Impact of Information Technology on Corporate Social Responsibility in Albanian Small and Medium-Sized Enterprises Across Key Industries

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Abstract. Implementing Information Technology (IT) in small and medium-sized enterprises (SMEs) is critical in promoting sustainable business practices, especially in developing European nations aligned with the United Nations with Sustainable Development Goals (SDGs). This study evaluated the impact of implementing IT on sustainable practices within Albanian SMEs, focusing on how IT usage improved corporate social responsibility (CSR) initiatives aligned with SDGs. We surveyed how implementing various IT for strategic business processes impacted CSR for SMEs in the Albanian agriculture, manufacturing, retail, and service industries (N=66). We applied machine learning with linear discriminant analysis to develop a model representing the survey data and highlight how four specific IT business processes impacted CSR achievement. This study offered practical recommendations for policymakers and business leaders to promote IT integration in SMEs, promoting a more sustainable and socially responsible environment.

Keywords: Information Technology Adoption, Small and Medium-Sized Enterprises, Sustainable Business Practices, Corporate Social Responsibility, Sustainable Development Goals, Operational Efficiency, Resource Management, Waste Reduction, Energy Efficiency, Machine Learning, Linear Discriminant Analysis.

1 Introduction

SMEs are critical to the economies of developing economies [1, 2]. SMEs form a significantly to the economic infrastructure in developing countries, such as Albania [3, 4]. The integration of IT within SMEs is a topic of continual interest among researchers because of the rapid changes and advancements in technology [5, 6]. SMEs often face unique challenges that make the adoption of IT tools instrumental for their sustainability [7-9]. This paper evaluates the impact of IT adoption on the sustainable practices of Albanian SMEs. The focus of this paper is to examine the impact of IT in enhancing operational efficiency, CSR initiatives, and alignment with the United Nations' SDG. In contrast to large companies, SME are often characterized by con-

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straints, including limited resources and lower adoption rates of advanced technologies [10, 11]. SMEs need to adopt IT tools not only to survive in the competitive market but also to align with the global sustainability standards [8]. The adoption of advanced IT technologies can serve as a key enabler in transforming the SMEs by improving their operational efficiency, tracking sustainability metrics, and meeting the CSR obligations [12].

Albanian SMEs in some of sectors, including agriculture, manufacturing, and retail have faced major challenges in adopting IT tools because of financial, infrastructural, and human resource limitations [3, 13]. There is an increasing demand for sustainability-driven business models globally, hence IT adoption is no longer viewed as optional [14, 15]. SMEs are increasingly focusing on adoption of IT to improve their resource management, waste reduction, and energy efficiency [16, 17]. SMEs are also focusing on aligning with the global SDGs and are looking at IT integration as a social responsibility and not just a business need [18, 19]. Several researchers have focused on the link between IT adoption and operational efficiency but there is a need for studies to examine the link between IT adoption and its effect on sustainable practices, especially in developing economies [20-22]. This study addresses this gap in literature by investigating how IT adoption influences sustainability outcomes across various sectors in Albania. Through this study we examine how different IT tools, including Enterprise Resource Planning (ERP), Business Intelligence (BI), and Internet of Things (IoT) systems impact key sustainability metrics like energy use, waste management, and water conservation.

2 Background

Our study is timely as there is a global push on achieving the SDGs by 2030 [23-25] and considering that SMEs form the backbone of several developing economies [26, 27], they need to be on board if these goals are to be achieved in this short timeframe. Hence, there is a need for SMEs to align their operations with the sustainability goals. SMEs can play a significant role in global supply chains and if they can adopt IT solutions for sustainability then this could help them contribute to achieving SDG goals, especially those related to responsible consumption, climate action, and clean energy [28].

IT tools can improve the data-driven decision-making processes in SMEs [29, 30]. For example, SMEs can track their performance on key sustainability indicators, such as carbon emissions, waste generation, and resource usage by using the data analytics capabilities offered by various IT tools [12, 31]. The use of these tools can help the management of SMEs make informed decisions contributing to achieving the long-term sustainability goals. The adoption of the IT tools can also help SMEs develop new business models with a focus on sustainability, for instance models based on circular economies and green supply chains [32, 33]. CSR is also now a key aspect of business strategy for SMEs, especially in developing countries, as these SMEs work on improving their social and environmental impact. IT tools can be used by the SMEs to measure and report their CSR activities and in this process offer increased

levels of transparency and accountability to stakeholders. Albanian SMEs are also increasingly adopting CSR initiatives to the SDG goals as they try to align with both national regulations and international standards [34, 35].

