# “The mediating role of competitive advantage in ERP-RFID integration for enhancing global market success of Indonesian SMEs”


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# THE MEDIATING ROLE OF COMPETITIVE ADVANTAGE IN ERP-RFID INTEGRATION FOR ENHANCING GLOBAL MARKET SUCCESS OF INDONESIAN SMES

## Abstract

Competitive advantage is crucial for the global market as the integration of enterprise resource planning (ERP) and radio frequency identification (RFID) enhances MSMEs' efficiency, flexibility, and responsiveness, strengthening competitiveness and global expansion. We aim to test the effects of ERP and RFID on competitive advantage and how competitive advantage influences global market success, both directly and through the mediating role. The survey was conducted in June 2025 in Kediri, East Java, Indonesia. It involved 225 SME actors from 75 clusters, selected randomly to reduce bias. Data were collected using a structured questionnaire with a 5-point Likert scale and analyzed with partial least squares structural equation modeling (PLS-SEM).

The analysis results demonstrate that ERP and RFID significantly enhance a company's competitive advantage, with path coefficients of 0.2708 for ERP and 0.5434 for RFID, both highly significant at $p = 0.0000$. This competitive advantage positively influences global market expansion, with a coefficient of 0.4687 ($p = 0.0000$), highlighting its crucial role in international growth. Furthermore, both ERP and RFID contribute directly to global market expansion, where RFID exhibits a stronger effect with coefficients of 0.1593 for ERP and 0.2500 for RFID ($p = 0.0000$). Mediation analysis confirms that competitive advantage significantly mediates the relationship between technology implementations and global market expansion, with RFID's mediating effect (0.2547) exceeding that of ERP (0.1269). This evidence confirms that implementing ERP and RFID significantly enhances a company's competitive advantage and contributes to global market expansion, with RFID demonstrating a stronger impact and serving as a crucial mediating factor in this relationship.

**Keywords** competitive advantage, global market, ERP-RFID, Indonesia

**JEL Classification** L25, L86, M15, O33

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## INTRODUCTION

In the current era, small and medium enterprises (SMEs) in Indonesia face significant challenges in integrating advanced technology that can enhance their core competencies – especially competence, flexibility, speed, and responsiveness – in managing increasingly complex business operations (Faisol et al., 2025). Recent data from the Ministry of Cooperatives and SMEs (2023) show that more than 60% of SMEs encounter problems with inventory inaccuracy, delays in decision-making, and rigid business processes, resulting in average operational losses of up to 15% each year. This condition hampers SMEs' ability to respond swiftly to market dynamics and limits their potential in global market expansion.

In this context, enterprise resource planning (ERP) and radio frequency identification (RFID) have become promising technological solutions. ERP systems integrate various business functions – including

finance, production, and marketing – into a single unified platform, thereby facilitating fast and accurate decision-making (Li & Wu, 2021; Pontoh et al., 2024). RFID technology enables real-time inventory tracking, drastically reducing stock mismatches and errors in supply chain management (Decker & Zoghi, 2023; Crooks & Haddud, 2025). Together, these technologies offer a synergistic approach to optimizing SME operations. Previous studies have explored the benefits of ERP and RFID, but still independently (Aburub, 2015; Shajrawi & Aburub, 2023; Vukman et al., 2024; Konecka & Maryniak, 2020; Al-Shboul, 2023). There is a lack of research examining the combined impact of both on SME performance, especially on four critical dimensions: competence, flexibility, speed, and responsiveness. The existing literature still lacks empirical evidence on how the integration of RFID and ERP can enhance SMEs' competitive advantage and enable sustainable global market expansion.

Therefore, it is interesting to answer the questions: How does the integration of enterprise resource planning (ERP) and radio frequency identification (RFID) affect the improvement of competence, flexibility, speed, and responsiveness of SMEs? To what extent can the integration of these technologies enhance competitive advantage and support SMEs' expansion into the global market? And how can the operational management of SMEs be optimized through the implementation of these technologies? By answering these questions, this analysis is expected to fill the research gap and provide practical contributions to the development of SMEs in Indonesia. The integration of ERP and RFID provides SMEs with real-time visibility and control over inventory and business processes, enabling proactive stock management and rapid response to market fluctuations (Unhelkar et al., 2022; Yusuf et al., 2023). This aligns with dynamic capabilities theory (Teece, 1997), which emphasizes the importance of organizational agility in maintaining competitive advantage. Empirical evidence from Aloqaily (2021) supports that companies leveraging integrated technology platforms achieve superior flexibility and responsiveness, which are crucial for thriving in volatile global markets.

The implementation of this integrative technological approach has profound implications. Operational service and reduced costs associated with stockouts and overstocks, accelerate service, and improve decision accuracy. Strategically, these improvements strengthen competitive positioning and enhance customer satisfaction, build loyalty, and open opportunities for global market expansion. Policymakers and SME support institutions can utilize these insights to design programs that encourage technological adoption, thereby supporting regional economic growth and resilience in facing global competition (Yusuf et al., 2023).

## 1. LITERATURE REVIEW AND HYPOTHESES

Enterprise resource planning (ERP) systems are integrated software applications that allow organizations to manage and automate their core business processes, including finance, human resources, supply chain, and customer relationship management. ERP systems are designed to provide a comprehensive and centralized platform for managing an organization's data and information, leading to improved efficiency, productivity, and decision-making (Alaskari et al., 2021; Putra et al., 2021; K. Hornung & M. Hornung, 2020). The successful implementation and utilization of ERP systems depend on several key factors, including user competency, system flexibility, and system speed. ERP user competency refers to the ability of employees to effectively use and leverage the capabilities of the ERP system. ERP system flexibility is the degree to which the system can adapt to changing business requirements and accommodate new functionalities. ERP system speed is the responsiveness of the system in terms of processing transactions and generating reports (Mahraz et al., 2019; Mandava, 2024).

Radio frequency identification (RFID) is a technology that uses radio waves to automatically identify and track objects or individuals. RFID systems consist of three main components: tags (or transponders), readers, and an information management system. RFID technology has been increasingly adopted by organizations to enhance


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their operational efficiency, security, and visibility (Tan & Sidhu, 2022; Al-Shboul, 2023). The integration of ERP systems and RFID technology can provide several benefits, including improved operational efficiency and time savings, enhanced security and risk reduction, increased visibility and real-time tracking, and improved system integration and business scalability (Pontoh et al., 2024; Crooks & Haddud, 2025).

Competitive advantage refers to the unique position an organization holds in the market, allowing it to outperform its competitors. Factors such as cost leadership, product differentiation, and focus strategy can contribute to an organization's competitive advantage (Rehman et al., 2022). The integration of ERP and RFID can enhance an organization's competitive advantage by improving operational efficiency, reducing costs, and enhancing product and service offerings (Oghazi et al., 2018; Tan & Sidhu, 2022).

Global market expansion refers to the process of extending an organization's operations and customer base beyond its domestic market. Factors such as market knowledge, resource availability, and technological capabilities can influence an organization's ability to expand globally (Pohludka et al., 2018; Jacks & Novy, 2018). The integration of ERP and RFID can support global market expansion by improving supply chain visibility, enhancing operational efficiency, and enabling better decision-making (Pontoh et al., 2024; Zhang et al., 2025). Several studies have examined the relationship between ERP user competency and an organization's competitive advantage. Hassab Elnaby et al. (2012) found that user satisfaction with ERP systems is positively associated with perceived organizational performance and competitive advantage. Similarly, Zongyuan and Haiyan (2024) reported that improved ERP user competency can lead to enhanced operational, managerial, and strategic benefits, which in turn can contribute to an organization's competitive advantage (Hansen et al., 2023).

