

Blockchain-Enabled Supply Chain Financing, Firm Performance and Financial Capital Availability: A Tri-Variate Interaction Analysis for Small and Medium Family Enterprises

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ABSTRACT

This study investigates the influence of blockchain-enabled supply chain financing (BcTSCF) on the performance and financial capital availability of small- and medium-sized family enterprises (SMFEs) in Ghana. Utilizing the purposive sampling method, data were collected from 215 SMFEs across Ghana's agribusiness, construction, catering and hospitality, fashion and design, and wholesale and retail sectors. Drawing implicitly on resource-based theory and employing a quantitative correlational approach and PLS-SEM, we find that financial capital availability is positively influenced by BcTSCF, enhancing firm performance, especially innovation performance. Specifically, BcTSCF is positively related to the availability of financial capital. Furthermore, firm performance was positively influenced by the availability of financial capital for SMFEs ($\beta = 0.652$; $t\text{-value} = 20.287$; $CI [0.587, 0.713]$; $p < 0.001$). Between innovation and financial performance, the availability of financial capital has a greater impact on the former than the latter ($\beta = 0.574$; $t\text{-value} = 19.443$; $CI [0.516, 0.632]$; $p\text{-value} < 0.01$). This study contributes significantly to the sparse academic discourse in sub-Saharan Africa by addressing the gap in research on BcTSCF and SMFEs in developing countries. Again, it provides important information for industry practitioners and regulators to encourage blockchain usage and to enhance SMFEs' financial health of SMFEs.

Keywords: blockchain-enabled supply chain financing (BcTSCF), firm performance, financial capital availability, small and medium family enterprises (SMFEs), Partial least squares structural equation modeling (PLS-SEM)

INTRODUCTION

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Access to financial capital is widely recognized as a primary challenge hindering small business growth (Kamble et al., 2019). Small- and medium-sized family enterprises (SMFEs) are integral to economic development, yet they often struggle with funding obstacles due to factors such as information asymmetry, heightened default risks, and limited collateral (Begnini et al., 2024; Gupta & Gregoriou, 2018). Blockchain technology-enabled supply chain finance (BcTSCF) presents a groundbreaking solution that facilitates business financing by expanding access to capital and offering alternative fundraising channels (Gao et al., 2018). Research indicates that BcTSCF can reduce knowledge asymmetry and streamline transactions, resulting in more efficient and cost-effective funding processes (Karlton et al., 2017). The implementation of BcTSCF offers multiple advantages, including ensuring the smooth flow of capital, enhancing funding services, building trust, fostering peer-to-peer collaboration, and promoting transparency (Beck & Cull, 2014). Financial capital is essential for businesses to operate effectively, allowing them to expand into new markets and strengthen their competitive positions (Xu & Hitt, 2020). It is a critical driver of sustainable competitive advantage, firm performance, and overall business growth (Choi, 2019; Du et al., 2020). According to Ruggiero and Cupertino (2018), adequate financial resources, such as working capital and cash flow, play a vital role in promoting innovation and enabling firms to invest in research and development, which is essential for performance. Despite the many benefits blockchain technology offers, limited research exists on how BcTSCF impacts the fundraising efforts of small businesses, especially in emerging markets. In Ghana, the development of BcTSCF has been supported by advances in ICT and increased funding (World Bank Group, 2019), with ICT4AD policy further promoting technological innovation (Coffie et al., 2021). Platforms like AgriXchain, Kudigo, and Pezesha have emerged, backed by support from Ghana's Ministry of Communication and Digitalization (MoCD), Ghana Enterprises Agency (GEA), and the Association of Ghana Industries (AGI) (Startup Facility, 2020). While blockchain adoption is gaining traction in developed countries, its implementation remains in the early stages in developing nations, with most studies being theoretical (Kshetri, 2018). This highlights the need for more research into the real-world application of BcTSCF (Schuetz & Venkatesh, 2020). Ghana presents a unique opportunity to explore the impact of blockchain technology in a developing country context. This study aims to fill the existing research gaps by taking an empirical approach to investigate how BcTSCF influences the availability of financial capital. Furthermore, it examines the relationship between financial capital availability and firm performance within SMFEs. The novelty of this research lies in its empirical exploration of the three-way relationship between BcTSCF, financial capital availability, and firm performance, specifically for SMFEs in Ghana. The findings of this study offer important insights into the potential of emerging technologies like BcTSCF in Ghana and will assist policymakers and stakeholders in formulating strategies to foster the successful integration of BcTSCF into the country's economic framework.