3 Review of Literature

One of the key drivers for advancing the CSR initiatives across various SMEs is the integration of IT into the business processes [36]. Many SMEs are increasingly focusing on sustainable development and in this process adopting IT tools for enhancing operational efficiency, reducing environmental impact, and improving the overall social responsibility practices [7]. There is existing literature indicating a positive correlation between IT adoption and improved CSR outcomes, especially in developed economies [37-39]. However, there is limited literature exploring the extent to which IT integration in SMEs in developing countries like Albania are enhancing the CSR efforts, especially in the areas of energy management, waste reduction, and operational efficiency.

IT systems and tools, including ERP and BI tools can provide SMEs track key performance indicators related SDG targets, such as carbon emissions, energy consumption, and waste management [40, 41]. Using these technologies, SMEs can align their business operations with improving transparency and accountability as well as the global SDGs. IT tools can provide SMEs with real-time data on various sustainability indicators that are critical for informed decision-making [28]. For instance, sustainability metrics, such as water consumption, waste generation, and energy efficiency are directly related to several SDGs, such as clean water and sanitation (SDG-6) [42], affordable and clean energy (SDG-7) [43], and responsible consumption and production (SDG-12) [44]. IT tools, such as tracking systems and IoT devices can help SMEs measure their contributions to these global goals ensuring that their operations remain sustainable and socially responsible [45].

Large corporations usually have the financial resources to implement advanced IT tools and systems to track SDG metrics, but SMEs often face significant challenges in IT adoption [46]. These challenges include financial limitations, lack of technical expertise and human resources, and infrastructural constraints [47]. However, if SMEs can manage to address these constraints, then they can integrate IT tools to track the sustainability metrics and, in this process, experience significant improvements in their CSR initiatives and overall business performance. SMEs can take advantage of IT tools such as cloud-based systems, mobile application, and data analytics platforms to address some of these constraints [48, 49], as these technologies and tools are increasingly accessible to SMEs at relatively lower costs as compared to some of the advanced tools used by large corporations.

Data analytics is a key IT tool that can be used by SMEs for tracking SDG performance as this tool allows SMEs to analyze large volumes of data related to environmental and social sustainability [50]. For example, SMEs can use data analytics to identify areas where they are falling short of SDG targets, including high energy consumption or excessive waste production [51]. Data analytics enable leadership of

SMEs to have data-driven insights through which they can adjust their operations to align with the sustainability goals. SMEs can also use the IoT technology to track sustainability metrics by monitoring resource usage, emissions, and energy efficiency in real-time [52]. For example, smart meters and sensors can track water and energy consumption in real-time allowing SMEs to meet their SDG targets as well as improve their operational efficiency [53, 54].

ERP systems are also critical IT tools that can be useful for SMEs in tracking SDG performance metrics La [55]. SMEs can monitor their overall performance in relation to SDG targets by integrating business processes, including supply chain management, production, and resource allocation into a unified system. ERP systems can help SMEs use a unified platform by centralizing data and tracking SDG-related goals, such as reducing carbon emissions, improving waste management, and optimizing energy use [41]. IT tools also help in enhancing transparency in SDG reporting as these tools can offer automated integrated information.

IT solutions, including ERP systems, CRM platforms, and automation tools can help SMEs streamline their processes and optimize the resource usage [56]. SMEs can improve their operational efficiency by automating routine tasks, improving data management, and optimizing supply chain processes leading to increased productivity and operational agility. SMEs often face challenges with human resources as most of their staff are organized in manual processes [8]. The use of IT tools can help SMEs by automating repetitive and labor-intensive tasks, freeing up human resources to invest in strategic activities and improving efficiency.

Another critical area where the SMEs in developing countries can benefit from the adoption of IT tools is in the domain of supply chain management [28, 33]. Supply chains in developing countries are fragmented and inefficient because of limited infrastructure. IT tools, including ERP systems and supply chain management software will allow the SMEs to manage their supply chains by providing real-time visibility in inventory levels, procurement processes and logistics [56]. SMEs can forecast demand accurately, optimize inventory levels, and reduce operational delays in supply chain management improving their overall operational efficiency [22]. Cloud computing is another IT solution that can help SMEs in developing countries improve their operational efficiency [48, 49]. Cloud-based applications can provide SMEs with scalable tools to manage operations without the need for significant financial investment.

