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# Enhancing SMEs Competitiveness through ICT Adoption: A Case Study of Gunung Puntang Coffee

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***ABSTRACT***

This paper aims to examine the level, influencing factors, and effectiveness of Information and Communication Technology (ICT) adoption in enhancing the competitiveness of Gunung Puntang coffee SMEs. A quantitative research design was employed using survey data from coffee SMEs in Gunung Puntang. The analysis was conducted with SPSS regression to evaluate the influence of individual, organizational, technological, and external environmental factors on ICT adoption and competitiveness. The results indicate that ICT adoption significantly contributes to improving market access, operational efficiency, and brand visibility of coffee SMEs. However, adoption remains constrained by low digital literacy, limited financial resources, and inadequate infrastructure. The novelty of this study lies in formulating holistic and context-specific strategies to enhance ICT adoption in Gunung Puntang coffee SMEs. The study proposes strategic directions emphasizing the enhancement of ICT literacy through training, coupled with improved access to digital infrastructure, particularly stable internet connectivity. These strategies are expected to optimize ICT adoption among SMEs and strengthen their competitiveness in the growing West Java coffee market.



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## 1. INTRODUCTION

Small and Medium Enterprises (SMEs) play a crucial role in Indonesia's economy, particularly in job creation, innovation, and contributions to the Gross Domestic Product (GDP). Among the promising subsectors is the coffee industry, which not only has significant economic value but also strengthens Indonesia's global reputation as a producer of high-quality coffee [1]. Among the promising subsectors, the coffee industry stands out for its economic value and contribution to Indonesia's international reputation as a producer of specialty coffee. Gunung Puntang, located in Bandung Regency, West Java, is recognized for its unique flavor characteristics, having won first place at the Specialty Coffee Association of America Expo in Atlanta in 2016 and the Indonesia Cupping Contest

XI in 2019. Despite these achievements, local coffee SMEs still face critical challenges in enhancing competitiveness within increasingly dynamic and globalized markets.

The main obstacles for Indonesian coffee SMEs include limited market access, constrained production capacity, and low adoption of information and communication technology (ICT) [2]. In the digital era, competitiveness is not solely determined by product quality but also by the ability to leverage ICT to expand market reach, improve efficiency, and strengthen brand positioning. ICT enables SMEs to streamline production, distribution, and marketing while enhancing customer interaction through digital platforms such as social media and e-commerce [3].

Nevertheless, ICT adoption among Gunung Puntang coffee SMEs remains limited due to low digital literacy, insufficient technical skills, inadequate infrastructure, and restricted financial resources. Previous studies have investigated ICT adoption in Indonesian SMEs post-pandemic, emphasizing benefits and consumer integration as significant determinants [4]. Other research has highlighted the role of digital literacy in strengthening entrepreneurial skills and business performance across SMEs [5]. Meanwhile, a study on coffee SMEs in Yogyakarta showed that although human capital readiness improved digital literacy, its direct impact on business performance was not statistically significant [6]. A systematic review further emphasized the scarcity of empirical evidence on ICT adoption strategies in SMEs within developing countries [3]. Additionally, studies in different contexts, such as Saudi Arabia's coffee shop industry, applied similar multi-factor frameworks but focused on distinct cultural and economic environments [4].

This study seeks to address these gaps by focusing on coffee SMEs in Gunung Puntang—an internationally recognized specialty coffee cluster—and employing SPSS-based regression analysis to examine the influence of individual, organizational, technological, and external environmental factors on ICT adoption. The novelty of this research lies in its contribution to both theory and practice: beyond assessing determinants of ICT adoption, it proposes holistic, context-specific, and empirically grounded strategies to enhance competitiveness in the Indonesian coffee sector.

Understanding the broader dynamics of small and medium industries (SMIs) is also essential, since they serve as a major driver of inclusive economic growth and equitable wealth distribution, even in rural and remote areas [7]. According to Law No. 20 of 2008 concerning Micro, Small, and Medium Enterprises (MSMEs), small and medium enterprises are defined based on assets and annual turnover. A small industry is categorized as having assets of up to IDR 500 million with an annual turnover of up to IDR 2.5 billion, while a medium industry has assets above IDR 500 million up to IDR 10 billion with an annual turnover of up to IDR 50 billion.

