of LMPs enables companies to achieve cost reductions but does not necessarily guarantee improvements in social and environmental performance. Tran, et al. [26] demonstrated that the interaction of LMPs with social and environmental management practices, or both, is detrimental to CSP. These findings, aligned with the research limitations mentioned above, highlight the need for further investigation into LMPs and CSR practices, particularly in manufacturing SMEs in developing countries like Tunisia, which often lack sufficient resources, skills, and strategic orientation to enhance their social and environmental impact.

In other words, this study aims to answer the following questions:

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1/ What is the impact of LMPs on CSR activities?
2/ What is the impact of LMPs on CSP?
3/ What is the impact of CSR activities on CSR activities?
4/ How can CSR activities mediate the relationship between LMPs and CSP?

2. Literature Review

2.1. Lean Manufacturing Practices

Lean manufacturing can be defined as a universal production philosophy that aims to provide a high-quality product while ensuring that the product does not cost the customer too much [27]. In the opinion of

Bhamu and Singh Sangwan [28] lean manufacturing can be viewed from a philosophical perspective related to guiding principles and overarching goals, or from the practical perspective of a set of management practices, tools, or techniques that can be observed directly. This includes, among other things, practices oriented just-in-time, total quality management, total productive/preventive maintenance, and human resource management, with the aim of achieving a high degree of productivity and quality through waste elimination [29, 30].

2.2. Corporate Social Responsibility

The concept of CSR represents the set of voluntary activities undertaken by an organization to operate in an economic, social, and environmental sustainable manner [31]. It can also be defined as a combination of environmental and social practices that are strategy-driven within an organization Dey, et al. [10]. Abbas [32] stated that companies that adopt CSR activities take initiatives to preserve the social, cultural, and economic aspects of the environment in which they operate and invest in human capital development.

2.3. Corporate Sustainability Performance

CSP mainly focuses on the environmental, social, and economic performance of sustainable development [33]. As specified by Khaled, et al. [34] evaluating firms' progress toward the Sustainable Development Goals (SDGs) from an impact perspective involves examining how CSP contributes to the achievement of these goals through firms' sustainable practices and activities. Moreover, it encompasses both economic, social, and environmental performance of companies. Economic performance measures a company's ability to reduce costs at various points of consumption, observed growth in sales, business volume, market share, and the company's ability to achieve desired profits [35].

Social performance encompasses aspects related to employees (such as well-being, health, and safety etc.), relationships with the community and stakeholders, and the well-being of corporate stakeholders [36]. Environmental performance indicates the extent to which a company mitigates the environmental impact of its operations. This can be achieved through the adoption of eco-design practices in products and services, the reduction of environmental incidents, energy conservation, minimizing the use of hazardous or toxic materials, promoting material reuse and recycling, and performing regular environmental audits [3].

3. Hypotheses Development

3.1. Lean Manufacturing Practices and Corporate Social Responsibility

According to the report of Dey et al. [10], LMPs and CSR practices have common aspects such as waste reduction, resource efficiency, workforce empowerment, community strategy, and transparency. Moreover, the lean manufacturing approach addresses three key factors that a CSR-oriented company must consider: economic performance, environmental sustainability, and fair relationships with both internal and external stakeholders [16]. Recently, Al-Swidi, et al. [9] showed that LMPs implementation positively affects CSR practices within Yemeni manufacturing SMEs. Similarly, Tran,

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et al. [26] demonstrated that LMPs positively influence both social and environmental management practices within Indian manufacturing firms. Fernández Carrera, et al. [37] stated that organizations that implement LMPs have a high rate of implementation of CSR practices/activities. Based on this evidence, the following research hypothesis was developed:

H_1: LMPs positively affect CSR practices/activities

3.2. Lean Manufacturing Practices and Corporate Sustainability Performance

In line with Resta, et al. [38] the implementation of LMPs not only enhances the economic aspects (operational and financial) of organizational performance but also improves its social and environmental dimensions. Moreover, Ibikunle, et al. [7] revealed that the implementation of lean practices positively impacts the economic, social, and environmental performance of Malaysian manufacturing SMEs. Similarly, Opoku, et al. [23] as well as Afum, et al. [4] demonstrated that the adoption of lean practices enhances the economic, social, and environmental performance of manufacturing firms in Ghana.