SMEs can also benefit IT tools, such as smart meters, energy analytics platforms, and real-time monitoring systems to monitor energy consumption, identify inefficiencies, and reduce energy usage [12, 28, 52]. Although these tools would require investment, SMEs can reap long-term benefits as they can avoid high costs of energy, improve operational efficiency, and reduce their environmental footprint. SMEs can use IT tools for energy management and in this process improve energy efficiency and reduce greenhouse gas emissions [57]. SMEs in agriculture, manufacturing, and service sectors can also benefit from the use of IT tools such as water monitoring systems and IoT sensors to track water usage, detect leaks, and optimize water consumption [58]. SMEs can not only reduce and enhance eater conservation but also contribute to the sustainability goals. SMEs adopting IT tools for water management

can benefit from improvements in energy efficiency and reduction in operational costs.

The integration of IT tools into business operations can also benefit SMEs in their CSR initiatives [37]. Especially, IT tools can provide SMEs with the capabilities to manage and report their social, environmental, and governance practices and in this process also increase their transparency, accountability, and data-driven decision-making capabilities. The use of data analytics and reporting platforms can help SMEs track their performance across CSR dimensions, including environmental impact, resource efficiency, and social contributions [19]. ERP systems and BI platforms can provide SMEs with real-time data on key sustainability indicators which can help the leadership measure the effectiveness of the CSR initiatives. CSR is a stakeholder-driven concept as businesses are not only accountable to the stakeholders but also to the employees, customers, communities, and regulators. IT tools can help improve the stakeholder engagement in CSR activities as the use of IT platforms like social media, CRM systems, and online reporting tools can help engage stakeholders in real-time.

4 Research Methodology

We adopted a pragmatic ideology for the research design, which means we attempted to collect information but would accept quantitative and qualitative data types (transforming the latter where necessary). We were also open-minded about the analytical techniques used to answer the research question. We obtained ethical clearance from our institutions to conduct the survey, we piloted the survey to improve its validity, and we released it for two weeks in 2024. Once the data were cleaned, we had 66 valid SME response records.

The survey used drop down choices for the descriptive statistics (age, gender, education level, job title category, and industry). The variables used a 1-5 interval scale for the survey items (5 was highest). These were the abbreviated survey questions with variable names for our analysis:

- How much is IT used for tracking SDG performance (TrackSDGIT);
- How much is IT used for operations (OperationsIT);
- How much is IT used for energy and water management (EnergyWaterMgtIT);
- How much is IT used for waste management (WasteMgtIT);
- How much did Corporate Social Responsibility improve by using IT (ImprovedCSR).

The first four variables, and the demographic attributes were the independent factors of interest. ImprovedCSR was the target or dependent variable related to answering the RQ.

We chose machine learning (ML) for the preliminary analysis, followed by linear discriminant analysis (LDA). We summarized the sample descriptive statistics and then developed a training model in ML to represent the four categories of business processes where IT was implemented to improve CSR (information systems, operations, energy/water management, and waste management). We calculated and report-

ed all model evaluation metrics. We extended our analysis on how implementing IT to automate the four business processes by exploring if there were any differences across the four industries of agriculture, retail, manufacturing and services. To accomplish this, we developed a generalized linear model with the four business processes as covariates and the industry as the independent factor, regressing on CSR improvement. Again, we calculated and disclosed all relevant model diagnostic and effect size estimates.

5 Findings and Discussion

5.1 Preliminary analysis

In terms of sample descriptive statistics, there were, as noted, four industries: agriculture, retail, manufacturing, and services. All were classified as SMEs, with less than 100 employees in Albania (N=66). There were 10 in agriculture (15.2%), 22 in manufacturing (33.3%), 16 in retail (24.2%), and 18 in the services industry (27.3%). The job titles of the sample participants were quite wide, ranging from support operations employee to CEO. There were 16 operations-level employees (24.2%), 28 IT specialists (42.4%), 15 were line managers (21.2%), and 8 were executives such as owners or CEOs (12.1%). All participants had some type of higher education degree. Most of the participants, 41 (62.1%) had a Bachelor's degree, 22 had a Master's degree (33.3%), and the remaining 3 (4.6%) had an Associate degree (percentages were rounded). Gender was balanced approximately equally in the sample distribution, with 47% female and the remaining 53% male. The ages of the participants ranged from post-college of 18 up to nearing retirement age. We assert it was normal to observe younger professionals in Albanian SMEs due to the developing status of the nation and the fact that many owners allow their children or relatives to work while obtaining their first degree. There were 13 in the 18-25 age group (19.7%), 17 in the 25-34 category (25.8%), 20 in aged 35-44 (30.3%), 14 at age 45-54 (21.2%), and two (3%) aged 55 or over.