SMIs also serve as a key driver of inclusive economic growth and equitable distribution of wealth, as they are spread across various regions, including remote areas [8]. SMIs contribute to more than 60% of employment absorption in Indonesia's industrial sector [9]. However, limited managerial capacity and restricted access to formal financing often pose challenges to the development of this sector [10]. Consequently, competitiveness is not only linked to product quality but also to managerial capabilities and the strategic utilization of modern technology.

Competitiveness is the ability of a company within an industry to face various environmental challenges Enhancing the competitiveness of Small and Medium Industries (SMIs) is crucial for the economy of a country, particularly in developing nations such as Indonesia [11]. The term competitiveness associated with a company suggests safety, efficiency, quality, high productivity, adaptability, success, modern management, superior products, optimal costs [12]. The implementation of proper quality management systems and adherence to international standards can help SMIs produce more competitive products [13].

Competitiveness is achieved through continuous development in all aspects of the organization, particularly in the production sector. For a business, competitiveness, especially in terms of products, is crucial because it enables the enterprise to survive in the face of intense competition in the business

world. The benefit of competitiveness in facing an increasingly tight competitive environment and dynamic market is that every company must be able to compete in an optimal and sustainable way. This means that efforts must be carried out continuously to produce something better in the future [14]. One of the key competitive advantage factors that every company must possess in order to compete in the global market is, above all, the mastery of technology and the enhancement of innovation [15].

At this point, Information and Communication Technology (ICT) plays a pivotal role in linking efficiency with innovation, providing SMEs with a sustainable path to improving their market positions. ICT is a concept that integrates information technology with communication technology. Communication technology encompasses all technologies used for long-distance communication, such as telephones, the internet, and satellites [16]. With technological advancements, information can now be accessed globally within seconds. The application of this technology is not only limited to business but also extends to education, healthcare, and other sectors that require efficiency and speed [17]. Over time, the development of ICT has accelerated rapidly. This advancement has been further driven by innovations in cloud computing, artificial intelligence (AI), and the Internet of Things (IoT) [18]. For instance, cloud computing has transformed the way data are stored and managed, allowing users to store and access data from various devices without relying on specific hardware. Meanwhile, IoT enables electronic devices to interconnect and communicate with one another, creating smarter and more efficient systems [19].

For SMEs such as Gunung Puntang Coffee, adopting ICT is therefore not merely a trend but a strategic necessity to ensure competitiveness in global markets. Gunung Puntang Coffee originates from the Puntang Mountain area in Bandung, with plantations consisting of around 30,000 coffee trees managed by 125 farmers, located approximately 40 minutes from its coffee shop. The coffee is marketed using stand-up pouch packaging through both offline and online channels, but it has not yet established a strong brand identity, which is essential for attracting more visitors, building a positive image, securing partnerships, and gaining trust from business collaborators [20]. This condition demonstrates that despite having substantial production potential, Gunung Puntang Coffee SMEs still face challenges in strengthening their market position, particularly in branding and digital engagement.

The international recognition of Gunung Puntang Coffee is reflected in its achievement of first place in the flavor category at the Specialty Coffee Association of America (SCAA) Expo in Atlanta, United States, and its victory in an international coffee competition in Paris in [21]. These achievements confirm that Indonesian coffee can compete on the global stage, provided that local SMEs are supported by effective marketing strategies and technological integration. In addition, the tradition of cultivating organic coffee in Gunung Puntang not only serves as a foundation of the local economy but also functions as a tourism attraction rooted in local wisdom [20].

## 2. METHOD

This study employed a quantitative and qualitative approach using questionnaires and interviews. The research object was the Gunung Puntang Coffee SMEs in Bandung, West Java, involving 15 business actors selected through purposive sampling, consisting of those who have and have not adopted ICT. The dependent variable was SME competitiveness, measured through product quality, pricing, sales volume, market access, and customer satisfaction. The independent variable was ICT adoption, which included the use of hardware and software, ICT training, internet and e-commerce utilization, and ICT system integration in production and distribution processes. Data were analyzed using multiple linear regression with SPSS, supported by descriptive analysis.