Following Al-Swidi et al. [9], Yemeni companies that adopt lean practices in their processes and actively engage in social development initiatives are likely to achieve better sustainability performance across economic, social, and environmental dimensions. Sajan and Shalij [8] asserted that manufacturing companies adopting lean principles and practices experience greater benefits in terms of economic, environmental, and social sustainability performance, based on their case study of five industrial firms in India. Based on the above, we formulate the following research hypothesis:

H_2: LMPs positively affect corporate sustainability performance

3.3. CSR and Corporate Sustainability Performance

Relative to Mondal, et al. [39], in recent years, CSR has gained significant traction as a strategic concept embraced by business managers. Moreover, these authors showed that CSR practices positively impact the sustainability performance of 137 manufacturing micro and SMEs in India. Similarly, Bacinello, et al. [40] demonstrated that CSR approaches (and practices) can be linked to sustainable practices, considering them a source of value creation that generates competitive advantage and superior performance for SMEs in Brazil. Dey, et al. [10] However, highlighted that both social and environmental management practices of CSR positively impact economic, social, and environmental performance, contributing to overall CSR. In addition, Hassis, et al. [41] revealed that CSR activities (CSR to society, to employees, and to customers) positively affect the sustainable performance of Palestinian manufacturing firms. Based on the above, the following research hypothesis was developed.:

H_3: CSR practices/activities positively affect corporate sustainability performance

3.4. The Mediating Role of CSR between LMPs and Corporate Sustainability Performance

Relative to Zaidi and Lakhal [36], LMPs can be negatively associated with social aspects in organizations, such as employees' well-being and the quality of life of the surrounding community. Moreover, previous studies have shown that some LMPs can be negatively associated with employees' job satisfaction, intention to stay, and health and safety at work Longoni, et al. [42]; Bouville and Alis [43]. Hao, et al. [44] as well as Green, et al. [45] respectively, demonstrated the non-significant impact of just-in-time practices on the environmental performance of companies.

On the one hand, LMPs allow for the justification of CSR and economic and financial performance, and provide CSR with a rigorous methodology in terms of operational management. On the other hand, CSR provides LMPs with a means to enhance their social and environmental benefits, which means enhancing employee engagement and expanding intervention in lean manufacturing to include external stakeholders. When these two approaches are combined, they compensate for their respective shortcomings [16].

LMPs can facilitate the implementation of social practices by improving labor relations, increasing employee involvement, and promoting respect for people, as well as employee health and safety Tran, et al. [26]; Camuffo, et al. [46]. Wang, et al. [47] emphasized that LMPs for continuous improvement,

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social health and safety practices, and environmental practices contribute to sustainable composite manufacturing practices. Based on the above, and in line with studies by Al-Swidi, et al. [9] and Dey et al. [10], we hypothesize that CSR practices can mediate the relationship between LMPs and CSP in our specific context of manufacturing SMEs in Tunisia. In addition, we propose the following hypothesis:

H4: CSR practices/activities mediate the relationship between LMPs and corporate sustainability performance

