



The Role of Intellectual Capital in Mediating the Impact of Knowledge Management and Innovation in the Halal Batik Industry of Yogyakarta

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Abstract: This study aims to investigate the role of intellectual capital in mediating the impact of knowledge management and motivation on halal small and medium-sized enterprises (SMEs) in the batik industry in Yogyakarta. Research on the mediating role of intellectual capital is still relatively novel in Indonesia. The study of the batik industry is particularly compelling, given that batik is an intangible asset recognized as UNESCO's cultural heritage. However, there is a noticeable decline in export value year by year. By focusing on halal batik SMEs, this study explores how halal certification can enhance these businesses' market appeal and export potential. The initial step of this research involves collecting data related to the research variables by distributing questionnaires to batik entrepreneurs in Yogyakarta. Subsequently, tests are conducted using PLS to analyze the results, examining the role of intellectual capital in mediating the impact of knowledge management and motivation on halal SMEs in the batik industry in Yogyakarta. The findings provide insights into how intellectual capital can influence the sustainability and growth of batik enterprises, offering strategies to counteract the declining export values and enhance the overall performance of these culturally significant businesses.

Originality/Value: Unlike prior research, which focuses on global views and big industry, this study provides valuable insights for halal SMEs, particularly in the batik industry. The findings aim to elucidate how intellectual capital impacts the sustainability and growth of halal batik enterprises. It seeks to offer strategies to mitigate declining export values and enhance the overall performance of these culturally significant businesses, with a particular emphasis on leveraging the opportunities presented by halal certification.

Introduction

The halal industry had gathered overwhelming responses from business professionals and researchers, including those in the halal fashion sector, such as batik. On October 2, 2009, Indonesia celebrated a special moment when UNESCO recognized batik as an Intangible Cultural Heritage of Humanity. This milestone was reinforced by Presidential Decree No. 33 of 2009, designating October 2 as National Batik Day. As part of cultural heritage, batik has been widely known in various regions of Indonesia, but UNESCO's recognition has elevated batik's appreciation worldwide. The perception of batik has

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become increasingly positive, not only as traditional or formal attire but also as a fashion favoured by all age groups, from children to adults.

There has been a concerning decline in halal batik exports in recent years. Over the past five years, there has been a significant decrease in the export of halal batik and batik products. In 2015, the export value reached US\$ 185 million, but it dropped to US\$ 156 million the following year. In 2017, the export value drastically fell to only US\$ 73.8 million, showing a 53% annual decline. In the last two years, halal batik sales and products in foreign markets have stagnated at around US\$ 52-54 million. Even during January-July 2020, the export value only reached US\$ 21.5 million, indicating sustained pressure on the halal batik industry to maintain its competitiveness in the global market.