The flexibility of ERP systems is recognized as a crucial element for strengthening an organization's competitive advantage. Sastrodiharjo and Khasanah (2023) found that this flexibility allows organizations to adjust to evolving business needs and respond swiftly to market changes, thereby enhancing their competitive position. Similarly, Shajrawi and Aburub (2023) highlighted the significance of ERP system flexibility in fostering organizational agility and responsiveness, both of which are vital for sustaining a competitive edge.

The integration of ERP systems and RFID technology has been demonstrated to enhance an organization's competitive advantage. According to Tarigan et al. (2021), this integration improves operational efficiency, increases supply chain visibility, and enhances decision-making, all of which strengthen the organization's competitive position. Oghazi et al. (2018) also indicated that combining ERP and RFID can result in cost savings, better inventory management, and higher customer satisfaction, thereby further reinforcing competitive advantage (Pontoh et al., 2024).

The integration of ERP and RFID has been recognized as a key enabler for global market expansion. Oghazi et al. (2018) highlighted that this integration improves supply chain management, enhances visibility, and facilitates better decision-making, all of which are critical for successful expansion into global markets. Pontoh et al. (2024) further emphasized that the integration of ERP and RFID can support organizations in overcoming challenges associated with global operations, such as inventory management, logistics, and customer service, thereby enabling them to expand their reach into new international markets. In conclusion, the integration of ERP and RFID technologies can enhance an organization's competitive advantage and support its global market expansion efforts. The empirical evidence suggests that factors such as ERP user competency, ERP system flexibility, and the integration of ERP with RFID can contribute to improved operational efficiency, enhanced supply chain visibility, and better decision-making, ultimately strengthening an organization's competitive position and enabling it to expand into new global markets. The study aims to examine the significant effects of ERP and RFID implementations on a company's competitive advantage, as well as their direct impact on success in the global market. It also investigates the role of competitive advantage as a mediator between these implementations and success in the global market.

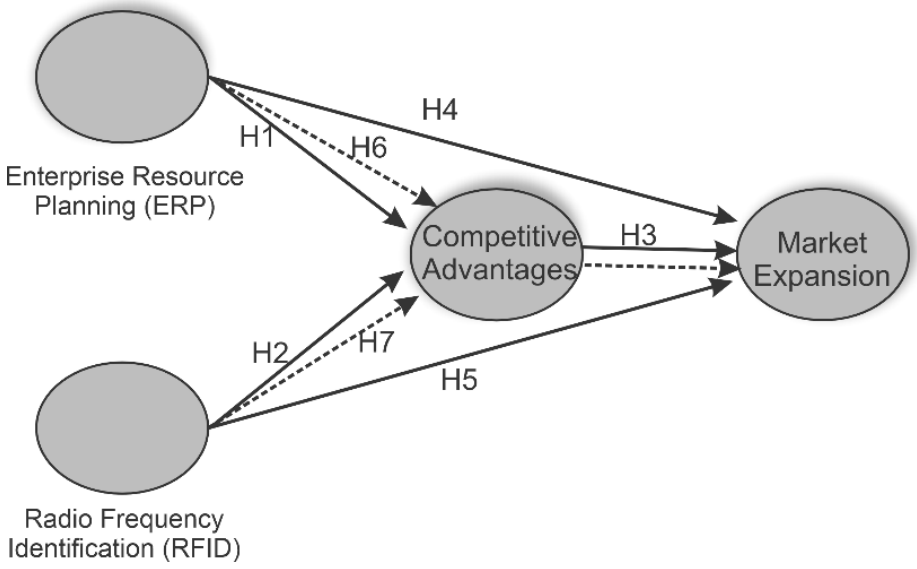


**Figure 1.** Conceptual framework

Following the literature review and the conceptual model depicted in Figure 1, the following hypotheses are proposed:

$H_1$: *The implementation of ERP has a significant and positive impact on a company's competitive advantage.*

$H_2$: *The implementation of RFID has a significant and positive impact on a company's competitive advantage.*

$H_3$: *Competitive advantage has a significant and positive impact on achieving success in the global market.*

$H_4$: *The implementation of ERP has a significant and positive effect on achieving success in the global market.*

$H_5$: *The implementation of RFID has a significant and positive effect on achieving success in the global market.*

$H_6$: *Competitive advantage serves as a mediator in the relationship between ERP implementation and global market success.*

$H_7$: *Competitive advantage serves as a mediator in the relationship between RFID implementation and global market success.*

## 2. METHODS

This analysis was conducted from May to June 2025 in Kediri City, East Java, Indonesia, focusing on owners of small and medium enterprises (SMEs) organized into 75 company clusters. Kediri was chosen as the research location due to its strategic significance, especially with the recent development of a new toll road providing improved access from Jakarta and Surabaya, which is expected to boost regional economic activity and SME growth. Primary data were collected from the Cooperative Office, Micro Enterprises and Manpower Office, and the Department of Industry and Trade of Kediri City. To ensure representativeness and minimize bias, 225 business actors from these clusters were randomly selected as respondents, enhancing the accuracy and generalizability of the findings to the wider SME population in the region.

Table 1 presents the characteristics of the respondents. Regarding their education, 20% of respondents have a high school education, 30% hold a college diploma, 40% possess a bachelor's degree, and 10% have a master's degree. In terms of professional roles, 17% serve as production managers, 11% as finance managers, 15% as financial analysts, 12% as inventory managers, 14% as human resources managers, 18% as operations managers, 9% as supply chain managers, and 4% as sales managers.


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Data were collected using a structured questionnaire designed to capture responses systematically and consistently from these various business actors. A 5-point Likert scale was applied to measure the respondents' perspectives, ensuring their opinions and attitudes were accurately reflected (Appendix A). This study employed the partial least squares structural equation modeling (PLS-SEM) technique, which is especially well-suited for exploratory research, as evidenced by previous studies (Faisol et al., 2022; Faisol et al., 2023; Faisol et al., 2024; Faisol et al., 2025), allowing for the examination of complex relationships among multiple variables. PLS-SEM is an effective technique for evaluating both measurement and structural models. It provides a detailed understanding of the direct and indirect impacts of constructs under study, such as the integration of enterprise resource planning with fast radio frequency identification to boost competitive advantage for SMEs and foster global market expansion. By combining random sampling, structured questionnaires, and advanced analytical methods like PLS-SEM, the research achieves a thorough investigation of its objectives, offering key insights into technology adoption and sustainable practices within SMEs.

**Table 1.** Demographics of respondents

| Category | Number respondents | % |
|---|---|---|
| **Age** | | |
| Aged 20 to 30 years | 20 | 9% |
| Aged 31 to 40 years | 40 | 18% |
| Aged 41 to 50 years | 45 | 20% |
| Aged 51to 60 years | 80 | 36% |
| Aged over 60 | 40 | 18% |
| **Gender** | | |
| Female | 85 | 38% |
| Male | 140 | 62% |
| **Role** | | |
| Production Manager | 38 | 17% |
| Finance Manager | 25 | 11% |
| Financial Analyst | 34 | 15% |
| Inventory Manager | 26 | 12% |
| Human Resources Manager | 32 | 14% |
| Operations Manager | 40 | 18% |
| Supply Chain Manager | 20 | 9% |
| Sales Manager | 10 | 4% |
| **Education** | | |
| Senior High School | 45 | 20% |
| Diploma (associate degree) | 68 | 30% |
| Bachelor's Degree | 90 | 40% |
| Master's Degree | 22 | 10% |
| **Industries** | | |
| Air Conditioner Repair | 2 | 0.9% |
| Aluminium Building Materials | 5 | 2.2% |
| Aluminium Goods | 3 | 1.3% |
| Batik Fabric | 4 | 1.8% |
| Batik Industry | 3 | 1.3% |
| Beverage Stalls | 3 | 1.3% |
| Birdcage Industry | 3 | 1.3% |
| Bread and Cake Product Industry | 4 | 1.8% |
| Bricks and Red Stone | 3 | 1.3% |
| Car Repair | 2 | 0.9% |
| Cement Products | 3 | 1.3% |
| Chips and Kerupuk Industry | 4 | 1.8% |
| Clothing | 4 | 1.8% |
| Clothing, Aprons, Sleeveless Jackets (Jampel) | 3 | 1.3% |
| Computer Industry | 3 | 1.3% |
| Computer Repair and Related Equipment | 2 | 0.9% |
| Concrete Roof Tiles, Tegel | 3 | 1.3% |
| Cosmetics | 2 | 0.9% |
| Dairy Processing / Fresh Milk | 4 | 1.8% |