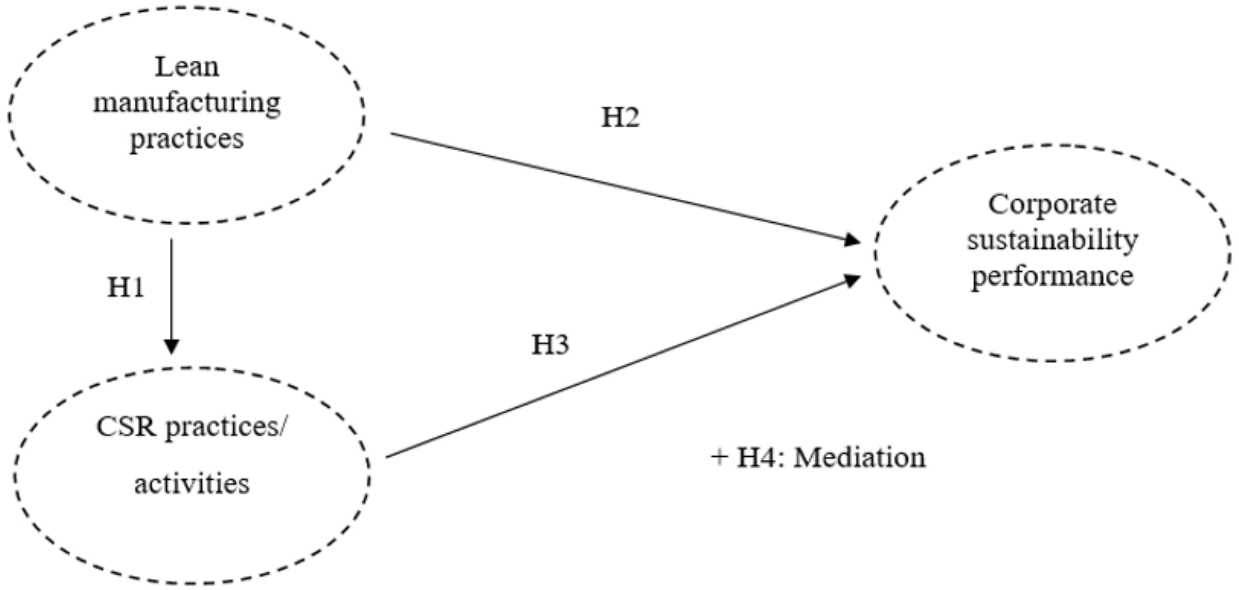

Figure 1.
Conceptual model.

4. Methodology

4.1. Research Design, Sample, and Questionnaire

This study is quantitative in nature, as it employed a structured questionnaire with closed-ended questions to collect data from 256 manufacturing SMEs in Tunisia. Moreover, the authors conducted meetings with a large number of professionals from manufacturing companies located in the Sahel region of Tunisia and contacted many others via email, professional social networks, and WhatsApp. In total, 520 individuals were contacted over a period of seven months (from January to the end of July), resulting in 363 responses, of which 256 were complete and usable for analysis.

Regarding the questionnaire, it was developed based on the recommendations of several academics and professionals in the research field. It included measurement items for each study variable, using a five-point Likert scale for responses. The questionnaire was also translated into French and sent to participants along with a cover letter expressing gratitude for their participation, highlighting the importance of their contribution, and assuring the confidentiality of their responses.

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Table 1.
Sample characteristics.

	Number	Percentage
Number of employees		
V 1-10 employees		
V 11-50 employees	32	12.5
V 51-100 employees	102	39.85
	122	47.65
Industry sectors		
V Metal industry	32	12.5
V Plastic industry	41	16.01
V Food industry	38	14.84
V Automotive industry	40	15.63
V Aviation industry	32	12.5
V Chemical industry	47	18.36
V Others	26	10.16
Certification Iso 9001		
V Certified company		
V Not a certified company	202	78.91
	54	21.09

4.2. Measurement of the Study's Variables

Based on recent studies by Al-Swidi, et al. [9] and Dey et al. [10], lean manufacturing practices (LMPs) were measured using six items, corporate social responsibility (CSR) practices or activities using six items, and corporate sustainability performance (CSP) using eleven items.

4.3. Analysis: Partial Least Squares Structural Equation Modeling (Pls-SEM)

PLS-SEM is now widely applied across various social science disciplines, including organizational management, strategic management, international management, human resource management, management information systems, operations management, and supply chain management [48]. Moreover, this approach estimates the parameters of a set of equations within a structural equation model by combining principal component analysis with regression-based path analysis. It also offers several advantages for researchers employing cause–and–effect relationship models to explain or predict specific constructs [49]. As stated by Hair Jr, et al. [50] compared to CB-SEM, PLS-SEM offers several significant advantages, including the ability to use formative measurement models, which differ considerably from reflective ones, as well as its robustness to non-normal data and suitability for small sample sizes.

5. Results and Discussion

5.1. Results

Following the guidelines of Hair, et al. [51] and Hair, et al. [48], the recent work published by Zaidi and Lakhal [2], we adapted the table presented in their study to illustrate the different steps involved in analyzing PLS-SEM results (see Table 2).

Table 2.
PLS-SEM analysis steps.