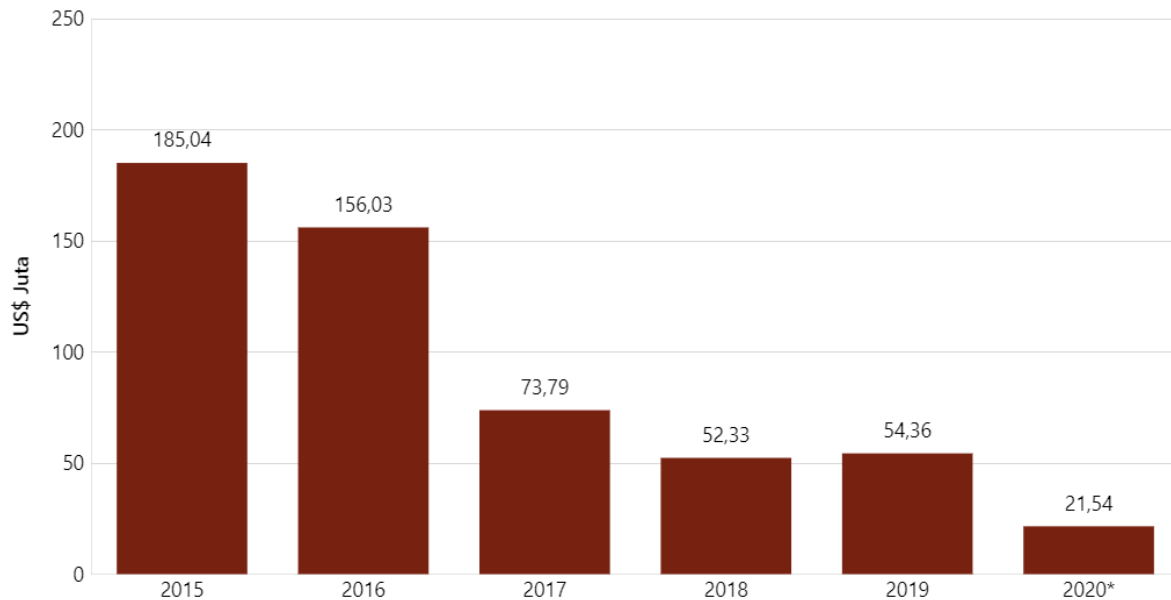


Figure 1. Batik Export Data
Source: Ministry of Industry 2021

The decline in the export value of the batik industry in Indonesia serves as a warning to all players in the Indonesian batik industry to anticipate and innovate to ensure the sustainability and progress of this industry. Organizational innovation is fundamentally a critical issue for management. Since management develops and implements ideas, innovation will depend on effective knowledge management. This also relies on knowledge, as every innovation implies the development of new knowledge as an input (e.g., new ideas, concepts, prototypes, etc.) and an output (i.e., the resulting novelty). Therefore, both human resources and knowledge are critical drivers of innovation in companies.

Several previous studies have identified integrating knowledge perspectives as a crucial issue with significant potential, yet it still needs development. Specifically, there is a lack of research addressing knowledge management as an influence on firm innovation (Mohajan, 2019; Ali et al., 2023) and intellectual capital (IC) (Attar et al. 2019; Efendi & Rahardja, 2021; Alnatsheh et al., 2023). Few studies have empirically analyzed the interaction between knowledge management and intellectual capital (IC) in relation to innovation (Kianto et al., 2017; Darroch, 2005). Furthermore, the knowledge management practices considered in this research must be more tailored to enhance innovation processes. More research is needed to highlight further studies on the relationship between knowledge management, IC, and innovation, particularly in small and medium enterprises (SMEs). This research aims to fill this gap by developing a conceptual model that 1) identifies vital IC elements for innovation, 2) proposes knowledge management practices, and 3) tests the impact of knowledge management on IC and innovation.

The researchers argue that innovation in firms is primarily enabled by knowledge-based management practices (Brix, 2020), including recruitment management, the extent to which training and development systems focus on knowledge-related development aspects, and how performance appraisal and compensation systems support knowledge-based employee behaviours. The researchers suggest that all these human resource management practices influence the level of a company's IC,

which reflects the firm's intangible value-generating attributes, including employee skills and innovation, external relationships, and the knowledge embedded in information systems, documents, and databases. These IC elements, in turn, influence firm innovation. Overall, knowledge management contributes to innovation by enhancing the organization's knowledge base and stimulating knowledge creation (Lee et al., 2020; Xu and Wei, 2023).

Literature Review

Resource-Based Theory

This study employs the Resource-Based Theory, which explains that a company can achieve a competitive advantage by possessing and utilizing resources that are valuable, rare, inimitable, and well-organized (Barney, 1991a). One of the most crucial resources is knowledge. This knowledge can be processed and managed through knowledge management (KM), which involves creating, storing, transferring, and applying knowledge within an organization (Barney, 1991b). Effective KM can help companies create solid intellectual capital (IC). IC is an organization's intangible assets, such as the knowledge, skills, and experience of employees, brands, and patents. Robust IC can then be used to develop innovative products and services.

Knowledge stands out as one of the most crucial resources under the RBT framework. Unlike physical resources, knowledge is inherently dynamic and can be continuously developed and expanded. It encompasses explicit knowledge, which can be easily documented and transferred, and tacit knowledge, which is deeply embedded in individual experiences and skills. Managing this knowledge effectively is pivotal for organizations aiming to leverage it for competitive advantage. The management of knowledge within an organization is often referred to as knowledge management (KM) (Grant, 1991). KM is a multifaceted process that involves the creation, storage, transfer, and application of knowledge. The creation of knowledge can occur through various means, such as research and development, learning from experiences, or absorbing information from external sources. Once created, this knowledge needs to be stored in a manner that is accessible and useful, often utilizing databases, documents, and organizational memory systems.