**Table 1 (cont.).** Demographics of respondents

| Category | Number respondents | % |
|---|---|---|
| Dry and Wet Bread | 3 | 1.3% |
| Electronic Devices Service | 2 | 0.9% |
| Food Packaging and Recycling | 2 | 0.9% |
| Fruit and Vegetable Drying Industry | 4 | 1.8% |
| Gambir Krupuk | 3 | 1.3% |
| Gambir Opak, Sugar Candy (Arum Manis) | 2 | 0.9% |
| Glucose and Similar Industry | 2 | 0.9% |
| Goldsmithing | 3 | 1.3% |
| Grocery and Other Food Product Industry | 4 | 1.8% |
| Herbal Drink (Sari Temu) | 4 | 1.8% |
| Herbal Medicine (Jamu) | 3 | 1.3% |
| Honey Collection | 2 | 0.9% |
| Household Appliance and Garden Equipment Repair | 2 | 0.9% |
| Ikat Weaving | 3 | 1.3% |
| Janggelan Packaging Industry | 4 | 1.8% |
| Kitchen Equipment Industry Made from Wood, Rattan, and Bamboo | 4 | 1.8% |
| Knitting | 2 | 0.9% |
| Leather Garment Industry (Convection) | 4 | 1.8% |
| Medicine and Chemical Materials | 3 | 1.3% |
| Military and Traffic Industry | 2 | 0.9% |
| Moist and Dry Cake Wholesale and Retail Trade | 2 | 0.9% |
| Motorcycle Workshop | 3 | 1.3% |
| Musical Instruments | 4 | 1.8% |
| Needle and Thread Garment Tailoring (Custom Tailoring) | 2 | 0.9% |
| Noodles | 3 | 1.3% |
| Other Beverage Industry, Fruit and Vegetable Juice Processing, Soft Drink Industry | 4 | 1.8% |
| Other Processing Industry | 2 | 0.9% |
| Other Textile Finished Goods Company | 4 | 1.8% |
| Copying, Document Handling, and Office Support | 3 | 1.3% |
| Photo Printing | 4 | 1.8% |
| Plastic Craft and Souvenir Industry | 2 | 0.9% |
| Plastic Factory | 3 | 1.3% |
| Plastic Packaging Industry | 4 | 1.8% |
| Puffed Corn (Brondong Jagung) | 2 | 0.9% |
| Rooster Feather Brush (Sulak Bulu Ayam) | 3 | 1.3% |
| Rubber Processing | 2 | 0.9% |
| Scouring Powder | 2 | 0.9% |
| Sewing Garment Industry with Embroidery | 3 | 1.3% |
| Sodium Chloride Salt (Garam Natrislim) | 4 | 1.8% |
| Soft Drink Industry | 2 | 0.9% |
| Soap and Household Cleaning Products Industry | 4 | 1.8% |
| Spare Part Industry and Components (e.g., Snelhecter Components) | 3 | 1.3% |
| Spice and Flavoring Industry | 4 | 1.8% |
| Textile Convection Garment Industry | 2 | 0.9% |
| Tin Craft | 3 | 1.3% |
| Traffic Light and Road Signs Industry | 3 | 1.3% |
| Traffic Industry | 2 | 0.9% |
| Traditional Medicine Products | 3 | 1.3% |
| Tofu Industry (Soybean) | 4 | 1.8% |
| Traffic and Road Equipment Services | 2 | 0.9% |
| Wallet, Bags, and Packaging Box Industry | 4 | 1.8% |
| Wheat Flour and Sago Packaging Industry | 3 | 1.3% |
| Wooden Clock | 4 | 1.8% |
| Wooden Furniture | 3 | 1.3% |
| Woodcraft and Other Non-Furniture Craft Industry | 3 | 1.3% |
| Wood and Weaving Materials | 2 | 0.9% |
| **Firm Size** | | |
| 5–50 employees | 113 | 50% |
| 51–100 employees | 78 | 35% |
| 101–150 employees | 27 | 12% |
| > 150 employees | 7 | 3% |
| Total | 225 | 100% |


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# 3. RESULTS AND DISCUSSION

## 3.1. Measurement model

Evaluating the measurement model (also known as the outer model) involves testing for both validity and reliability. This process includes assessing convergent validity by analyzing the factor loadings (λ) to determine if the indicators accurately represent the latent constructs. For an indicator to be considered valid, its loading factor must exceed 0.6. Indicators that do not meet this threshold are excluded from the model. Additionally, the outer model evaluation incorporates metrics such as average variance extracted (AVE) and composite reliability (CR). The outcomes of these validity and reliability assessments for the various constructs within the research framework are summarized in Table 2. Convergent validity is confirmed through factor loadings and AVE values, while reliability is gauged using Cronbach's Alpha (α) and composite reliability (CR). The results indicate that the measurement model, analyzed using SEM-PLS, meets all required criteria, as illustrated in Figure 2 and Table 2.

## 3.2. Discriminant validity

To assess the discriminant validity of the constructs, we used both the Fornell-Larcker criterion and cross-loadings analysis. According to the Fornell-Larcker criterion, discriminant validity is confirmed if the square root of the average variance extracted (AVE) for each construct is greater than its correlations with other constructs (Ab Hamid et al., 2017; Rasoolimanesh, 2022). Cross-loading analysis evaluates how each indicator correlates with its assigned construct, verifying that the indicator has a stronger loading on its own construct than on any other constructs (Sarstedt et al., 2019). A summary of the discriminant validity results is presented in Table 3.

## 3.3. Structural model

The next stage involves analyzing the structural model, also referred to as the inner model, after confirming the measurement model's reliability and validity. The analysis of the structural model offers an in-depth evaluation of the proposed re-