1. Measurement model assessment	
Indicators	**Recommended threshold**
Constructs' reliability: Cronbach alpha Composite reliability	≥ 0.7
Convergent validity: Average variance extracted (AVE)	≥ 0.5
Discriminant validity: Fornell-Larcker criterion	The shared variance for all model constructs must be less than their AVEs.
2. Structural model assessment	
Indicators	Interpretation
R2 coefficient	Values of 0.25, 0.50, and 0.75 are considered weak, moderate, and substantial explained variances.
f2 coefficient	Values of 0.02, 0.15, and 0.35 of f2, respectively, indicate weak, moderate, and strong effects.
p-value	Value < 0.05 indicates a significant impact.

Source: Hair, et al. [51] and Hair, et al. [48].

Moreover, we start with the assessment of the measurement model. Table 3 shows that all Cronbach's alpha and composite reliability values are greater than 0.7, confirming the internal reliability of our measurement model. In addition, the average variance extracted (AVE) values exceed the threshold of 0.5, thereby confirming convergent validity. Finally, Table 4 presents the Fornell–Larcker criterion assessment. In line with the recommendations of Hair et al. [48], the shared variance between all model constructs is lower than their corresponding AVE values. Thus, discriminant validity is confirmed.

Table 3.
Composite reliability and Convergent validity.

	Cronbach's alpha	**Composite reliability (rho_a)**	**Composite reliability (rho_c)**	**Average variance extracted (AVE)**
CSR Practices	0.861	0.871	0.897	0.593
Corporate sustainability performance	0.886	0.899	0.906	0.537
LMP	0.815	0.824	0.867	0.523

Table 4.
Discriminant validity using Fornell-Larker Criterion.

	CSR Practices	**Corporate sustainability**	**LMP**
CSR Practices			
Corporate Sustainability	0.851		
LMP	0.978	0.871	

Table 5 shows the R2 assessment. Based on our results, 77.5% of the CSR variance was explained by the LMPs, and 61.4% of the CSP variance was explained by LMPs and CSR practices.

Table 5.
Assessment of R2.

	R-square	**R-square adjusted**
CSR	0.775	0.773
Corporate sustainability performance	0.614	0.606

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In addition, Table 6 shows the F2 assessment. Our results indicate that LMPs have a strong effect on CSR (F2=3.454) and a weak effect on corporate sustainability performance (F2=0.078).

Table 6.
Assessment of f2.

	Lean Manufacturing Practices	CSR Practices	Corporate Sustainability performance
CSR Practices			
Corporate Sustainability performance			
Lean Manufacturing Practices		3.454	0.078

Table 7 shows the results of hypothesis testing, particularly the direct effects from LMPs to CSR, from LMPs to CSP, and from CSR to CSP. Relative to our results, we accept the three research hypotheses (H1, H2, and H3).

Table 7.
Direct effects analysis.

	Original sample (O)	Sample mean (M)	Standard Deviation (STDEV)	T -Statistics (|O/STDEV|)	P-value	Decision
LMPs -> CSR	0.881	0.755	0.026	33.353	0.000	Accept
LMPs -> CSP	0.336	0.386	0.142	2.568	0.010	Accept
CSR -> CSP	0.442	0.918	0.150	2.946	0.003	Accept

Moreover, the latest Table 8 shows the results of the mediating or indirect effects analysis. Our results indicate that CSR practices positively mediate the relationship between LMPs and CSP. Thus, mediation can be called, as maintained by Baron and Kenny [52] a partial mediation, as the direct effect exists.

Table 8.
Mediation effects analysis.

	Original sample (O)	Sample mean (M)	Standard Deviation (STDEV)	T statistics (|O/STDEV|)	p-value	Decision
LMPs -> CSR-> CSP	0.389	0.392	0.132	2.946	0.003	Accept