The target variable to explore our RQ was how much CSR had improved by implementing IT (ImprovedCSR). We calculated the sample descriptive statistics for the independent factors of interest and the target-dependent variable by reporting the mean (M), standard deviation (SD), and standard error (SE). From an overall sample distributional perspective, TrackSDGIT had the most use on average by SMEs (M = 4.030, SD = 0.841, SE = 0.103), which was tied with EnergyWaterMgtIT (M = 4.030, SD = 1.037, SE = 0.128). OperationsIT was next (M = 3.561, SD = 1.025, SE = 0.126), followed by WasteMgtIT (M = 3.364, SD = 1.377, SE = 0.170). We could say from these sample factor estimates that IT was being used by SMEs in these four important business process categories to support SDG alignment and CSR reporting. ImprovedCSR on average, showed improvement (M = 3.788, SD = 1.157, SE = 0.142) through implementing IT across the four business process categories in the SMEs.

5.2 Model development and evaluation

We developed the SME model in ML by setting ImprovedCSR as the target variable and selecting all four business process IT categories as features (TrackSDGIT, EnergyWaterMgtIT, OperationsIT, and WasteMgtIT). We allocated 20% of the data as a holdout for testing the model. Since our RQ was focused on how well or how much the four IT-enabled business processes improved CSR, we were interested in the levels of the features, and it was a small sample size, this is the reason we selected discriminant analysis over regression as the statistical technique. Statistically, the four independent factors, the features, were not actually scaled data types, instead, they were perceived categories of IT usefulness across the four business processes judged by the participants. This was essentially a classification goal, to determine which levels of IT implementation across the business processes could explain increases in the target variable improved CSR. Science the features and target variable were interval data types we used Pearson Product Moment as the algorithm for estimating the discriminant function.

The discriminant function model had 69.2% test accuracy. The detailed ML training model evaluation metrics are listed in Table 1. Certain evaluation metrics are generally accepted as indicators of a suitable ML model, which are discussed here (the other metrics are listed in Table 1 for completeness and transparency). We may observe from Table 1 that the model classification accuracy using the 20% test data was 86% (all estimates are rounded in this discussion). Generally we would look for an overall accuracy over 70% and close to 90%. A useful indicator of a good model is the F1 score since it incorporates several of the metrics. The F1 coefficient was 0.683, which indicates a functional model with medium accuracy. Since the sample size was small, we would need more data to further validate this model. AUC is an indicator of ML model effectiveness, and we would also benefit from a visual representation of the data fit to the ML model. In Table 1, we can see the AUC is 0.869 which is acceptable as it is over 80%.

Table 1. Machine Learning discriminant analysis classification model evaluation metrics

ML evaluation metric	**1.0**	**3**	**4**	**5**	**Mean**
Support	1.0	5	2	5	13
Accuracy	1.0	0.923	0.769	0.769	0.865
Precision (Positive Predictive Value)	1.0	0.833	0	0.75	0.686
Recall (True Positive Rate)	1.0	1	0	0.6	0.692
False Positive Rate	0	0.125	0.091	0.125	0.085
False Discovery Rate	0	0.167	1	0.25	0.354

F1 Score	1	0.909	NaN	0.667	0.683
Matthews Correlation Coefficient	1	0.854	-0.123	0.501	0.558
Area Under Curve (AUC)	1	1	0.727	0.75	0.869
Negative Predictive Value	1	1	0.833	0.778	0.903
True Negative Rate	1	0.875	0.909	0.875	0.915
False Negative Rate	0	0	1	0.4	0.35
False Omission Rate	0	0	0.167	0.222	0.097
Threat Score	∞	2.5	0	0.75	∞
Statistical Parity	0.077	0.462	0.077	0.308	0.923

Note: All metrics are calculated for every class against all other classes.

Figure 1 depicts the AUC plotted with the receiver operator curve. This illustrates several important metrics interacting with one another in the same diagram. The false positive rate, which was 0.085 (lower is preferable) is shown on the x-axis in Figure 1. The true positive rate (also called the recall rate), which was 0.692 (higher is preferable) is plotted on the y-axis in Figure 1. The data series in Figure 1 represents each classification level of the ImprovedCSR target variable.

We could interpret Figure 1 as suggesting that lower levels of CSR improvement were easily predicted by lower IT implementation across the four business processes, they had no impact (were not listed). The middle-of-the road CSR achievement of 3 (brown line in Figure 1). was easily predicted by the model, with perfect separation. Levels 4 and 5 of CSR improvement varied somewhat in terms of model classification accuracy (green and blue lines in Figure 1). Since the top of each scale, false versus true positives, are opposite in terms of what we would like to see, the better lines are going straight up with a low false positive rate (on left) and a high true positive (recall) rate on the top of the y-axis. This simply indicates the model is not perfect, and likely it could be improved with a larger sample size. Nonetheless, we have proven that more effectively applying IT across the four business processes does result in better (higher classified) CSR improvements.