LITERATURE REVIEW

Blockchain-enabled SCF

BcTSCF is the application of blockchain technology (BcT) to oversee the supply financing activities of businesses (Gao et al., 2018). BcTSCF accelerates supply chain finance by concurrently exchanging information among stakeholders to minimize communication and transfer errors (Kamble et al., 2019). According to Ta et al. (2018), business funding activities are increased by BcTSCF's facilitation of improved costs, information exchange, and financial accessibility. Wang et al. (2019) examine how the decentralized consensus processes of blockchains can minimize information asymmetry and improve the efficiency of lending and borrowing. Saberi et al. (2019) assert that because BcT promotes decentralization, security, audibility, and smart execution, small businesses may find themselves in need to use it extensively for their fundraising efforts. Previous research indicates the potential utilization of BcT across supply chain financing operations (Kshetri, 2021). However, most of these investigations have been conceptual and across developed countries (Wang et al., 2019). In Ghana, supply chain finance (SCF) is an important mechanism for enterprises, offering a range of financial solutions that maximize working capital management and supply chain liquidity (Collins et al., 2015). With solutions such as supplier finance, invoice financing, and reverse factoring, the full potential has not been exploited because of challenges, such as information asymmetry, adverse selection, moral hazards, and defaults (Boakye et al., 2022). Consequently, there is a need to adopt the BcTSCF, which provides a system to improve cash flow management and enhance trust among suppliers, buyers, and financial institutions. This study addresses the necessity for empirical evidence to contribute to existing discussions, as previous research has largely been dominated by case studies, literature reviews, and qualitative studies (Queiroz & Wamba, 2020; Queiroz & Wamba, 2019).

Financial capital availability

In a study on small enterprises in Pakistan, Memon et al. (2020) asserted that capital plays a crucial role in environmental, financial, and innovative performance. Financial capital facilitates smooth business operations. Strong funding encourages firms to expand into new markets and solidify their positions. Low cash availability, on the other hand, can discourage businesses from carrying out their present operating activity (Xu & Hitt, 2020). According to Khan et al. (2019), adequate financing can promote viable growth, act as a buffer against unforeseen shocks, and provide a durable competitive edge for SMEs in Pakistan. Ruggiero and Cupertino (2018) posit that financial capital is essential, helping firms to invest in creative ventures, social, scientific, and developmental endeavours. According to Davari and Farokhmanesh (2017), available funding has a significant impact on finding and

developing new opportunities for business expansion. Based on Knight et al. (2019), SMFEs' insufficient finances hinder them from actively participating in sustainable and environmental initiatives. However, little is known about how technological advancements affect financial capital availability. The BcTSCF serves as the conceptual framework for this study's understanding of the availability of finance. From enhancing accessibility and availability to cutting expenses, it resides on the BcTSCF's initiatives to address the innate features of business financing.

Firm performance

Diverse explanations of firm performance and measurement have been provided. Due to the multiple interpretations given by different scholars based on their perspectives, firm performance currently has no operational definition (Taouab & Issor, 2019). For instance, Gavrea et al. (2015) recognized that management, economics, and marketing combine to produce performance, which gives the organization's procedural and structural components a competitive edge. Over time, scholars have researched business success by using financial and market performance data to ascertain firm performance (Lu et al., 2014). Ombaka et al. (2015) reported that a firm's intangible and tangible resources significantly influence the performance of SMEs in Kenya. Research has examined the impact of financial capital availability on the success of small businesses in Spain and Mexico, considering financial, innovative, and environmental performance (Ayuso & Navarrete-Báez, 2018). Martinez-Conesa et al. (2017) explored the factors that contribute to SMFEs' financial, environmental, and creative performance of SMFEs. Khan et al. (2019) proposed that high capital availability encourages businesses to enter new markets and obtain a competitive edge, ultimately encouraging growth financing. Although previous studies have examined the impact of financial capital availability on the performance of firms, they mostly utilized traditional metrics for performance, leaving room for the consideration of non-traditional metrics. This study tests how financial capital availability can influence the performance of SMFEs. In this study, firm performance entails both financial and innovation performance. Financial performance in this context involves cash flows and working capital optimization to improve liquidity. Innovative performance, on the other hand, considers expenditure on innovative products and the improved research and development activities of SMFEs. Overall, this study closes the research gap by presenting a thorough investigation of the relationship between firm performance, financial capital availability, and BcTSCF using an empirical methodology.

HYPOTHESES DEVELOPMENT

Access Improvement

Popa (2013) asserts that BcTSCF offers the potential to create an all-inclusive gain environment across the supply chain finance ecosystem by improving liquidity

and capital allocation. As per Wang et al. (2018), BcTSCF integrates sufficient flow of information to solve the challenges of information asymmetry, guaranteeing thorough communication and dependable financial partnerships. Consequently, capital movements can be streamlined digitally, enabling proper, transparent sharing and financial information monitoring. According to Du et al. (2020), BcTSCF facilitates safe real-time information exchange, transaction execution, and automated validation, all of which increase the accessibility of capital for small businesses.