The Resource-Based View (RBV) theory emphasizes that a firm's competitive advantage is derived from its internal resources, which are valuable, rare, inimitable, and non-substitutable. In the context of knowledge management, RBV suggests that knowledge is a critical resource that can significantly contribute to innovation and sustained competitive advantage. Knowledge management practices enable firms to leverage their intellectual capital, which includes employee expertise, organizational processes, and external relationships, to foster innovation and create value. The integration of knowledge management into strategic operations is crucial because it enhances the firm's ability to manage intangible assets, which are critical drivers of innovation and competitive performance. Studies like those from (Grant, 1991) highlight that when effectively managed, knowledge becomes a strategic asset that differentiates firms in highly competitive markets.

Knowledge Management

Knowledge management (KM) is a comprehensive approach encompassing various strategies and practices to optimize the creation, sharing, and application of knowledge within an organization. A fundamental component of KM is knowledge-based recruitment, which involves implementing practices and activities designed to identify and attract potential employees with the necessary skills and knowledge to align with the organization's strategic objectives. This process is crucial as proper recruitment and selection can significantly influence the generation of knowledge within the organization. By hiring individuals with the right expertise and potential, organizations can lay a solid foundation for a robust knowledge ecosystem (Housel & Nelson, 2005).

Another critical aspect of KM is knowledge-based training and development. This involves systematically enhancing employees' skills and capabilities to ensure they can contribute effectively to the organization's knowledge base. Training programs and development initiatives focused on enhancing knowledge are essential for cultivating human capital, which drives organizational success. These programs can include workshops, seminars, online courses, and other educational opportunities

that facilitate continuous learning and professional growth. By investing in workforce development, organizations can foster innovation and continuous improvement (Xu and Wei, 2023). Knowledge-based performance evaluation is another vital element of KM. This approach involves assessing employees' contributions to the organization's knowledge processes, ensuring that their efforts in creating, sharing, and applying knowledge are recognized and rewarded. Performance evaluations that emphasize knowledge management help to monitor and enhance the flow of knowledge within the organization, making it a highly relevant tool in human resource management. This evaluation method recognizes employees' contributions and encourages them to participate in knowledge-sharing activities actively, reinforcing a culture of collaboration and continuous learning.

Additionally, knowledge-based compensation is a strategic approach that motivates employees to engage in knowledge-related activities. Organizations can incentivize employees to share, create, and apply knowledge effectively by aligning compensation and reward systems with knowledge-sharing behaviours. This strategy improves individual performance and enhances overall organizational performance by fostering an environment where knowledge is highly valued and continuously leveraged for competitive advantage (Lundvall & Nielsen, 2007).

When knowledge-based human resource management practices are applied collectively in an integrated package, they are more likely to enhance innovation and organizational intellectual capital compared to when these practices are implemented separately. An integrated approach ensures that all aspects of KM, from recruitment to compensation, are aligned and mutually reinforcing. This holistic strategy enables organizations to create a synergistic effect, where the combined impact of various KM practices significantly boosts innovation and the development of intellectual capital. For instance, knowledge-based recruitment ensures that the right talent is brought into the organization while training and development programs enhance their skills. Performance evaluations and compensation systems that focus on knowledge management further motivate employees to contribute to the organization's knowledge base, creating a continuous cycle of knowledge generation and application (Asghar et al. 2023).

Moreover, fostering a culture that supports KM requires ongoing commitment from organizational leadership. Leaders play a crucial role in establishing and maintaining a knowledge-friendly environment. They must demonstrate a clear commitment to KM by providing the necessary resources, infrastructure, and support for knowledge-related initiatives. This includes investing in advanced technologies and systems that facilitate knowledge sharing and collaboration and promoting open communication and transparency across all levels of the organization. In conclusion, knowledge management is a multifaceted discipline that integrates various human resource management practices to optimize the creation, sharing, and application of knowledge within an organization. Organizations can cultivate a continuous learning and innovation culture by implementing knowledge-based recruitment, training and development, performance evaluation, and compensation. An integrated approach to KM enhances individual and organizational performance and drives intellectual capital development, positioning the organization for sustained competitive advantage in a rapidly evolving business landscape. Through effective KM, organizations can harness their workforce's collective knowledge and expertise, fostering a dynamic environment that supports ongoing growth and innovation.

Innovation

Innovation is the process of creating or developing new ideas, products, services, or processes that can significantly transform an organization and its market environment (Chen & Ma, 2021). This dynamic process is essential for maintaining competitiveness and fostering growth. Innovation contributes to value enhancement because it allows companies to differentiate themselves, meet changing customer demands, and capitalize on new market opportunities. One of the fundamental reasons innovation is so valuable is that the knowledge required to drive it often extends beyond the internal boundaries of the organization. By leveraging external relationships and resources, companies can access a broader spectrum of knowledge, which can be crucial for innovative success.