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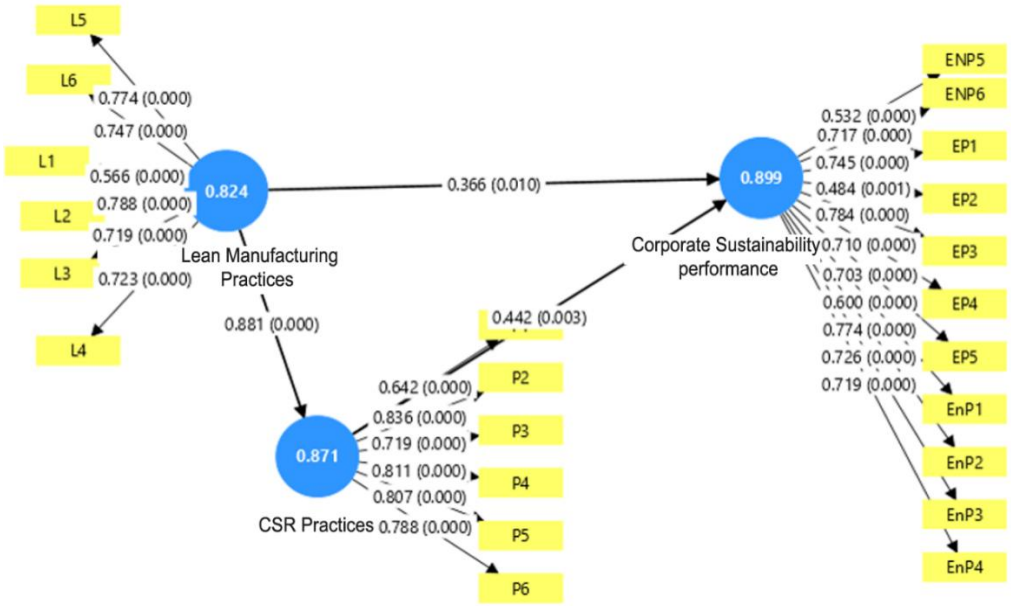

Figure 2.
Structural model.

5.2. Discussion

Our findings first revealed that LMPs positively affect CSR activities within manufacturing SMEs in Tunisia. This is consistent with the study conducted by Chiarini, et al. [1], which indicated the compatibility between lean manufacturing tools, methods, and practices and corporate social responsibility (e.g., the environmental and safety dimensions of corporate social responsibility), as well as the evidence provided by Al-Swidi, et al. [9] and Dey, et al. [10] in their studies on manufacturing SMEs in Yemen and the United Kingdom.

According to Afum, et al. [53] LMPs can be viewed as an effective mechanism employed by SMEs in emerging economies to address stakeholder concerns and to mitigate social and reputational risks. Moreover, the findings of the study support this assertion by providing empirical evidence of the positive influence of LMPs on both social and environmental initiatives within the manufacturing context.

Despite the growing literature on lean manufacturing and corporate sustainability performance [7, 54], more research is still needed on LMPs and CSP in the context of developing countries, including potential mediators and/or moderators to better explain the relationship between these two concepts [9]. Based on these limitations, this study also showed that LMPs positively affect CSP, which can be in line with studies by Afum, et al. [4] on Ghanaian SMEs and Burawat [12] on Thai manufacturing SMEs.

In fact, the lean approach is sometimes viewed as a "neo-Taylorist" approach that aims to increase productivity at the expense of employees, social, and environmental aspects [25]. Based on this assumption, we examined the mediating role of CSR practices and activities on the relationship between LMPs and CSP. However, our results first indicated that CSR practices positively contribute to CSP, which are in line with findings of Mondal, et al. [39] on micro, small, and medium-sized enterprises in India, as well as findings of Bacinello, et al. [40] on Brazilian SMEs. Second, CSR activities significantly (albeit partially) mediate the relationship between LMPs and CSP. These findings are consistent with recent evidence made by Al-Swidi, et al. [9] and Dey, et al. [10]. They also corroborate the statement of Ivanaj, et al. [16] that LMPs and CSR activities are synergistic, and that this synergy can align economic performance with social and environmental performance, ultimately leading to enhanced CSP.

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In accordance with Agyabeng-Mensah, et al. [55] few studies conducted from an African perspective focus on environmental sustainability. Moreover, Hamdoun, et al. [56] recently noted that, in Tunisia, companies are becoming increasingly concerned with their social responsibility, paying particular attention to environmental issues in response to the laws and policy instruments enacted by public authorities. Despite this evidence, there is still insufficient literature on the impact of operational practices (e.g., LMPs) on social and environmental practices and performance [2], which motivates the present study to examine the relationship between LMPs, CSR activities, and CSP. Such an investigation will contribute to the limited body of literature on these concepts, while also providing Tunisian managers and policymakers with valuable insights to better address sustainability challenges.

6. Conclusion

This study empirically examined the relationship between LMP adoption, CSR activities, and CSP within manufacturing SMEs in Tunisia. Our findings revealed that LMPs represent an effective strategy and tool for enhancing CSP in the manufacturing sector of developing countries, assisting companies in integrating socially and environmentally sustainable practices into their operations. Moreover, it provides both theoretical and managerial implications.