Availability

Ta et al. (2018) show that BcTSCF rationalizes activities across the value chain, eliminating communication errors by exchanging information simultaneously with all parties. Omran et al. (2017) claim that BcTSCF offers more clarity by making all documents accessible and providing immutability through its distributed ledger. Consequently, opacity in supply chain financing is reduced. Furthermore, BcTSCF lessens information asymmetry and disparities, increases participant trust, and improves useful capital and financial data (Du et al., 2020). Zhu et al. (2019) emphasized that by allowing participants to communicate, track, and access pertinent information digitally, the BcTSCF may progressively rationalize the flow of funds. We argue that BcTSCF can enhance funding, thereby affecting financial capital availability.

Cost Savings

Typically, supply chain finance operations are expensive because multiple third parties act as agents to facilitate the flow of funds and information (Kamble et al., 2019). The application of distributed ledger technology (DLT) will drastically change many supply chain financing processes, bringing transparency, cutting expenses, and promoting peer-to-peer transactions, especially the latter, which minimizes expensive third-party interventions. Gurtu and Johny (2019) demonstrated how a blockchain's special features of cost savings, transparency, and trust enhance supply chain finance. We argue that the influence of the BcTSCF in funding access improvement, capital availability promotion, and cost savings is imperative to facilitating SMFEs' availability of finance. Thus, we propose that:

H1: The application of BcTSCF is positively related to the availability of financial capital.

Financial resources have emerged as pivotal predictors of this angle, allowing businesses to invest in viable opportunities to sustain performance. According to Xu and Hitt (2020), financial capital is necessary for the efficient operation of a firm. Therefore, high capital availability gives businesses the cash flow they need to grow into new markets and achieve a competitive edge. Karltorp et al. (2017) contend that

easy access to financial capital is key to achieving the growth of businesses in emerging markets. Thus, having access to financial capital helps them enhance their cash flow and working capital, enabling them to pursue their operational goals. According to Adomako and Danso (2014), having access to financial resources helps businesses maximize their use of working capital, while also promoting cash flows.. Therefore, this study argues that financial capital availability can promote the fruitful implementation of financial plans by enabling businesses to acquire funding, even during tumultuous times, to satisfy their funding demands.

H2a: SMFEs with high financial capital availability enjoy high financial performance.

Having sufficient financial resources is essential for businesses to carry out a variety of innovative operations. Financial resources for investing in creative activities are crucial for firms, and a firm's internal and external financing might impact its innovative performance, research and development, and social initiatives (Ruggiero & Cupertino, 2018). Mulkay et al. (2001) found that financial resources greatly support R&D and innovative activities. SMFEs in developing economies compete fiercely in an age of globalization and innovation. Under these conditions, financial resources allow businesses to invest in creative products and innovative strategies (Rodríguez-Gulías et al., 2016). As a result, when firms have sufficient resources, they can undertake innovative projects to satisfy operational and market demands and gain a competitive advantage. Thus, businesses with adequate funding enjoy higher creative performance.

H2b: SMFEs with high financial capital availability enjoy high innovative performance.

The tri-variate linear relationship among BcTSCF, financial capital availability, and firm performance is explained. In Figure 1, there is a prediction that the availability of financial capital is influenced by BcTSCF (*H1*). Our model further envisions that firm performance (innovation and financial) is affected by financial capital availability (financial and innovation) (Hypotheses ***H2a-H2b***). Based on the implications of the resource-based theory (RBT), the above hypotheses are proposed. Thus, our argument stems from the implication of using the RBT to categorize BcTSCF as a technological resource that, when strategically used, enhances the financial capital for SMFEs. Correspondingly, available finance (capital resources), when efficiently utilized, could also promote business performance.

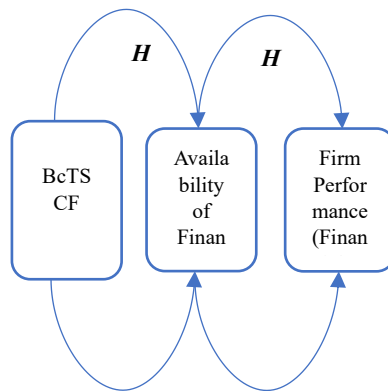


Figure 1: Study's Model

METHODOLOGY

Research Design

A quantitative correlational research approach is used to examine the tri-variate linear relationship between BcTSCF, financial capital availability, and firm performance. This approach is valuable for identifying and understanding relationships among variables and is cost-effective, insightful, time-efficient, and non-intrusive, making it applicable across various disciplines (Creswell, 2014). Data from businesses with BcTSCF ideas, experience, or potential were gathered using the purposive sampling technique. Thus, considering SMFEs with enough knowledge of BcT. With this approach, researchers become confident in determining a convenient study sample. From the total of 520 SMFEs under the Association of Ghana Industries (AGI), 360 were selected using a purposive sampling approach. Consequently, SMFEs within the agribusiness, catering & hospitality, construction, fashion & design, and wholesale & retail sectors are included. Furthermore, deploying a simple random sample approach, 215 responses from SMFEs were obtained.