External relationships play a pivotal role in the innovation process. These relationships can be with other businesses, academic institutions, research organizations, or customers and suppliers. They provide a conduit for new ideas and technologies that may need to be more readily available within the

company. By collaborating with external partners, companies can introduce existing solutions from different contexts into their operations, leading to significant improvements and breakthroughs. For example, a company might collaborate with a university research department to develop a new technology or work with a supplier to create a more efficient production process (Asghar et al. 2023). Inter-organizational collaboration is particularly beneficial for fostering innovation. Such collaboration tends to facilitate knowledge sharing and interactive learning among the parties involved. When organizations collaborate, they combine their unique resources and capabilities, creating a synergy that can lead to innovative outcomes that would be difficult to achieve independently. This collaborative approach can pool resources, share risks, and reduce the costs associated with research and development. Furthermore, it encourages a continuous exchange of information, which can spark new ideas and solutions that drive innovation.

For instance, in the technology sector, companies often engage in partnerships to co-develop new products or enhance existing ones. These collaborations allow them to share technological expertise and market insights, accelerating innovation. Similarly, pharmaceutical companies might collaborate with research institutions in the healthcare industry to develop new drugs, combining their drug development knowledge with cutting-edge medical science research. Such collaborations not only lead to the creation of new products but also enhance the companies' innovative capabilities by expanding their knowledge base (Kennedy, 2023). Innovation is also driven by the ability to integrate knowledge from various external sources. This integration involves not only acquiring new knowledge but also adapting and applying it in ways that are beneficial to the organization. Companies that excel in innovation often have robust mechanisms for scanning the external environment, identifying relevant knowledge, and assimilating it into their operations. This process requires a strategic approach to knowledge management, ensuring that the organization can effectively leverage external knowledge to support its innovation goals.

One practical example of integrating external knowledge into the innovation process is open innovation, where companies use external and internal ideas and paths to market. This approach contrasts with the traditional model of closed innovation, where R&D is kept strictly within the company. Open innovation recognizes that valuable ideas can come from outside the organization and seeks to exploit these external sources of innovation. Companies practising open innovation may use various strategies, such as crowdsourcing ideas from customers, engaging in joint ventures, or acquiring startups with innovative technologies.

Moreover, fostering a culture of innovation within the organization is crucial for leveraging external knowledge effectively. This involves creating an environment that encourages experimentation, tolerates failures as learning opportunities, and rewards innovative thinking. Leaders play a critical role in establishing this culture by promoting open communication, supporting collaboration, and providing the necessary resources for innovation activities. When employees are encouraged to think creatively and explore new ideas, they are more likely to engage with external partners and bring valuable knowledge into the organization.

Intellectual Capital (IC)

In the last decade, management literature has increasingly focused on the concept of Intellectual Capital (IC) to understand how knowledge functions as a primary asset that creates value for organizations (Bontis, 1998). Intellectual capital is broadly defined as "the possession of knowledge, applied experience, organizational technology, customer relationships, and professional skills that provide a competitive advantage to companies in the market" (Visconti, 2019). This broad definition encompasses various intangible assets that are crucial for an organization's success in a knowledge-based economy.

IC is fundamentally about harnessing an organization's collective intellect and capabilities to drive innovation, efficiency, and competitive advantage. It involves the knowledge held by individual employees and the systems and processes that enable the organization to leverage that knowledge effectively. IC can be divided into three main categories: human capital, structural capital, and relational capital, each of which plays a vital role in the overall intellectual capability of the organization (Xu and Wei, 2022).

Human capital refers to the knowledge, skills, and abilities possessed by individuals within an organization. It encompasses the competencies and expertise of employees, which are critical for

innovation and problem-solving. Human capital is often considered the most crucial component of IC because it directly impacts an organization's ability to perform and adapt to changes in the market. Investments in employee training, professional development, and continuous learning are essential to enhancing human capital. These investments improve individual performance and contribute to the organization's knowledge base, fostering a culture of innovation and continuous improvement.