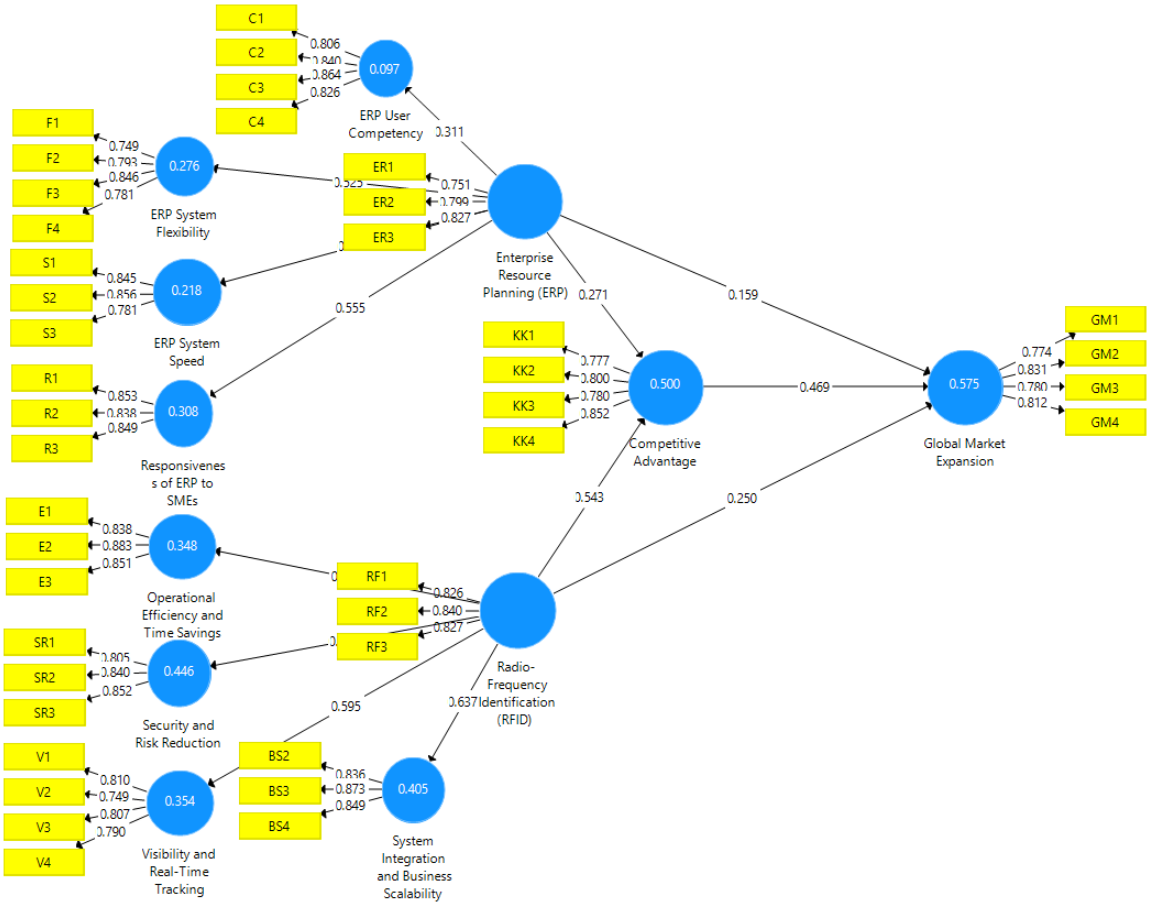


**Figure 2.** Outcomes of the measurement model analysis

**Table 2.** Reliability and convergent validity

| Construct | Convergent Validity | | Reliability | | |
|---|---|---|---|---|---|
| | Loading factor | Significance | AVE | α | CR |
| **Enterprise Resource Planning (ERP)** | | | | | |
| ER1 | 0.751 | *** | 0.6289 | 0.7043 | 0.8354 |
| ER2 | 0.798 | *** | | | |
| ER3 | 0.827 | *** | | | |
| **ERP System Flexibility** | | | | | |
| F1 | 0.748 | *** | 0.6289 | 0.8030 | 0.8712 |
| F2 | 0.793 | *** | | | |
| F3 | 0.845 | *** | | | |
| F4 | 0.781 | *** | | | |
| **ERP System Speed** | | | | | |
| S1 | 0.844 | *** | 0.6852 | 0.7703 | 0.8670 |
| S2 | 0.855 | *** | | | |
| S3 | 0.780 | *** | | | |
| **ERP User Competency** | | | | | |
| C1 | 0.806 | *** | 0.6961 | 0.8543 | 0.9015 |
| C2 | 0.840 | *** | | | |
| C3 | 0.863 | *** | | | |
| C4 | 0.825 | *** | | | |
| **Responsiveness of ERP** | | | | | |
| R1 | 0.852 | *** | 0.7167 | 0.8026 | 0.8836 |
| R2 | 0.838 | *** | | | |
| R3 | 0.848 | *** | | | |
| **Radio Frequency Identification (RFID)** | | | | | |
| RF1 | 0.744 | *** | 0.6907 | 0.7768 | 0.8701 |
| RF2 | 0.909 | *** | | | |
| RF3 | 0.757 | *** | | | |
| **Operational Efficiency and Time Savings** | | | | | |
| E1 | 0.837 | *** | 0.7352 | 0.8196 | 0.8928 |
| E2 | 0.882 | *** | | | |
| E3 | 0.851 | *** | | | |
| **Security and Risk Reduction** | | | | | |
| SR1 | 0.805 | *** | 0.6936 | 0.7802 | 0.8716 |
| SR2 | 0.840 | *** | | | |
| SR3 | 0.852 | *** | | | |
| **Visibility and Real-Time Tracking** | | | | | |
| V1 | 0.810 | *** | 0.6232 | 0.7985 | 0.8686 |
| V2 | 0.748 | *** | | | |
| V3 | 0.806 | *** | | | |
| V4 | 0.790 | *** | | | |
| **System Integration and Business Scalability** | | | | | |
| BS1 | 0.835 | | 0.7270 | 0.8125 | 0.8887 |
| BS2 | 0.872 | | | | |
| BS3 | 0.849 | | | | |
| **Competitive Advantage** | | | | | |
| KK1 | 0.776 | *** | 0.6446 | 0.8158 | 0.8787 |
| KK2 | 0.800 | *** | | | |
| KK3 | 0.780 | *** | | | |
| KK4 | 0.852 | *** | | | |
| **Global Market Expansion** | | | | | |
| GM1 | 0.774 | *** | 0.6395 | 0.8126 | 0.8764 |
| GM2 | 0.830 | *** | | | |
| GM3 | 0.780 | *** | | | |
| GM4 | 0.811 | *** | | | |

*Note:* *** means significant.


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**Table 3.** Discriminant validity

| | CA | SF | SS | UC | ERP | GM | OE | RFID | R of ERP | SRR | SIBS | VR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CA | 0.8029 | | | | | | | | | | | |
| SF | 0.7062 | 0.7930 | | | | | | | | | | |
| SS | 0.5994 | 0.5983 | 0.8278 | | | | | | | | | |
| UC | 0.3717 | 0.3626 | 0.3224 | 0.8343 | | | | | | | | |
| ERP | 0.5127 | 0.5251 | 0.4667 | 0.3115 | 0.7930 | | | | | | | |
| GM | 0.7164 | 0.7099 | 0.6418 | 0.3439 | 0.5108 | 0.7997 | | | | | | |
| OE | 0.5464 | 0.6023 | 0.7464 | 0.2885 | 0.4105 | 0.6124 | 0.8574 | | | | | |
| RFID | 0.6640 | 0.5941 | 0.5994 | 0.3990 | 0.4451 | 0.6321 | 0.5895 | 0.8311 | | | | |
| R | 0.7106 | 0.7188 | 0.5949 | 0.3676 | 0.5548 | 0.6766 | 0.5539 | 0.6152 | 0.8466 | | | |
| SRR | 0.5936 | 0.6104 | 0.6871 | 0.3533 | 0.4705 | 0.6140 | 0.7272 | 0.6680 | 0.6308 | 0.8328 | | |
| SIBS | 0.6809 | 0.6450 | 0.6874 | 0.3785 | 0.4705 | 0.6641 | 0.6348 | 0.6367 | 0.6821 | 0.6816 | 0.8527 | |
| VR | 0.6242 | 0.6026 | 0.6631 | 0.3345 | 0.4594 | 0.6421 | 0.6541 | 0.5948 | 0.5965 | 0.6886 | 0.7321 | 0.7894 |

*Note*: CA = Competitive Advantage, SF = System Flexibility, SS = System Speed, UC = User Competency, ERP = Enterprise Resource Planning, GM = Global Market Expansion, OE = Operational Efficiency and Time Savings, RFID = Radio-Frequency Identification, R = Responsiveness of ERP to SMEs, SR = Security and Risk Reduction, BS = System Integration and Business Scalability, VR = Visibility and Real-Time Tracking.