Measurement Constructs and Survey Instrument

The constructs for BcTSCF were derived from Yang et al. (2017), Kamble et al. (2019), Du et al. (2020), and Ta et al. (2018). These studies were used for the availability of financial capital. Elements of firm performance were based on the work of Karltorp et al. (2017) and Ruggiero and Cupertino (2018). A four-part survey was designed to gather responses on demographics, BcTSCF, firm performance, and financial capital availability. Evaluations were conducted using a seven-point Likert scale, ranging from 1 ("strongly disagree") to 7 ("strongly agree"). To ensure the reliability of the survey instrument, two pre-tests were conducted. The first pre-test

involved distributing a prototype questionnaire to nine professionals and five academics to obtain their feedback on the content of the survey items.

Collection and Analysis of Data

Participation requirement for this study was familiarity with BcT, and BcTSCF platforms (AgriXchain, Pezesha, and Kudigo) experience. Data was collected from managers and owners of SMFEs involved in the ICT4AD project and registered with the AGI using a purposive non-probability sampling. A hyperlink shared via email and WhatsApp facilitated participants in submitting the response online, while others opted to fill it out manually. This sampling method is particularly advantageous for this study, which delves into a specific, in-depth issue, as it enables targeted participant selection. Unlike other sampling techniques (e.g., cluster, simple, or systematic sampling), it offers cost-effectiveness, greater validity of findings, flexibility, and the ability to gather rich, detailed data (Saunders et al., 2012). This is especially valuable in exploratory research, where understanding a detailed, specific perspective is essential. The sample size was calculated using the formula $n > 50 + 8m$, where "n" is the sample size and "m" is the number of variables in the research (Tabachnick et al., 2007). Since the study involved three variables, the minimum sample size needed was 74, as determined by the calculation $n > 50 + (8 * 3)$, which results in $n > 74$. The sample size of 215 respondents exceeded this threshold. Our sample size of 360 SMEs is justifiable because it is sufficiently large to ensure 95% confidence and a lower margin of error (under 5%), which is standard practice for several social science studies. Again, the probability of detecting a true effect/representation of the population) was adequate to provide a statistical power of 80%. Microsoft Excel and SPSS were used to check for outliers, unengaged responses, and missing data. Missing value analysis and multiple data imputations were conducted using SPSS version 26 software to filter and identify missing or invalid data. A descriptive statistics test was performed on the demographic data, and other statistical analyses, such as the measurement model assessment tests, hypothesis testing, and structural model assessment tests, were performed using Smart PLS 4. Furthermore, partial least squares structural equation modeling (PLS-SEM) was used. PLS-SEM is a highly versatile tool for understanding complex relationships among variables. Its advantages include flexibility in handling small and non-normal data samples, and both reflective and formative constructs. Furthermore, the predictive power, robustness, and ease of use of PLS-SEM make it a desirable choice in exploratory research. Its capacity to concurrently model structural and measurement components makes it a comprehensive method for studying complicated data in various research domains (Shmueli et al., 2019).

ANALYSIS OF DATA AND RESULTS

Table 1 represents respondents' demographics

Table 1: Respondents' Demographics

| Demographic Variable | Item | Frequency (n = 215) | Percentage (%) |
|----------------------|-----------------------------|---------------------|----------------|
| Gender | Male | 157 | 73 |
| | Female | 58 | 27 |
| Ages (years) | 18-27 | 12 | 5.6 |
| | 28-37 | 67 | 31.2 |
| | 38-49 | 89 | 41.4 |
| | 50-59 | 45 | 20.9 |
| | Above 60 | 2 | 0.9 |
| | High school diploma or less | 14 | 6.5 |
| Education | High school diploma | 115 | 53.5 |
| | Bachelors | 63 | 29.3 |
| | Masters | 23 | 10.7 |
| | | | |
| SMFE Sector | Catering & Hospitality | 28 | 13 |
| | Agribusiness | 93 | 43.3 |
| | Construction | 34 | 15.8 |
| | Fashion & Design | 29 | 13.5 |
| | Wholesale & Retail | 31 | 14.4 |
| Size of Business | Micro (Less than 5) | 22 | 10.2 |
| | Small (6 – 29) | 173 | 80.5 |
| | Medium (30 – 99) | 20 | 9.3 |
| Business Age (years) | 0 – 2 | 12 | 5.6 |
| | 3 – 5 | 67 | 31.2 |
| | 6 – 8 | 71 | 33 |
| | 9 – 11 | 39 | 18.1 |
| | More than 11 | 26 | 12.1 |
| BcTSCF level | Learning about BcTSCF | 82 | 38.1 |
| | Adopted BcTSCF | 59 | 27.5 |
| | Exploring BcTSCF | 74 | 34.4 |