6.1. Theoretical Implications

This research seeks to test a theoretical framework linking LMPs, CSR activities, and CSP within Tunisian manufacturing SMEs. Moreover, it contributes to the limited body of literature addressing the relationships among these concepts. According to Chiarini et al. [1], the relationship between LMPs and CSR activities remains vague and unclear in existing research. Similarly, Ivanaj, et al. [16] indicated that, despite the importance of both approaches (i.e., lean manufacturing and CSR), companies tend to address them separately.

Building on this gap, we examined the links between LMPs, CSR activities, and CSP, considering CSR as a mediating factor between LMPs and CSP. Our findings reveal that LMPs significantly influence CSP both directly and indirectly through CSR activities. This evidence particularly highlights the importance of adopting social and environmental management practices alongside LMPs to enhance CSP within manufacturing SMEs.

6.2. Managerial Implications

This study offers several implications and recommendations for Tunisian managers in the manufacturing sector. First, it highlights the importance of adopting LMPs (such as just-in-time practices, quality management practices, and employee-related practices) to enhance labor productivity, product and process quality, as well as social and environmental outcomes. Moreover, these practices have been shown to reduce waste generation and conserve resources and energy within manufacturing processes, thereby improving employee health and safety and the satisfaction and well-being of stakeholders, including customers. These insights are particularly novel given the limited research in the Tunisian context. In addition, the study provides new evidence regarding the role of social and environmental practices, within the CSR framework, in enhancing corporate sustainability performance. Such practices enable managers to more effectively address sustainability challenges in light of current global pressures.

Finally, in line with the study by Zaidi and Lakhal [36]. Tunisian managers should reconsider their operational policies and align them more closely with corporate social responsibility in order to enhance their sustainability performance and social reputation.

6.3. Limitations and Future Research Directions

Like any other study, the present research has several limitations. First, we conducted a purely quantitative investigation within manufacturing SMEs in Tunisia, which may limit the generalizability of the findings. Second, our focus on manufacturing SMEs excluded large firms and organizations from

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this and other sectors, even though the lean approach can be adopted across various industries; therefore, future studies should explore its impact in different analytical contexts. Third, we did not include any moderating or control variables in our conceptual model, which represents an additional limitation. Fourth, we conceptualized CSP as a first-order construct that combines economic, social, and environmental performance, whereas these dimensions could be examined separately. Based on these limitations, we recommend further qualitative and mixed-method research on LMPs, CSR, and CSP, incorporating additional moderating and control variables (e.g., firms' size, industry type, etc.), and conceptualizing CSP as a second-order construct.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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Appendix 1.
Measures of variables.

Lean manufacturing practices, Shah and Ward [30]
JIT1: Our customers receive JIT deliveries from us
JIT2: We use a kanban pull system for production control
TQM1: Our plant ensures that all tools and fixtures are in place
TQM 2: We actively develop proprietary equipment
HRM1: We encourage employees to work together to achieve common goals, rather than compete with each other
HRM2: Our employees receive training to perform multiple tasks
Corporate social responsibility activities Dey, et al. [10]
CSR1: Our company has an energy management system
CSR2: Our company has a waste management system
CSR3: Our company has a resource management system
CSR4: Our company ensures employee well-being
CSR5: Our company ensures the well-being of relevant stakeholders
CSR6: Our company undertakes corporate social responsibility (CSR) projects
Corporate sustainability performance
Abdul-Rashid, et al. [57], Iranmanesh, et al. [58], Yu, et al. [13] and Jum'a, et al. [59]
CSP1: Our company increases market share and growth rate
CSP2: Our company increases sales revenue
CSP3: Our company enhances production efficiency and product quality
CSP4: Our company improves profitability
CSP5: Our company reduces expenses and unit production costs
CSP6: Our company reduces the consumption of fossil fuels to reduce emissions
CSP7: Our company uses energy-efficient equipment to save energy
CSP8: Our company uses green technology for cleaner production and less material consumption
CSP9: Our company reduces the use of hazardous materials in product development and production processes
CSP10: Our company improves customer relationships through just-in-time delivery and high-quality products.
CSP11: Our company enhances brand image through social commitment to society.

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