Structural capital includes the supportive infrastructure, processes, and databases that enable the organization to capture, store, and utilize knowledge effectively. This category of IC covers a wide range of elements, such as information systems, organizational routines, patents, trademarks, and proprietary technologies. Structural capital provides the backbone for leveraging human capital by ensuring that knowledge is systematically managed and accessible when needed. It also includes organizational culture and leadership, which play critical roles in shaping how knowledge is shared and utilized within the organization. Adequate structural capital allows for efficient knowledge transfer, enabling organizations to maintain continuity and resilience even when individual employees leave. Relational capital is the value derived from an organization's relationships with external stakeholders, including customers, suppliers, partners, and the broader community. It encompasses the trust, loyalty, and goodwill an organization has built over time, which are crucial for long-term success. Relational capital is essential for securing business opportunities, fostering collaborations, and gaining market insights. It includes customer relationships, which are pivotal for understanding market needs and driving customer satisfaction. Additionally, partnerships and alliances with other organizations can enhance innovation by providing access to new technologies, markets, and expertise. Substantial relational capital helps organizations navigate complex business environments and sustain competitive advantage by leveraging external knowledge and resources.

The integration of human, structural, and relational capital is what truly enhances an organization's intellectual capital. These components are interdependent and must be managed cohesively to maximize their value. For example, human capital is most effective when supported by robust structural capital, which provides the tools and processes needed to apply knowledge efficiently. Similarly, relational capital can amplify the impact of human and structural capital by bringing in external perspectives and resources. Organizations that excel in managing IC recognize the importance of aligning these components with their strategic objectives, creating a synergistic effect that drives performance and innovation.

In recent years, the importance of IC has been further highlighted by the rapid advancements in technology and the increasing complexity of global markets. Organizations are now more aware of the need to cultivate and manage their intellectual assets to stay competitive. This has led to a growing emphasis on knowledge management practices, such as implementing advanced information systems, creating collaborative work environments, and establishing strategic partnerships. These practices are designed to enhance the flow of knowledge within the organization and between external partners, ensuring that valuable insights and innovations are effectively captured and utilized.

Hypothesis Development

Knowledge Management and Intellectual Capital

[Lee et al. \(2020\)](#) explain that knowledge management, which includes recruitment, training, assessment, and compensation, is crucial in strengthening an organization's intellectual capital. Companies can attract high-quality individuals who bring new knowledge and skills through effective recruitment processes. Subsequently, continuous training programs help enhance employees' skills and knowledge, while assessment knowledge assists in evaluating and optimizing individual performance. A fair and sustainable compensation system is also crucial in building employee motivation and loyalty, strengthening the organization's intellectual capabilities and competitive advantage ([Alnatsheh, 2023](#)). Thus, knowledge management in all dimensions significantly impacts intellectual capital and overall company performance.

A study by [Roos \(1998\)](#) consistently showed a positive and statistically significant relationship between knowledge management and intellectual capital. Subsequent studies by [Nissa et al. \(2020\)](#) and [Sun et al. \(2021\)](#) have corroborated these findings, emphasizing the critical link between effective knowledge management practices and the enhancement of intellectual capital.

H1: Knowledge management positively impacts intellectual capital.

Knowledge Management and Innovation

According to [Ali, Shad, and Mahmood \(2023\)](#), knowledge management is essential in enhancing employee motivation, both intrinsically and extrinsically, which is critical to strengthening organizational performance. By providing access to knowledge resources, development opportunities, and a supportive work environment, knowledge management fosters a sense of achievement and personal satisfaction, which are the main drivers of intrinsic motivation. On the other hand, knowledge management also stimulates employees' extrinsic motivation by rewarding their achievements by introducing recognition programs, fair compensation systems, and appropriate incentives. By leveraging both aspects of motivation, organizations can strengthen employees' bonds with the company.

Knowledge management practices that prioritize and encourage knowledge sharing are essential to driving innovation, especially in all sectors where intellectual resources are critical to progress and development. ([Alnatsheh et al., 2023](#)) Knowledge management is an important mechanism that facilitates the spread of ideas, expertise, and solutions, stimulating creative processes and innovation. Research findings suggest that effective knowledge management, particularly in the form of knowledge management sharing, can lead to higher levels of innovation even in challenging environments.

H2: Knowledge management positively impacts innovation.

Intellectual Capital and Innovation

[Alnatsheh, Karatmaca, and Çavuşoğlu \(2023\)](#) argue that intellectual capital, which consists of human capital, relational capital, and structural capital, plays a crucial role in driving both intrinsic and extrinsic innovation, which in turn affects overall organizational performance. First, human capital, which includes the knowledge, skills, and experience individuals possess within the organization, provides the foundation for innovation. Employees who feel that their expertise and knowledge are recognized and empowered are driven to enhance the company's innovation performance.