Measurement Model Assessment

The Cronbach's alpha and Rho_A values ranged from 0.703 to 0.792, and 0.711 to 0.793, respectively, representing the Internal consistency. All values were above

the recommended level of $CA > 0.7$ and demonstrated indication dependability. The composite reliability examination for the constructs ranged from 0.834 to 0.878, above the CR criterion of 0.7. These findings indicate that the measuring constructs have acceptable internal consistency and reliability. The validity of the measurement model was further established by calculating the average variance extracted (AVE), which was found to be above the recommended threshold of 0.5 for all constructs, with values ranging from 0.627 to 0.711.

Table 2: Assessment of Model

| Variable | Items | Loadings ^a | Cronbach's Alpha ^b | Composite reliability (rho_a) ^b | Composite reliability (rho_c) ^c | Average Variance Extracted (AVE) ^d |
|--------------------------|-------|-----------------------|-------------------------------|--|--|---|
| BcTSCF | BCA1 | 0.774 | 0.703 | 0.711 | 0.834 | 0.627 |
| | BCA2 | 0.828 | | | | |
| | BCA3 | 0.771 | | | | |
| | BCA4 | 0.771 | | | | |
| Financial Capital Avail. | FCA1 | 0.738 | 0.761 | 0.764 | 0.847 | 0.711 |
| | FCA2 | 0.740 | | | | |
| | FCA3 | 0.798 | | | | |
| | FCA4 | 0.773 | | | | |
| Firm Performance | FP3 | 0.849 | 0.792 | 0.793 | 0.878 | 0.706 |
| | FP4 | 0.836 | | | | |
| | FP5 | 0.836 | | | | |
| | FP6 | 0.836 | | | | |

Investigating potential data biases such as the common ratter effect, social desirability, consistency motif, mood state, and common scale anchoring was essential, given that this study relied on a questionnaire for data collection (Podsakoff et al., 2003). The Variable Inflation Factor (VIF) was used for the multicollinearity testing. Kock (2015) states that a variable inflation factor (VIF) greater than 3.3 indicates the potential presence of common bias in a model. Conversely, when the VIF is 3.3 or lower, the model is considered free from common bias. Table 3 shows that there are no concerns about collinearity.

Table 3: CMB Test

| Constructs | Items | Outer loadings | Outer weights | VIF |
|--------------------------|-------|----------------|---------------|-------|
| BcTSCF | BCA1 | 0.774 | 0.405 | 1.341 |
| | BCA2 | 0.828 | 0.470 | 1.409 |
| | BCA4 | 0.771 | 0.385 | 1.369 |
| Financial Capital Avail. | FCA1 | 0.738 | 0.280 | 1.542 |
| | FCA2 | 0.740 | 0.347 | 1.351 |
| | FCA3 | 0.798 | 0.331 | 1.664 |
| | FCA4 | 0.773 | 0.353 | 1.440 |
| Firm Performance | FP3 | 0.849 | 0.403 | 1.715 |
| | FP3 | 0.836 | 0.386 | 1.679 |
| | FP5 | 0.836 | 0.401 | 1.628 |

The discriminant validity test was conducted. The indicator loadings are the highest compared to other variables, and the square root of the AVE is displayed along the diagonal line (Fornell & Larcker, 1981). In Table 4, the diagonals show the square root of the AVE of the latent variables. These are the largest in any row or column, thus depicting discriminant validity

Table 4: Testing Discriminant Validity (Fornell-Larcker's Criterion)

| | 1 | 2 | 3 |
|--------------------------------|--------------|--------------|--------------|
| BcTSCF | 0.792 | | |
| Financial Capital Availability | 0.454 | 0.763 | |
| Firm Performance | 0.474 | 0.652 | 0.841 |