lationships among latent variables by examining path coefficients and their *t*-values. The path coefficients represent the magnitude and direction of the relationships, while the *t*-values determine their statistical significance using bootstrapping methods. Hair et al. (2017) emphasize that interpreting these values is crucial for understanding both direct and indirect effects within the model, enabling us to validate or reject proposed hypotheses. According to Henseler et al. (2009), a *t*-value greater than 1.64 corresponds to a significance level of 5% in a one-tailed test, which is commonly used in partial least squares structural equation modeling (PLS-SEM) to determine whether relationships are statistically significant and meaningful (Hair et al., 2017). Before interpreting path coefficients, it is essential to check for multicollinearity among predictor constructs, as high col-

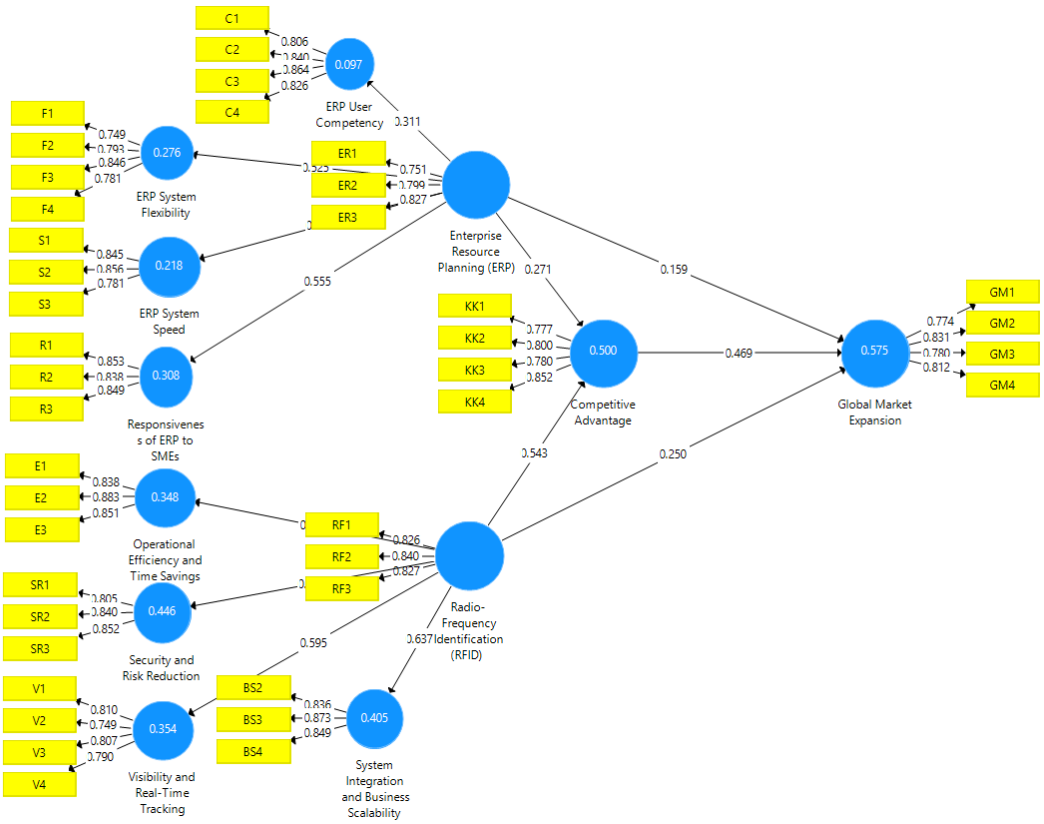


**Figure 3.** Outcomes of the structural model analysis

linearity can bias the estimation of path coefficients and undermine the model's validity (Hair et al., 2021). Additionally, the model's explanatory power is evaluated through coefficients of determination ($R^2$), which indicate how well the predictor constructs explain the endogenous constructs. The structural model and its estimated paths are visually summarized in Figure 3, providing a clear overview of the relationships tested in the study.

The analysis shows that enterprise resource planning (ERP) positively and significantly impacts competitive advantage, with a path coefficient of 0.2708, a *t*-value of 7.89, and a *p*-value of 0.0000. This means effective ERP implementation enhances a company's competitive position. ERP also directly supports global market expansion, though with a smaller effect (path coefficient = 0.1593, *t*-value = 4.78, *p*-value = 0.0000). Additionally, ERP's indirect effect on global market expansion through competitive advantage is significant (path coefficient = 0.1269, *t*-value = 6.40, *p*-value = 0.0000), showing that improving competitiveness mediates ERP's influence on market growth. Similarly, radio-frequency identification (RFID) has a stronger positive effect on competitive advantage (path coefficient = 0.5434, *t*-value = 16.45, *p*-value = 0.0000). RFID also significantly boosts global market expansion directly (path coefficient = 0.2500, *t*-value = 7.06, *p*-value = 0.0000) and indirectly through competitive advantage (path coefficient = 0.2547, *t*-value = 10.11, *p*-value = 0.0000). Overall, both ERP and RFID are crucial for enhancing competitiveness and global market growth, with RFID showing a stronger impact.

The hypotheses testing results reveal the following key findings. The results of the H1 test reveal that implementing enterprise resource planning (ERP) has a significant positive effect on a company's competitive advantage, with a coefficient of 0.2708 and a *t*-statistic of 7.8935. This indicates that ERP functions not just as a technological tool but as a strategic asset that enhances operational efficiency, integrates business processes, and optimizes resource use. This finding aligns with the DeLone & McLean Information System Success Model, which emphasizes that ERP system quality, information quality, and service quality collectively improve company performance and competitive edge (Aksana et al., 2025).

Empirical evidence from Pontoh et al. (2024) in Pakistan's SME sector further supports this, showing that ERP quality and effective cost management through ERP significantly strengthen competitive advantage. This study highlights that, beyond technical factors, individual and group productivity, as well as cost management, are crucial for sustaining competitive superiority. However, challenges in ERP implementation reported by Buor and Darteh (2024) suggest that benefits may be limited by high costs, complexity, and resistance from employees. Harun et al. (2022) identified obstacles such as misalignment of ERP with existing business processes, insufficient top management support, and organizational culture barriers that can undermine ERP advantages.

Further studies demonstrate that ERP success heavily depends on organizational context and

**Table 4.** Results of hypothesis testing

| Hypothesis Statement | Original Sample (O) | Sample Mean (M) | Standard Deviation (STDEV) | T Statistics (\|O/STDEV\|) | P Values |
|---|---|---|---|---|---|
| H1: ERP Implementation → Competitive Advantage | 0.2708 | 0.2718 | 0.0343 | 7.8935 | 0.0000 |
| H2: RFID Implementation → Competitive Advantage | 0.5434 | 0.5424 | 0.0330 | 16.4497 | 0.0000 |
| H3: Competitive Advantage → Global Market Expansion | 0.4687 | 0.4744 | 0.0378 | 12.3908 | 0.0000 |
| H4: ERP Implementation → Global Market Expansion | 0.1593 | 0.1566 | 0.0333 | 4.7761 | 0.0000 |
| H5: RFID Implementation → Global Market Expansion | 0.2500 | 0.2473 | 0.0354 | 7.0593 | 0.0000 |
| H6: ERP Implementation → Competitive Advantage → Global Market Expansion | 0.1269 | 0.1290 | 0.0198 | 6.3961 | 0.0000 |
| H7: RFID Implementation → Competitive Advantage → Global Market Expansion | 0.2547 | 0.2573 | 0.0252 | 10.1143 | 0.0000 |


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the company's readiness to manage change. A quantitative SEM-PLS study of manufacturing firms (Aloqaily, 2021) confirmed that ERP implementation significantly enhances organizational capabilities, which, in turn, improve company performance. Nonetheless, limited research indicates the ERP's impact on performance could be weak or insignificant if not coupled with improvements in organizational capabilities and human resource readiness (Zongyuan & Haiyan, 2024). In summary, while this study confirms the positive role of ERP in cultivating competitive advantage, it also underlines the importance of addressing implementation challenges and investing in organizational capabilities to fully realize ERP's potential. These findings refine previous research by emphasizing that technical excellence alone is insufficient; strategic alignment and organizational preparedness are equally essential for maximizing ERP benefits.