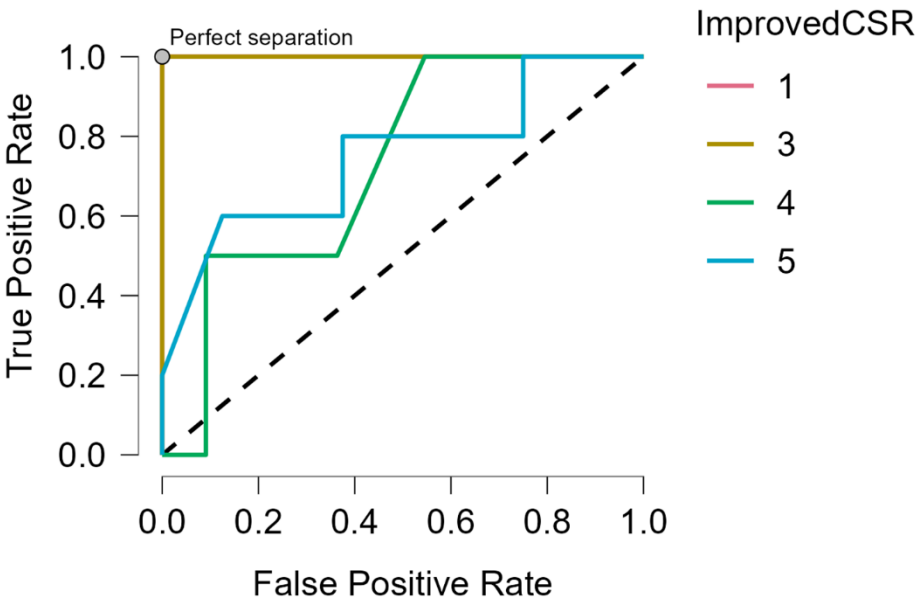

Fig. 1. ML SME CSR improvement training model area under the curve

We acknowledge this model is just the beginning. We are in the process of extending this study by collecting more data and by developing a generalized linear model to illustrate how using IT across the four business processes improves CSR by industry.

6 Future Research Directions

This study focused on the impact of adoption of IT tools by Albanian SMEs on the sustainability practices. Future research work could focus on cross-country comparative analysis of IT adoption in SMEs in other developing economies. This will help researchers examine the challenges and benefits of IT integration across different socio-economic and regulatory environments. There is also a need to examine the long-term impact of IT adoption on SME sustainability as the current studies indicate immediate improvements in operational efficiency and waste reduction. However, more longitudinal studies are needed to explore how IT-enabled sustainability practices contribute to long-term business resilience in SMEs.

As IT tools cover a wide range of technologies, including AI and advanced data analytics, future studies could examine the impact of each of these technologies in driving sustainability practices in SMEs. Considering the significant advancements in AI, there is also a need for integration of AI in sustainability-focused IT systems leading to the development of new business models. Future studies also need to examine the financial implications of IT adoptions for sustainability in SMEs. This is important because SMEs often face financial investment hurdles because the initial investment in IT infrastructure can be significant. Hence, SMEs are likely to be reluc-

tant to invest on new technological tools unless they understand how these costs are offset by the long-term savings because of using these technological tools. Future research is also needed on a sector-specific basis because each sector faces unique sustainability challenges and opportunities. For instance, agricultural SMEs may benefit more from IT tools enhancing water management, while manufacturing sector SMEs could focus on reducing energy consumption and waste.

7 Conclusion

This study has demonstrated the positive impact of IT adoption on CSR performance within Albanian SMEs across the agriculture, manufacturing, retail, and service sectors. The findings suggest that integrating IT into business processes enhances operational efficiency and enables better tracking of sustainability metrics such as waste management, energy use, and resource optimization. The use of tools like ERP systems, BI, and IoT devices has helped SMEs improve their alignment with global sustainability goals, including the UN SDGs. The adoption of IT has increased transparency and accountability in CSR reporting, allowing SMEs to engage more effectively with stakeholders. This study also has its limitations, including a smaller sample size and it is limited to a few industrial sectors in Albania. There is a need to replicate this study to cover SMEs in other sectors and also other countries. The small sample size and sector-specific focus of this study limit the generalizability of the findings to other industries and regions. More research is needed to understand the long-term impacts of IT on CSR across different sectors and in other developing economies. The limited availability of technical expertise and the high initial cost of IT investments have made it difficult for many SMEs to implement comprehensive IT solutions for improving CSR performance.

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