Hypotheses Testing

To assess the strength of impacts at different levels, the study employed a bootstrapping confidence interval of 97.5% and 2.5%. The structural model interactions were evaluated by analyzing the beta coefficients, t/p-values, and effect sizes (f^2) through bootstrapping. Table 5 presents the direct effects and results from bootstrapping. Hypotheses were tested using the t-statistic test, with a benchmark level of 1.96 to determine the acceptance or rejection of hypotheses. Specifically, a t-value above 1.96 is considered significant, with higher values indicating stronger significance. The results of the analysis indicated that the hypotheses with strong support revealed a significant and positive relationship. Path coefficients (β) ranged from 0.209 to 0.652, with significance levels under 0.05 and 97.5% confidence intervals. Specifically, the adoption of BcTSCF was found to have a positive influence on the availability of financial capital ($\beta = 0.209$; t-value = 4.866; CI [0.127, 0.294]; p-value < 0.001). Moreover, financial capital availability was shown to significantly impact firm performance, with a positive and statistically significant

effect ($\beta = 0.652$; $t\text{-value} = 20.287$; $CI [0.587, 0.713]$; $p\text{-value} < 0.001$). The results also indicated a positive and significant effect of financial capital availability on financial performance ($\beta = 0.618$; $t\text{-value} = 18.733$; $CI [0.552, 0.680]$; $p\text{-value} < 0.01$), as well as on innovative performance ($\beta = 0.574$; $t\text{-value} = 19.443$; $CI [0.516, 0.632]$; $p\text{-value} < 0.01$). Therefore, the impact of financial capital availability on innovative performance was found to be more significant than its effect on financial performance, as measured by the $t\text{-value}$. In terms of effect size (f^2), BcTSCF adoption had a medium-sized effect on financial capital availability, while financial capital availability had a large-sized effect on firm performance.

Table 5: Hypothesis Testing

| Hypotheses. | Paths | Path-Coeff. | Std-Dev. | T-value. | P-value. | Remarks | Effect-Size (f^2) | 2.5% CI LL | 97.5% CI UL |
|-------------|---|-------------|----------|----------|----------|-----------|-----------------------|------------|-------------|
| H1 | BcTSCF → Financial Capital Availability | 0.209 | 0.043 | 4.886 | 0.000*** | Supported | 0.061 | 0.127 | 0.294 |
| H2 | Financial Capital Availability → Firm Performance | 0.652 | 0.032 | 20.287 | 0.000*** | Supported | 0.739 | 0.587 | 0.713 |
| H2a | Financial Capital Availability → Financial Performance | 0.618 | 0.033 | 18.733 | 0.006** | Supported | 0.617 | 0.552 | 0.680 |
| H2b | Financial Capital Availability → Innovation Performance | 0.574 | 0.038 | 19.443 | 0.009** | Supported | 0.491 | 0.576 | 0.632 |

DISCUSSIONS

The findings indicate that the availability of financial capital is positively affected by the implementation of BcTSCF ($\beta = 0.209$; $t\text{-value} = 4.866$; $CI [0.127, 0.294]$; $p\text{-value} < 0.001$). This discovery is consistent with earlier research (Belleflamme et al., 2014; Du et al., 2020; Kamble et al., 2019; Omran et al., 2009; Popa, 2013; Ta et al., 2018) and has the potential to be applied universally in both advanced and emerging economies. In countries such as China and India, studies indicate that BcTSCF also

influences the availability of financial capital (Du et al., 2020; Kamble et al., 2019). The findings of the study align closely with similar results observed in a developing country such as Ghana. This study shows that, regardless of the differences in technological adoption among various economies, the influence of BcTSCF on the availability of financial capital remains consistent in both developed and developing nations.

The study categorizes the availability of financial capital into access improvement, availability promotion, and saving of cost. Regarding access improvement, Wang et al. (2018) found that BcTSCF addresses information asymmetry by ensuring efficient information flow and fostering reliable financial collaboration. Blockchain's transparency—where each transaction is recorded permanently on the blockchain—reduces perceived risks for financial institutions and lenders. This enhanced transparency and real-time transaction verification make financial institutions more willing to offer capital at lower costs and faster rates, thus increasing accessibility for supply chain businesses, especially those in need of working capital. Providers who previously faced challenges obtaining financing can now secure funds more easily and at reduced rates. Similarly, Popa (2013) suggested that BcTSCF enhances liquidity and capital allocation, benefiting the entire value chain.

In terms of availability promotion, Omran et al. (2017) highlighted that BcTSCF fosters greater transparency through its distributed ledger, reducing opacity among supply chain financing participants. Tokenization further expands access to financial capital by enabling faster liquidity without relying on traditional banks or intermediaries. This particularly benefits smaller suppliers and SMEs, who would otherwise face long approval processes or high lending rates. Blockchain-based SCF enables quicker liquidity by directly connecting asset-backed tokens with capital providers.

Regarding cost savings enhancement, Cocco et al. (2017) argued that BcTSCF reduces funding costs for businesses by minimizing operational expenses tied to centralized processes, streamlining financial actions, and utilizing distributed ledgers. Transaction automation through smart contracts reduces administrative costs and operational inefficiencies, resulting in a faster and more reliable financing process. Since these smart contracts are enforceable, suppliers can access capital quickly and under favorable conditions, improving liquidity within the supply chain and enhancing capital availability for all stakeholders.