The results of the H2 test demonstrate that the implementation of radio frequency identification (RFID) technology significantly enhances a company's competitive advantage, evidenced by a path coefficient of 0.5434 and a very high *t*-statistic of 16.4497 ($p = 0.0000$). This coefficient exceeds that of ERP implementation, highlighting RFID as a critical factor in enabling companies to create and sustain competitive advantage.

According to Porter's (1985) competitive advantage theory, innovative and efficient technologies serve as strategic resources that are difficult for competitors to replicate, offering advantages in cost, quality, service, and product flexibility. RFID technology enables real-time asset tracking, inventory management, and supply chain optimization with high accuracy, aligning well with this theory. Konecka and Maryniak (2020) showed that companies implement RFID primarily to improve inventory management, enable better competitive decision-making, and reduce process costs. RFID increases supply chain visibility, speeds operational response, and reduces errors and labor costs. Similarly, Fritz and Silva (2018) confirmed that RFID use within Industry 4.0 supply chains improves organizational performance and competitive edge by providing real-time data supporting faster and more accurate decisions. Moreover, RFID enables enhanced collaboration with business partners through timely, precise information sharing, further strengthening competitive positioning. Thus, RFID extends beyond an operational tool to a strategic asset vital for maintaining a company's market standing.

These results align well with previous research but also underscore the relative strength of RFID compared to ERP in impacting competitive advantage. The higher coefficient suggests RFID's direct real-time operational benefits translate more immediately into competitive gains. This interpretation emphasizes the necessity for companies to integrate both technologies strategically: leveraging ERP for process integration and resource optimization while utilizing RFID for real-time visibility and supply chain agility. In conclusion, both theoretically and empirically, RFID implementation is confirmed as a significant driver of competitive advantage, positively influencing business performance and growth. This expands on earlier studies by situating RFID as a pivotal technology in dynamic and complex market environments where rapid information flow and operational responsiveness confer substantial strategic benefits.

The results of the H3 test reveal that competitive advantage significantly and positively drives global market expansion, with a path coefficient of 0.4687 and a *t*-statistic of 12.3908 ($p = 0.0000$). This indicates that companies with a strong competitive position are more capable of expanding their operations internationally. The finding highlights the critical role of competitive advantage as a fundamental determinant in achieving success in global markets. According to Porter's (1985) competitive advantage theory, firms can attain this advantage through two principal strategies: product differentiation and cost leadership. These strategies provide companies with a superior competitive position that is difficult for rivals to replicate. This superiority enables companies to offer unique, high-quality products or services or operate at lower costs, thereby increasing their attractiveness in the global market (Porter, 1985). Empirical research strongly supports the connection between competitive advantage and international expansion. Cavusgil (2021) emphasizes that competitive advantage serves as the foundation for successful global expansion strategies, particularly when navigating challenges such as cultural

diversity, regulatory compliance, and increased competition in international markets. Van Hoang et al. (2025) concur, noting that firms with clear competitive advantages are better able to adapt their marketing and operational tactics, thus effectively expanding their global footprint. Further studies by Basrowi et al. (2023) and Chuwichain et al. (2024) underscore the significance of customers' perception of added value from a company's products or services that surpass those of competitors. This perception is crucial for accessing and retaining customers across diverse international markets and acts as a key driver for global market expansion. Competitive advantages grounded in innovation, operational efficiency, and strong branding also enhance a company's global distribution capabilities and its ability to adapt products to meet diverse market demands.

These findings are aligned with and reinforce previous theoretical frameworks and empirical studies that establish competitive advantage as the cornerstone for global market expansion. For example, Farida and Setiawan (2022) demonstrate that competitive advantage directly impacts profitability and firm valuation, while Rehman et al. (2022) and Nour (2023) associate it with improved financial performance and organizational effectiveness. In interpreting these results, it is clear that investing in unique resources and capabilities that foster competitive advantage is critical for firms aiming for growth on the international stage. The significant path coefficient and *t*-value confirm that competitive advantage is not merely a theoretical construct but a practical mechanism that facilitates the success of global operations. Compared to earlier research, this study provides additional empirical support for the dynamic and adaptable nature of competitive advantage, especially in evolving global conditions. It also highlights that firms must continually innovate and tailor their strategies to sustain and leverage their advantages internationally. Overall, this comprehensive view validates competitive advantage as a vital foundation upon which firms build and sustain successful global market expansions.

The results of the H4 test show that ERP implementation has a significant direct effect on global market expansion, with a coefficient value of 0.1593 and a *t*-statistic of 4.7761. This demonstrates that ERP contributes positively and substantially to supporting companies in expanding their markets internationally. ERP, as an integrated information system, theoretically harmonizes and standardizes business processes across regions and organizational functions. Through consistent and well-documented data integration, companies operate their global activities more effectively and efficiently. Real-time centralized information facilitates prompt decision-making, coordination among business units across regions or countries, and management of complex cross-border transactions. Empirical research by Gessa et al. (2023) supports these findings, stating that companies with mature ERP implementations manage global operations responsively and in a coordinated manner, optimally supporting global expansion strategies. ERP is not merely an internal management tool but a strategic asset addressing the dynamics and challenges of international markets. However, AlMuhayfith and Shaiti (2020) offer a critical viewpoint, highlighting barriers such as ERP complexity and high deployment costs, which pose significant challenges, especially for companies pursuing globalization. Additionally, ERP systems require adaptation to diverse regulations, business cultures, and market conditions worldwide, necessitating system flexibility and local customization. Overall, ERP plays an important role in supporting global market expansion, but successful implementation depends heavily on an organization's readiness to overcome technical challenges, manage costs, and adapt to diverse international environments. Therefore, companies must carefully plan and manage ERP deployment to harness optimal strategic benefits for global expansion.

The H5 test results show that the implementation of radio frequency identification (RFID) has a positive and direct effect on global market expansion, as indicated by the path coefficient of 0.2500 and a *t*-value of 7.0593 ($p = 0.0000$). This indicates that RFID technology not only strengthens the company's competitive advantage but also directly supports international market expansion through improved visibility and supply chain management.

According to supply chain management and competitive advantage theory, the ability to manage and optimize the supply chain effectively is a key factor in expanding global market reach


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(Chanchaichujit et al., 2020). RFID, as an automatic identification technology, enables companies to track goods, assets, and inventory in real time with high accuracy. This provides better transparency over the flow of goods and information, which is crucial in the complex and dynamic global market environment. Recent research supports this trend. The global RFID market size was estimated at approximately USD 15.86 billion in 2024 and is projected to grow to USD 48.51 billion by 2034, with a compound annual growth rate (CAGR) of around 11.83%. Increased adoption of RFID technology in manufacturing, logistics, retail, and healthcare sectors drives operational efficiency and supply chain optimization, thereby boosting companies' ability to enter new markets more effectively and efficiently. RFID-enabled supply chain visibility reduces storage costs and risks associated with loss or damage, while also accelerating data-driven decision-making. This enhancement facilitates meeting various global market requirements and regulations, improves distribution management capabilities, and ensures quick and accurate response to consumer demand (Decker & Zoghi, 2023). Furthermore, the integration of RFID with Internet of Things (IoT) and artificial intelligence (AI) technologies further enhances analytics capabilities, demand forecasting, and business process automation within global supply chains. This synergy improves the speed and quality of market expansion by reducing operational barriers and increasing responsiveness to changing market dynamics. Thus, the analysis results showing the direct influence of RFID on global market expansion are consistent with theory and empirical evidence that confirm the crucial role of this technology in supporting sustainable business growth and success in international markets.