In this study, the regression equation can be formulated as follows:

$$Yi=\alpha+\beta1X1+\beta2X2+\beta3X3+\beta4X4+e$$

Notes

Yi = Level of ICT adoption by SMEs
X1 = Individual factor
X2 = Organizational factor
X3 = Technological factor
X4 = External environmental factor
α = Constant
β1,β2,β3,β4 = Regression coefficients
eee = Error term

## 3. RESULTS AND DISCUSSION

### 3.1 Results

This study involved 15 respondents who are actors of Small and Medium Industries (SMIs) of Gunung Puntang Coffee, consisting of business owners, plantation managers, and workers engaged in both production and post-harvest processes.

Table 1. Respondent Characteristics

| No | Category | Subcatagory | Number of Respondents | Percentage |
|---|---|---|---|---|
| 1. | Gender | | | |
| | | Male | 11 | 73 |
| | | Perempuan | 4 | 27 |
| 2. | Age Grup | | | |
| | | 21-35 Years | 5 | 33 |
| | | 36-50 Years | 8 | 53 |
| | | >50 Years | 2 | 14 |
| 3. | Education Level | | | |
| | | Elementry/Junior High | 2 | 13 |
| | | Senior HighVocational | 9 | 60 |
| | | Diplo,a/Bachelor | 4 | 27 |
| 4. | Business Duration | | | |
| | | <3 years | 3 | 20 |
| | | 3-5 years | 5 | 33 |
| | | >5 years | 7 | 47 |
| 5. | Business Turnover | | | |
| | | Rp 50 million – Rp 75 million | 5 | 33,3 |
| | | Rp 75 million – Rp 100 million | 6 | 40 |
| | | Rp 100 million – Rp 150 million | 4 | 26,7 |

Source: Processed data, SPSS (2026)

The respondent' characteristics show that the majority were male (73%), within the productive age range of 31–50 years (86%), and most had completed senior high school (60%). In terms of business experience, nearly half (47%) had operated their enterprises for more than 5 years. This diversity in demographic and business profiles provides valuable insights for analyzing the role of ICT adoption in enhancing the competitiveness of Gunung Puntang Coffee SMIs.

This study documents the success of Gunung Puntang Coffee from West Java, which won First Place at the *Specialty Coffee Association of America (SCAA) Expo* in Atlanta, Georgia, United States (April 14–17, 2016). Out of 74 national coffee samples selected, Gunung Puntang Coffee ranked in the top 20 and ultimately achieved the highest award. This achievement demonstrates that local agricultural products can meet world-class standards through stringent quality selection processes, while also

benefiting from institutional support such as SCOPI and the Indonesian Ministry of Trade in promoting SCAA certification and participation in international events (scopi.or.id).

As one of the respondents, Ayi Sutedja, the owner of Gunung Puntang Coffee plantation, has implemented an innovative sustainable coffee cultivation approach since 2011. He utilized forest land through the *Community-Based Forest Management (PHBM)* system and cultivated the Arabica Typica variety organically without chemical fertilizers. This approach not only enhanced the cup quality (SCAA score reaching 85+), but also empowered local communities through knowledge transfer and the adoption of high-quality post-harvest practices. Such an empowerment model is highly relevant in agribusiness innovation studies and in strengthening the position of smallholder farmers in the global market.

The empowerment approach of Gunung Puntang coffee farmers focuses not only on improving coffee flavor quality through sustainable cultivation practices, but also on strengthening the bargaining position of smallholder farmers in the global supply chain. This empowerment model is realized through knowledge transfer and the adoption of standardized post-harvest practices, enabling value-added products and broader market access.