Furthermore, the study found that financial capital availability has a significant positive impact on firm performance ($\beta = 0.652$; $t\text{-value} = 20.287$; $CI [0.587, 0.713]$; $p\text{-value} < 0.001$), consistent with previous research (Fernandez-Feijoo et al., 2018; Memon et al., 2020). Firm performance in this study was assessed in two main

dimensions: financial and innovation performance. The results showed a significant positive influence of financial capital availability on financial performance ($\beta = 0.618$; $t\text{-value} = 18.733$; CI [0.552, 0.680]; $p\text{-value} < 0.01$). According to Xu and Hitt (2020), the availability of financial capital significantly impacts financial performance by providing businesses with the cash flows needed to expand into new markets and gain a competitive edge. Financial capital also helps create new growth opportunities for firms. Additionally, research suggests that financial capital positively affects a company's innovative performance by improving managerial decision-making and enhancing tangible outputs.

The study by Karltorp et al. (2017) also emphasized that easy access to funding is critical for business growth in emerging markets, enabling firms to achieve greater success. As noted by Adomako and Danso (2014), access to financial resources allows businesses to optimize working capital and improve cash flow, serving as both a proxy for internal financial capability and a signal of future growth potential. The research also demonstrated a significant positive effect of financial capital availability on innovation performance ($\beta = 0.574$; $t\text{-value} = 19.443$; CI [0.516, 0.632]; $p\text{-value} < 0.01$). Ruggiero and Cupertino (2018) argued that financial capital plays a key role in driving innovation by supporting investments in creative activities that are essential for firms' competitive advantage and profitability.

Moreover, Mulkay et al. (2001) highlighted that both internal and external financial resources are crucial for innovative performance, including research and development and social initiatives. Rodríguez-Gulías et al. (2016) also found that financial resources significantly impact innovation, particularly for SMFEs in developing economies, by enabling investments in creative products and innovative strategies. Therefore, SMFEs with sufficient financial capital can leverage creative projects to meet market demands, ultimately gaining a competitive edge and increasing profitability.

Theoretical Contribution

This study expands the ongoing discussions on BcTSCF by examining the tri-variate relationship among BcTSCF, financial capital availability, and firm performance across Ghanaian SMFEs. Again, most research has explored the role of BcT in transforming economies globally. However, the work explores the deployment of BcTSCF (technological capability) via affecting financial capital availability, which subsequently affects firm performance. Specifically, this provided the basis for predicting BcTSCF's impact on financial capital availability (improved access to financing, promoting capital availability, and enhancing cost savings) and firm performance (financial and innovation) among Ghanaian SMFEs in the agribusiness, construction, catering & hospitality, fashion & design, and wholesale & retail sectors. This is a contribution to the ongoing discussions as research on

blockchain has been predominated by adoption drivers. Considering financial and innovative dimensions for firm performance provides additional insights, as several studies have used subjective performance metrics (Boso et al., 2013; Saeidi et al., 2015). Thus, making this work unique from previous research. This study's results, particularly in a developing economy that is still improving on blockchain technology adoption, generally have a strong implication for the generalization of the model in other economies' situations in the sub-Saharan region. Furthermore, the current study implicitly draws on the resource-based theory, providing the grounds to predict Blockchain as a technological resource and how BcTSCF can enhance financial capital availability as well as firm performance when exploited judiciously.

Practical Implications

First, businesses are to consider leveraging on BcTSCF to enhance their finances as well as performances (financial & innovation). Specifically, SMEs can prioritize BcTSCF due to the relative advantages over traditional SCF. Again, businesses should consider and exploit pilot programs offered by blockchain service providers and state agencies like NEIP, AGI, and GEA to test BcTSCF solutions before large-scale adoption, since compatibility and trialability are key. Governments and other stakeholders can provide policy measures such as creating a supportive infrastructure for technology adoption and making regulatory adjustments (financial incentives, reduced compliance burdens, or specific regulations that ease adoption). Again, SME managers are expected to actively engage with available frameworks, stay informed about changes in regulations, and government-backed initiatives.

Second, SME managers need to address the challenges of BcTSCF adoption. Thus, they can look for affordable BcTSCF solutions, explore grants, subsidies, or low-interest loans offered by governments and other stakeholders (e.g., Microfinance and Small Loans Center (MASLOC)). They can also consider user-friendly platforms that are easy to use, maintain, and implement. BcTSCF platform vendors that provide comprehensive support and training should be prioritized. Third, SME managers are supposed to cultivate an innovative culture within the company to give staff a favorable attitude regarding the implementation of technology. Again, observing how others successfully implement blockchain can provide valuable lessons and reduce fears or uncertainties. Finally, SMEs need to be alert to competitors adopting BcTSCF; this could spur their action to do the same and stay competitive.