H6 indicates that competitive advantage significantly mediates the relationship between enterprise resource planning (ERP) implementation and global market expansion, with a path coefficient of 0.1269 and a *t*-value of 6.3961 ($p = 0.0000$). This implies that ERP's impact on international market expansion primarily occurs because ERP first enhances competitive advantage, which then drives global market expansion.

Theoretically, the concept of competitive advantage developed by Porter (1985) asserts that companies can attain a superior competitive position through enhanced operational efficiency, process innovation, and improved resource management. ERP, as an integrated information system, plays a vital role in optimizing a company's internal business processes, such as production management, finance, human resources, and supply chain management. Through data integration and process automation enabled by ERP, companies can reduce redundancies, improve information flow, increase productivity, and support data-driven decision-making.

Empirical studies support these findings. For example, Harun et al. (2023) found that ERP implementation strengthens competitive advantage by providing faster and more accurate information. Additionally, Pohludka et al. (2018) demonstrated how ERP contributes to improving operational performance and cost control, which are key elements of competitive advantage. This competitive advantage forms a strong base for global market expansion. With more efficient and adaptive business processes, companies can tailor products and services to meet diverse and dynamic international market needs. ERP also helps companies manage operational and regulatory complexities across countries, enabling business entities to expand markets with more confidence and structure (Weerasekara & Gooneratne, 2023). Recent research further acknowledges that ERP not only enhances internal efficiency but also improves coordination among divisions and business partners, which is crucial in globalization networks. This corresponds with findings by Pohludka et al. (2018), which show that ERP accelerates collaboration and innovation, thereby broadening a company's market reach.

In the contemporary research context, PLS-SEM analysis showing competitive advantage as a mediator in the ERP-to-global market expansion path reinforces awareness that digital transformation through ERP is not merely an administrative tool but a fundamental strategic transformation to enhance competitiveness and global business reach. Therefore, these results are consistent with existing theories and empirical studies, indicating that ERP implementation indirectly propels global market expansion by enhancing a company's competitive advantage.

H7 indicates that competitive advantage significantly mediates the relationship between RFID technology implementation and global market expansion, with a path coefficient of 0.2547 and a very high *t*-statistic of 10.1143 ($p = 0.0000$). This suggests that the influence of RFID on international market expansion largely occurs through the enhancement of competitive advantage first.

According to Porter's (1985) competitive advantage theory, companies can gain a competitive advantage in various ways, one of which is by adopting innovative technologies that improve operational efficiency, productivity, and market responsiveness. RFID is advanced technology that enables companies to track assets, manage inventory, and optimize supply chains in real time. With better data visibility and process automation, companies can reduce operational errors and costs, thereby strengthening their competitive position in the market (Al-Shboul, 2023). Recent research supports these findings. The RFID market is projected to experience significant global growth with a compound annual growth rate (CAGR) between 9% and 12% over the next decade, primarily driven by RFID usage in manufacturing, logistics, retail, and healthcare sectors focused on process efficiency and optimization (Konecka & Maryniak, 2020). Studies show that RFID implementation improves inventory accuracy, operational speed, and cost reduction, which are key drivers of a company's competitive advantage (Chanchaichujit et al., 2020).

The competitive advantage gained from RFID integration enables companies to more effectively expand their global market operations. With more transparent supply chain management and faster responsiveness to market demands, companies can penetrate new markets and better manage global distribution networks, thus supporting global market expansion (Unhelkar et al., 2022). Furthermore, RFID technology is often combined with the Internet of Things (IoT) and Artificial Intelligence (AI), which further enhances analytical and predictive capabilities in global business (Faisol et al., 2025). This synergy provides a strong strategic advantage in facing increasingly intense global market competition. Thus, the results of the H7 analysis are consistent with theory and empirical evidence showing that RFID technology substantially improves competitive advantage, which then serves as an important mediator in expanding a company's global market reach.

## CONCLUSION

The purpose of this paper is to examine the role of enterprise resource planning (ERP) and radio frequency identification (RFID) technologies in strengthening a company's competitive advantage and supporting its expansion into global markets. The research results indicate that ERP enhances competitive advantage by integrating and streamlining internal business processes, improving operational efficiency, data accuracy, and supporting faster, more precise strategic decision-making. This aligns with the resource-based view (RBV) theory, which emphasizes the importance of unique and valuable resources for sustainable competitive advantage. Additionally, ERP facilitates global market expansion by standardizing complex international operations.

RFID technology has also been proven to boost competitive advantage by improving supply chain visibility, inventory accuracy, and operational efficiency. RFID automates data collection, reduces errors, and accelerates responses to market demands, positively impacting operational costs and global supply chain integration. In conclusion, ERP and RFID jointly form a technological foundation that enhances companies' abilities to innovate, adapt, and compete in dynamic global markets. These technologies enable firms to convert operational efficiencies into strategic growth opportunities.

Future research prospects include exploring ERP and RFID integration in specific industry sectors or small and medium enterprises (SMEs). Studies can delve into developing organizational dynamic capabilities to maximize the potential of both technologies and examine their impact under rapidly changing and uncertain market conditions. Practical integration of ERP and RFID is believed to provide


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higher operational efficiency and more sustainable competitive advantages. Additional supporting references can be found in case studies on furniture company warehouses that demonstrate up to a 50% reduction in operational activities, improved speed, data accuracy, and labor efficiency. This integration exemplifies how the combination of these technologies can produce significant results in supply chain management. Thus, implementing a combined ERP and RFID system is not merely an operational technology solution but a strategic investment for global business growth and competitiveness.

## AUTHOR CONTRIBUTIONS

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Project administration: Faisol, Risky Aswi Ramadhani, Subagyo.
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Writing – original draft: Faisol.
Writing – review & editing: Faisol, Risky Aswi Ramadhani.