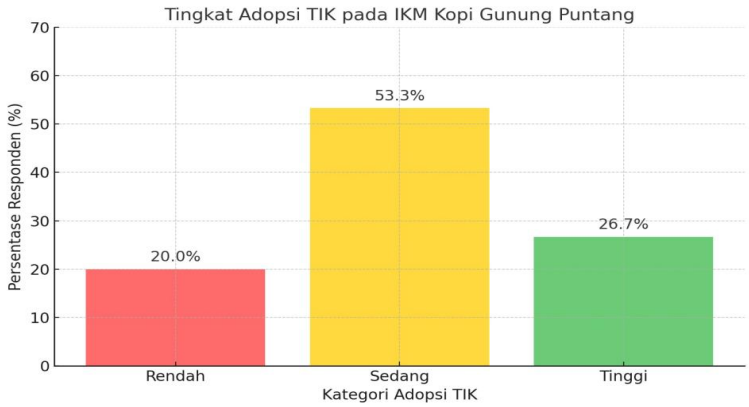


Figure 2. ICT Adoption Level in Gunung Puntang Coffee SMEs

The findings indicate that most SMEs are at a medium level of ICT adoption (53.3%), suggesting that digital tools have begun to be integrated but are not yet fully optimized. SMEs in the high adoption category (26.7%) demonstrate greater competitiveness through market expansion and operational efficiency, while those in the low adoption category (20%) remain vulnerable to challenges in the digital era. This highlights the importance of continuous training, human resource capacity building, and policy support to accelerate ICT adoption among SMEs.

Based on the results of the research and data analysis, it is known that the level of utilization of Information and Communication Technology (ICT) by MSME actors of Gunung Puntang Coffee varies across the analyzed variables. The percentage of utilization can be seen in Table 3.

Table 3. Percentage of ICT Utilization by Variable

| **Variabel** | **Persentase (%)** |
|---|---|
| Media Sosial | 42% |
| E-Commerce | 18% |
| Sistem Manajemen Produksi | 25% |
| Akses Informasi Pasar | 37% |

| Variabel | Persentase (%) |
|---|---|
| Aplikasi Keuangan | 20% |
| Internet | 61% |

Source: Primary data (2026)

Based on the results of the multiple linear regression analysis, the level of adoption and the influence of each ICT variable on competitiveness were identified. The data processing results indicate that although certain variables show relatively high levels of utilization, the regression coefficients generally fall within the low to moderate influence category.

Table 4. ICT Adoption Level and Its Influence on Competitiveness

| ICT Component | Usage Percentage (%) | Regression Coefficient (β) | Influence Category | Remarks |
|---|---|---|---|---|
| Social Media | 42 | 0.321 | Low Moderate | Many SMEs are not yet consistent in digital promotion. |
| *E-Commerce* | 18 | 0.215 | Low | Marketplace use remains limited, with sales still dominated offline. |
| Production Management Systems | 25 | 0.287 | Low | Digital systems for production are not yet widely adopted. |
| Online Market Information Access | 37 | 0.412 | Moderate | There is a growing tendency, but it is not yet significant. |
| Financial Applications | 20 | 0.356 | Low | Only a small proportion of SMEs use applications, and functions remain basic |
| Internet Connection | 61 | 0.143 | Low | Internet access has not yet been strategically utilized for business activities. |

Source: Processed data, SPSS (2026)

Through multiple linear regression analysis, the findings indicate that ICT adoption has a positive and significant effect on the competitiveness of SMEs (significance value < 0.05). The most influential ICT components are the use of digital media for marketing and communication (β = 0.421), followed by the use of financial recording and inventory management applications (β = 0.367). The contribution level of ICT variables to enhancing competitiveness reached 67.4% ($R^2$ = 0.674), demonstrating that ICT adoption is one of the dominant factors in determining the competitive position of the Puntang coffee SMEs.

From the in-depth interviews, several SME actors stated that: sales increased by 30–50% after actively marketing their products on digital platforms; time and operational cost efficiency improved due to a more structured ordering and distribution system; and the local Puntang Coffee brand began to gain recognition beyond West Java thanks to well-planned digital presence. These statements reinforce the quantitative analysis results, confirming that ICT plays a tangible role in stimulating growth and competitive advantage.

Based on the identification of internal and external factors, Puntang Coffee SMEs possess three main strengths: a strong digital commitment, an already recognized brand, and solid support from the local community. However, significant weaknesses remain, including low ICT literacy among human resources and limited digital infrastructure. Externally, there are considerable opportunities through government digitalization programs and a market trend that increasingly favors digital technology

utilization. Nevertheless, threats also arise from rapid technological changes and intensifying global competition

### 3.2 Discussion

These constraints collectively hinder the improvement of efficiency, productivity, and market penetration of Gunung Puntang coffee SMEs. Without adequate utilization of ICT, SME actors will face difficulties in competing with competitors who have already adopted digital-based systems, whether in terms of promotion, distribution, or supply chain management. Therefore, a strategic and collaborative approach is needed to address these barriers in a systemic manner.