Relational capital, on the other hand, refers to the relationships and networks built between individuals within and outside the organization. Building strong and collaborative relationships makes employees feel supported and connected, increasing their motivation to work effectively. Additionally, structural capital, which encompasses the organization's systems, processes, and technologies, impacts employee motivation.

These components of intellectual capital work synergistically to create an environment where innovation can thrive. The recognition and development of human capital ensure that employees are well-equipped with the necessary skills and knowledge. Substantial relational capital facilitates effective communication and collaboration, while robust structural capital provides the infrastructure needed to implement innovative ideas efficiently.

H3: Intellectual capital positively impacts innovation

Knowledge Management, Intellectual Capital, and Innovation

Research by [Li et al. \(2019\)](#) highlights that intellectual capital, including human capital, relational capital, and structural capital, is a precious asset for any organization as it significantly impacts employee motivation. Human capital, which includes the knowledge, skills, and experience of individuals within the organization, plays a crucial role in intrinsically motivating employees. Employees who feel empowered to develop their skills and apply their knowledge are more motivated to contribute their best efforts.

Relational capital, on the other hand, refers to the quality of interpersonal relationships among employees, management, and other stakeholders. Effective communication and collaboration fostered by strong relational capital lead to a more cohesive and motivated workforce. Structural capital, comprising the organization's systems, processes, and technologies, provides the necessary support for employees to innovate and perform efficiently.

[Mohajan \(2019\)](#) also emphasizes the positive impact of knowledge management on innovation, indicating that well-managed knowledge resources lead to improved innovation outcomes. Similarly, research by [Xu and Wei \(2023\)](#) reveals that intellectual capital significantly influences knowledge management and employee motivation, further supporting the critical role of intellectual capital in

driving innovation. By integrating effective knowledge management practices with the development and utilization of intellectual capital, organizations can create a robust foundation for sustained innovation and competitive advantage. Employees who are motivated and equipped with the right resources are more likely to engage in innovative activities that drive organizational success.

H4: Management knowledge has a positive effect on innovation, mediated by intellectual capital

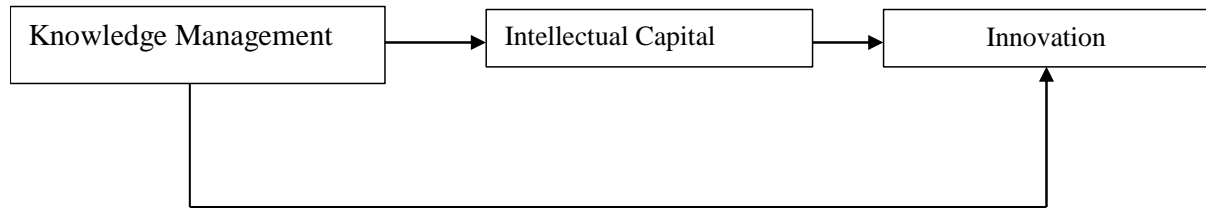


Figure 2. Research Framework

Research Methods

This study explores a set of variables and constructs a research model designed for quantitative testing. Partial Least Squares Structural Equation Modeling (PLS-SEM) is employed in this study because it is well-suited for analyzing models with smaller sample sizes. Given the extensive use of PLS-SEM in business research, it is essential to consider the sample size when selecting the analytical method to ensure accurate and reliable results (Hair et al., 2021). The Ministry of Industry provided data indicating the presence of 128 small and medium enterprises (SMEs) within the batik industry in the Special Region of Yogyakarta. This study focuses on batik SMEs that have the potential to become halal products or have already implemented halal principles in their operations. While not all have official halal certification, many batik SMEs have adopted halal principles in their selection of halal raw materials and production processes, adhering to Islamic guidelines. Considering the relatively modest population of halal-oriented batik SME entrepreneurs, this study utilizes the entire population for comprehensive analysis.

The research model in this study incorporates three critical variables associated with knowledge-based Human Resource Management (HRM). These variables include recruitment and selection, training and development, and performance appraisal and compensation, as detailed in prior studies by Chang, Franke, and Lee (2016) and Coltman, Devinney, Midgley, and Venaik (2008). Additionally, the model integrates three Intellectual Capital (IC) components: human capital, structural capital, and relational capital. A human resource scale was developed to measure these variables based on the seminal works of Bontis (1998) and Lin et. al (2009). The structural and relational capital scales were adapted from the research conducted by Kianto, Hurmelinna-Laukkanen, and Ritala (2010).