CONCLUSION AND FURTHER RESEARCH

This study explored the tri-variate relationship among BcTSCF, firm performance, and financial capital availability. This addresses the research gap on BcTSCF and SMFEs in developing countries and contributes significantly to the sparse academic discourse in sub-Saharan Africa. While BcTSCF has been well

researched in developed countries, it is limited in empirical evidence in the context of its utilization efforts on financial capital availability and firm performance in developing countries, particularly for small and medium family enterprises (SMFEs). By focusing on Ghana, providing insights into a developing economy's context, the research gap is addressed. On empirical validation and quantitative evidence, the study employs a robust quantitative methodology using PLS-SEM to empirically validate the interaction among BcTSCF, firm performance, and available financial capital. This adds empirical weight to what has largely been a conceptual discourse in existing literature. Again, it offers crucial insights for stakeholders to promote the adoption of BcT and enhance the financial health of SMFEs. We examined a representative sample of diverse SMFEs in Ghana (agribusiness, construction, catering & hospitality, fashion & design, and wholesale & retail) and discussed the collaborative BcTSCF influences on available financial capital, which subsequently influence both the financial and innovative performance of these focal firms. Specifically, the findings depict BcTSCF influences available financial capital of SMFEs ($\beta=0.209$; $t\text{-value}=4.866$; $CI [0.127, 0.294]$; $p\text{-value}<0.001$) (via access improvement, availability promotion, and enhanced cost savings). Also, financial capital availability has a significantly positive influence on firm performance. In detail, the impact of financial capital availability on innovative performance ($\beta=0.574$; $t\text{-value}=19.443$; $CI [0.516, 0.632]$; $p\text{-value}<0.01$) is more significant than that on financial performance ($\beta=0.618$; $t\text{-value}=18.733$; $CI [0.552, 0.680]$; $p\text{-value}<0.01$) in reference to $t\text{-value}$. Thus, financial capital can enhance the investment in creative activities, which are crucial for firms' profitability and competitive advantage. Financial capital availability (internal and external resources) greatly supports innovative performance (research and development, social initiatives, and innovative activities). The transformative power of BcTSCF is further demonstrated by the long-term viability of SMEs. Small businesses can concentrate on innovation, diversification, and long-term plans by optimizing their supply chains and enhancing financial management, which will promote long-term economic success. Also, BcTSCF promotes more equitable trade interactions, which lessen exploitation and improve small enterprises' position in the global marketplace. Additionally, SMEs can invest in their communities by gaining access to more reliable funding, which will help provide better employment and assist social development projects (social sustainability) (Martin-Rios, 2024). Furthermore, BcTSCF promotes the ability to access flexible financing, thus making SMEs more financially resilient to meet their goals (economic sustainability). In line with the global sustainability agenda, BcTSCF promotes sustainability and positive social impact. BcTSCF adoption supports the attainment of United Nations Sustainable Development Goals (SDGs), such as SDG 9 (Industry, Innovation, and Infrastructure), SDG 12 (Responsible Consumption and Production), and SDG 8 (Decent Work and Economic Growth) (DSDG, 2015).

Limitations and Implications for Future Studies

First, the current study is cross-sectional, thus limited in satisfactorily reflecting the understanding of BcTSCF efforts and observing the consistency of the relationship among the study's variables (BcTSCF, financial capital availability, and firm performance). Furthermore, because BcTSCF adoption is still nascent, this work was limited in its ability to evaluate the ongoing BcTSCF gains on available financial capital over a substantial period of time. Further constraint is the design of our model for Ghana (a single economy). Using the model from this work might not have an impact on the results for other countries whose economies are not as big as Ghana's. The results relied solely on questionnaire replies because there was no secondary data. It is recommended the utilize a longitudinal approach to evaluate changes in the associations and validate findings. Further studies can explore holistically the actual application of BcTSCF and its influence on specific industries, such as agriculture or manufacturing, to identify sector-specific implications. Again, the roles of regulatory frameworks, financial institutions, and government policies in shaping the adoption and impact of BcTSCF could be examined in future studies. These can be carried out across other advanced countries in the sub-region, such as Kenya, South Africa, and Botswana. Although the decentralized mechanisms employed under BcTSCF deal with the issues of trust, further studies can holistically seek to discuss the role of trust in adopting BcTSCF and its impact on financial capital availability. The results might then be examined for differences or consistency in a case or comparative study. Finally, due to the lack of secondary data, PLS-SEM was used. With available secondary data, future studies may consider time-series econometric analysis.

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