Effective ICT adoption will enhance the ability of SMEs to adapt to market changes and consumer needs. In the long term, this will strengthen the position of Gunung Puntang coffee SMEs as producers of high-quality coffee that excel not only in terms of product quality but also in technology-based management and marketing systems.

Based on the findings, the level of ICT adoption among Gunung Puntang Coffee SMEs is still confronted with several challenges, both from internal business actors and external business environment factors. Therefore, the proposed strategies are holistic, measurable, and contextual, taking into account the characteristics of these coffee SMEs.

Enhancing digital literacy and human resource competencies becomes the first crucial strategy, considering the low level of digital literacy and limited technical knowledge among SME actors. This effort can be carried out through regular training and workshops on the use of digital applications such as e-commerce, social media, Point of Sales (POS) systems, and digital accounting. Collaboration with universities or training institutions is also essential to provide direct field assistance. The development of training modules tailored to local needs is necessary to ensure that the materials are relevant and easily understood.

Furthermore, the provision of infrastructure and access to technology plays a vital role in optimizing ICT adoption. This includes improving internet access in coffee-producing areas through government cooperation with internet service providers, providing subsidies or micro-financing schemes for purchasing technological devices such as computers, tablets, and labeling machines, as well as establishing technology service centers (tech centers) that can be collectively utilized by SME actors.

Government policies and incentives are also essential to promote large-scale ICT adoption. Such support may take the form of tax incentives or awards for SMEs that successfully implement ICT, the formulation of local regulations mandating the use of digital technology in product administration and certification processes, and facilitation by relevant agencies to monitor ICT adoption progress at the SME level.

The policy implications of ICT adoption involve the active role of multiple stakeholders. For the government or related agencies, measures may include organizing regular ICT training focused on digital marketing, quality control, and application-based production management; providing digital tools such as automatic coffee grading machines, moisture meters, and QR code packaging equipment; as well as developing local quality certification through the establishment of a Cupping Lab in the Gunung Puntang District.

The policy implications of ICT adoption involve the roles of various stakeholders. For the government or related agencies, potential steps include organizing regular ICT training programs focusing on digital marketing, quality control, and application-based production management; providing digital tools such as automatic coffee grading machines, moisture meters, and QR code packaging systems; as well as establishing local quality certification through the development of a Cupping Lab in Gunung Puntang District.

For PT Telkom and technology partners, the development of a *"Digital Coffee" application* featuring stock management, harvest recording, product tracking, and cupping data could serve as a

technological solution to support digital operations and online marketing. Expanding internet networks in plantation areas and coffee shops is also necessary, along with hosting digital events with SMEs for promotion through marketplaces and social media.

Meanwhile, coffee SMEs are expected to adopt digital quality control technologies such as automatic coffee dryers, humidity sensors, and automatic sorting tools, while also being active on marketplaces like Shopee and Tokopedia, as well as social media platforms, to showcase the origin and production process of their coffee. The formation of digital cooperatives is also recommended as a platform for sharing equipment and joint training, thereby encouraging greater efficiency and stronger collaboration among coffee entrepreneurs.

## 4. CONCLUSION

The study on 15 Gunung Puntang coffee SMEs concludes that ICT adoption is uneven, with relatively high usage in internet and social media, but limited application in e-commerce and digital finance. Key factors influencing adoption include internet connectivity, access to market information, and financial applications, while e-commerce and social media are less impactful in business operations. Overall, ICT adoption significantly enhances SME competitiveness, explaining 88% of the variation in performance. Strengthening digital infrastructure and government support, particularly from Pemda Jabar, is essential to maximize market potential and sustain competitiveness in the growing West Java coffee industry.

Based on the results and conclusions, it is recommended that the West Java Provincial Government, in collaboration with SME communities, enhance ICT literacy through regular training on e-commerce, digital financial management, and online marketing. At the same time, equal access to digital infrastructure, particularly stable internet connectivity in all coffee production areas of Gunung Puntang, needs to be ensured. Strengthening technology-oriented policies will enable SMEs to optimize ICT adoption and maintain competitiveness in the growing West Java coffee market.

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