Furthermore, the research model includes three dimensions representing innovation performance: product innovation, process innovation, and managerial innovation. The performance measures for these dimensions were adapted from the study by Weerawardena (2003). To ensure the robustness of the measurement, all items associated with the latent variables were evaluated using a five-point Likert scale. This comprehensive approach allows for a detailed examination of the relationships between knowledge-based HRM practices, intellectual capital components, and innovation performance within the context of SMEs in the batik industry in Yogyakarta.

Table 1. Operationalization of the research instrument

Variable	Operational definition	Item Wording
Knowledge Management Chang, Franke, & Lee, 2016; Coltman, Devinney, Midgley, & Venaik, 2008	Training and Development	We offer our employees opportunities to deepen and expand their expertise. We offer training that provides employees with up-to-date knowledge. Our employees have an opportunity to develop their competence through training tailored to their specific needs. The competency development needs of employees are discussed with them regularly. The sharing of knowledge is one of our criteria for work performance assessment.
	Performance Appraisal	Creating new knowledge is one of our criteria for work performance assessment. The ability to apply knowledge acquired from others is one of our criteria for work performance assessment. Our company rewards employees for sharing knowledge.
	Compensation	Our company rewards employees for creating new knowledge. Our company rewards employees for applying knowledge.
	Human capital	Our employees are highly skilled at their jobs. Our employees are highly motivated in their work. Our employees have a high level of expertise.
Intellectual Capital (IC) Bontis (1998), Lin (2009), Kianto, Hurmelinna-Laukkanen, dan Ritala (2010)	Structural capital	Structural capital (reflective) Our company has efficient and relevant information systems to support business operations. Our company has tools and facilities to support cooperation between employees. Our company has a great deal of helpful knowledge in documents and databases. Existing documents and solutions are easily accessible.
	Relational capital	Our company and its external stakeholders - such as customers, suppliers and partners - understand each other well. Cooperation between our company and its external stakeholders runs smoothly. Our company and its external stakeholders frequently collaborate to solve problems.
Innovation Performance Weerawardena (2003)	Product Innovation	Products and services for customers
	Process Innovation	Production methods and processes.
	Management Innovation	Management practices.

Analysis and Discussion

Analysis

Outer Model Assessment

This study employed SmartPLS 4.0 for analysis, considering it the most appropriate SEM method with a sample size of 96 respondents. [Hair et al. \(2021\)](#) suggest that if the highest number of structural paths leading to a construct is three, then ten times that number, or thirty respondents, are required to ensure reliable results. Based on this reasoning, a sample of 96 respondents is more than adequate. When conducting PLS-SEM analysis, researchers should first assess the outer model (evaluating variable reliability and validity) before moving on to the inner model (examining the relationships between variables) ([Hair et al., 2014](#)).

Various reliability and validity measures are available, but several standard statistics are typically examined using PLS-SEM to confirm different types of reliability and validity. In this study, internal consistency reliability can be determined through Cronbach's alpha, which is considered satisfactory when values exceed 0.6 ([Hair et al., 2021](#)). Convergent validity is confirmed when AVE values are above 0.5, and the loading factor is above 0.6, as shown in Table 3 ([Hair et al., 2021](#)). Discriminant validity can be assessed using one of two statistical tests. According to [Fornell and Larcker \(1981\)](#), discriminant validity is achieved when squared AVE scores are higher than corresponding correlation values, as illustrated in Table 4. The most rigorous measure for discriminant validity is the Fornell-Larcker Criterion ([Henseler et al., 2009](#)), ensuring well-established discriminant validity. It can be noted that all standard measures of reliability and validity are present.

Table 2. Outer Model Assessment

Variable	Indicators	Loading factors	AVE (AVE > 0.5)	Cronbach's Alpha ($\alpha > 0.6$)
Knowledge Management	KM1	0.663	0.563	0.608
	KM2	0.791		
	KM3	0.791		
Intellectual Capital	IC1	0.864	0.562	0.604
	IC2	0.752		
	IC3	0.612		
Innovation	I1	0.828	0.561	0.670
	I2	0.698		
	I3	0.775		

Discriminant validity can be assessed using one of two statistical methods. According to [Fornell and Larcker \(1981\)](#), discriminant validity is confirmed when the squared AVE scores exceed the corresponding correlation values, as shown in Table 4. Also, discriminant validity is fully achieved when standard loadings exceed 0.6. The most rigorous test for discriminant validity is the Fornell-Larcker Criterion ([Henseler et al., 2009](#)), ensuring that discriminant validity is thoroughly established. It can be noted that all standard reliability and validity measures are present.