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# APPENDIX A

**Table A1.** Questionnaire

| Section 1. Respondent Demographic Data | | | | | | |
|---|---|---|---|---|---|---|
| **Category** | **Response option / Choose your answer** | | | | | |
| Age | Aged 20 to 30 years | | | | | |
| | Aged 31 to 40 years | | | | | |
| | Aged 41 to 50 years | | | | | |
| | Aged 51 to 60 years | | | | | |
| | Aged over 60 | | | | | |
| Gender | Female | | | | | |
| | Male | | | | | |
| Role | Owner | | | | | |
| | Manager | | | | | |
| | Employment | | | | | |
| | Other: | | | | | |
| Education | Senior High School | | | | | |
| | Diploma | | | | | |
| | Bachelor | | | | | |
| | Master's or above | | | | | |
| Number of employees | 5–50 employees | | | | | |
| | 51–100 employees | | | | | |
| | 101–150 employees | | | | | |
| | > 150 employees | | | | | |
| **Section 2: Enterprise Resource Planning (ERP)**<br>**Please rate your agreement with the following statements on a scale of 1–5 (1 = strongly disagree; 5 = strongly agree).** | | | | | | |
| | **Enterprise Resource Planning (ERP)** | **1** | **2** | **3** | **4** | **5** |
| ER1 | ERP enables seamless data and information flow between departments such as finance, production, human resources, sales, and supply chain within a unified platform. | | | | | |
| ER2 | A competent ERP system can support various functions such as financial management, production, inventory, and human resources in an integrated manner, helping organizations achieve their business goals optimally. | | | | | |
| ER3 | ERP allows for module customization, integration with other systems, and scalability to support business growth and dynamic changes in business processes. | | | | | |
| ER4 | ERP refers to the system's ability to process data and provide information quickly and in a timely manner. | | | | | |
| | **ERP User Competency** | **1** | **2** | **3** | **4** | **5** |
| C1 | The ERP system I use provides comprehensive modules that meet my business needs, such as finance, production, inventory, and human resources. | | | | | |
| C2 | ERP helps me run business processes more effectively compared to previous manual methods. | | | | | |
| C3 | ERP integrates various business functions, facilitating coordination among departments in my business. | | | | | |
| C4 | The ERP system provides accurate and complete information to support business decision-making. | | | | | |
| C5 | ERP can handle increased data volume and transactions as my business grows. | | | | | |
| C6 | By using ERP, I can manage my business processes more efficiently and in an organized manner. | | | | | |
| | **ERP System Flexibility** | **1** | **2** | **3** | **4** | **5** |
| F1 | The ERP system I use can easily adapt to changes in my business needs. | | | | | |
| F2 | ERP allows me to add or remove features according to business developments without significant difficulties. | | | | | |
| F3 | The ERP I use supports the management of various types of products or services in my business. | | | | | |
| F4 | ERP makes it easy to customize reports and data according to changing business needs. | | | | | |
| F5 | The ERP system enables me to make business process changes quickly without requiring reinstallation or major modifications. | | | | | |
| | **ERP System Speed** | **1** | **2** | **3** | **4** | **5** |
| S1 | The ERP system I use processes data and transactions quickly without causing delays. | | | | | |
| S2 | ERP assists me in speeding up business decision-making in a timely manner. | | | | | |
| S3 | I can obtain the reports and information I need in real-time through the ERP system. | | | | | |

**Table A1 (cont.).** Questionnaire

| | ERP System Speed | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| S4 | ERP accelerates production processes and customer service, thereby enhancing customer satisfaction. | | | | | |
| S5 | The ERP system allows me to respond quickly to changing market needs. | | | | | |
| S6 | The speed of the ERP system helps improve the overall operational efficiency of my business. | | | | | |
| | **Responsiveness of ERP** | **1** | **2** | **3** | **4** | **5** |
| R1 | The ERP system I use responds quickly to my needs and requests as a user. | | | | | |
| R2 | ERP allows for rapid adjustment of business processes when changes in business conditions occur. | | | | | |
| R3 | The ERP system facilitates communication and coordination among departments in my business. | | | | | |
| R4 | ERP helps me provide faster and more responsive service to customers. | | | | | |
| R5 | The ERP system can quickly accommodate changes in market demand or external conditions. | | | | | |
| R6 | ERP speeds up the flow of information, allowing me to act more quickly in facing business challenges. | | | | | |
| | **Section 3: Radio-Frequency Identification (RFID)** | | | | | |
| | **Radio-Frequency Identification (RFID)** | **1** | **2** | **3** | **4** | **5** |
| RF1 | RFID enhances the accuracy of stock and asset recording automatically, reducing errors from manual recording, allowing SMEs to manage inventory more precisely and avoid stock shortages or surpluses. | | | | | |
| RF2 | RFID accelerates the processes of searching, tracking, and counting items, thus reducing operational time and costs. | | | | | |
| RF3 | RFID helps SMEs monitor the movement of goods and prevent loss or theft, which is crucial for maintaining customer trust and business reputation in the global market. | | | | | |
| RF4 | RFID provides real-time data regarding the location and status of products, enabling SMEs to respond quickly to market demands and optimize the supply chain, which becomes a competitive advantage in international market expansion. | | | | | |
| RF5 | RFID can be integrated with existing management systems (such as ERP or WMS), supporting the growth and expansion of SMEs into global markets. | | | | | |
| | **Operational Efficiency and Time Savings** | **1** | **2** | **3** | **4** | **5** |
| E1 | The use of RFID technology in my business significantly speeds up the processes of searching and tracking items. | | | | | |
| E2 | RFID helps reduce the time needed to count and manage stock. | | | | | |
| E3 | With RFID, daily operational processes have become more efficient, allowing me to focus on business development. | | | | | |
| E4 | The use of RFID reduces operational costs associated with inventory and asset management. | | | | | |
| E5 | RFID technology makes it easier for me to manage and control items, thereby speeding up customer service. | | | | | |
| | **Security and Risk Reduction** | **1** | **2** | **3** | **4** | **5** |
| SR1 | RFID technology helps me monitor the movement of goods in real-time, reducing the risk of loss or theft. | | | | | |
| SR2 | With RFID, the security of my business's goods and assets is more assured compared to traditional management methods. | | | | | |
| SR3 | An ERP system integrated with RFID allows me to quickly detect unauthorized movements of goods. | | | | | |
| SR4 | The use of RFID increases customer trust because it can better ensure product security. | | | | | |
| SR | RFID helps me maintain my business reputation by minimizing the risks of loss and theft of goods. | | | | | |
| | **Visibility and Real-Time Tracking** | **1** | **2** | **3** | **4** | **5** |
| V1 | The RFID system allows me to know the location and status of products directly and accurately at any time. | | | | | |
| V2 | With RFID, I can respond quickly to market demands because product information is available in real-time. | | | | | |
| V3 | The use of RFID provides a competitive advantage in managing product distribution to international markets. | | | | | |
| V4 | The RFID system makes it easy for me to identify and address issues that arise in the shipping or storage processes quickly. | | | | | |
| V5 | RFID helps me optimize the supply chain by continuously monitoring the movement of goods. | | | | | |
| | **System Integration and Business Scalability** | **1** | **2** | **3** | **4** | |
| BS1 | The system I use can integrate well with various other applications or software that support my business operations. | | | | | |


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**Table A1 (cont.).** Questionnaire

| | System Integration and Business Scalability | 1 | 2 | 3 | 4 | |
|---|---|---|---|---|---|---|
| BS2 | System integration helps me manage various business functions in a unified manner, facilitating decision-making. | | | | | |
| BS3 | The system I use can be easily developed or upgraded according to my business growth. | | | | | |
| BS4 | I can add new features or modules to the system without disrupting ongoing business operations. | | | | | |
| BS5 | An integrated system enables my business to be better prepared for market expansion and increased business volume. | | | | | |
| | **Competitive Advantage** | **1** | **2** | **3** | **4** | **5** |
| KK1 | My business's products have unique features that differentiate them from competitors. | | | | | |
| KK2 | My business consistently strives to improve product or service quality. | | | | | |
| KK3 | I can offer competitive prices compared to competitors. | | | | | |
| KK4 | My business's production and operational processes run efficiently. | | | | | |
| KK5 | My business regularly innovates products or business processes. | | | | | |
| KK6 | I can retain loyal customers amid market competition. | | | | | |
| KK7 | My business has advantages that are difficult for competitors to replicate. | | | | | |
| | **Global Market Expansion** | **1** | **2** | **3** | **4** | **5** |
| GM1 | My business has marketed products to international markets. | | | | | |
| GM2 | I understand the needs and preferences of consumers in the global market. | | | | | |
| GM3 | My business's products have been designed to meet international market standards. | | | | | |
| GM4 | I have a distribution network that supports sales abroad. | | | | | |
| GM5 | My business actively participates in exhibitions or promotions at the international level. | | | | | |
| GM6 | I understand the export and import regulations that apply in the global market. | | | | | |