Table 3. Fornell-larcker criterion

	Innovation	Intellectual Capital	Knowledge Management
Innovation	0.769		
Intellectual Capital	0.406	0.750	
Knowledge Management	0.361	0.356	0.751

Inner Model Assessment

The evaluation of the inner model should follow the completion of the outer model. Initially, examining pathway coefficients and their significance values is standard practice. Significance is typically determined using the bootstrapping method in SmartPLS 4.0 ([Hair et al., 2021](#)). This research used a

sample size of 2000 for bootstrapping to assess significance. All pathways were accepted with varying strengths. Lower p-values and higher coefficient values indicate stronger relationships.

Table 4. Pathway assessment

Hypotheses	Pathways	Pathway Coefficient	T-stats	P-value	Results
H1	Knowledge Management -> Intellectual Capital	0.356	2.906	0.004	Accept
H2	Knowledge Management -> Innovation	0.248	1.885	0.060	Reject
H3	Intellectual capital -> Innovation	0.318	2.729	0.006	Accept

Table 5 presents the indicators for conducting hypothesis testing. The calculations for the inner model address three hypotheses: H1, H2, and H3. The hypothesis testing indicates that H1 and H3 are accepted, supported by P-values less than 0.05. This indicates that Knowledge Management significantly influences Intellectual Capital, with a P-value of 0.004. Furthermore, Hypothesis 3 also demonstrates a significant influence between Intellectual Capital and Innovation, with a P-value of 0.006. H2 has a P-value of 0.060, indicating that there is no significant influence between Knowledge Management and Innovation.

The strength of relationships between variables is determined by examining the Pathway Coefficient values. The strongest relationship is between Knowledge Management and Intellectual Capital, with a score of 0.356, corresponding to the lowest P-value. The second strongest relationship is between Intellectual Capital and Innovation, with a score of 0.318. Finally, the weakest relationship is between Knowledge Management and Innovation, with a score of 0.248.

As shown in Table 6, the Coefficient of Determination (R²) illustrates how well the independent variables account for their predictor variables. In this study model, two variables are identified as independent or endogenous: intellectual capital and innovation. The R² value for intellectual capital is 0.127, meaning it can explain 12% of the variance in the Knowledge Management variable, while the remaining 88% is attributed to factors outside the model. For innovation, the R² value is the highest at 0.219, indicating it accounts for 21.9% of its dependent variable, with the other 79.1% explained by external factors.

Table 5. Structural model assessment

Endogenous Variables	R ²
Innovation	0.219
Intellectual Capital	0.127

The goodness-of-fit (GOF) statistic in PLS-SEM analysis remains to be debated, as no universally accepted single measure exists, though several proxies have been proposed. In this study, we have adopted the measure suggested by [Wetzels et al. \(2009\)](#), which allows for assessing degrees of fit. Specifically, the goodness-of-fit value is determined by taking the square root of the product of the AVE cut-off and the average R² and then comparing this value against baseline benchmarks. For this model, the goodness-of-fit value is calculated to be 0.294, indicating a medium degree of fit. Detailed information can be found in Table 7.

Table 6. Goodness-of-Fit

Description	Value	Reference
Goodness of Fit (GoF)	$\sqrt{\text{Cut - Off of AVE} \times \text{Average of R_Square}}$ = $\sqrt{0.5 \times 0.173} = 0.294$	Wetzels et al. (2009)

Table 7. Mediation effects

Mediating Pathway	T Statistics	P Values
Knowledge Management -> Intellectual Capital -> Innovation	1.993	0.046

Mediation Effect Assessment

Based on Table 8, intellectual capital significantly acts as a mediating variable between knowledge management and innovation. This is indicated by a P-value of 0.046, which meets the requirement of less than 0.05. Additionally, when evaluated using the T-statistic at a 5% significance level, the hypothesis is accepted if the value exceeds 1.96. The T-statistic for this relationship is 1.993, greater than 1.96, confirming that H4 is accepted.

Referring to Figure 3, it is evident that the direct relationship between knowledge management and innovation is not significant, with a P-value of 0.060. However, the indirect relationship through intellectual capital is significant. From this, it can be concluded that the type of mediation in this study is complete mediation (Hair et al., 2021). Full mediation occurs when the dependent variable (Y) cannot be directly influenced by the independent variable (X) but must go through the mediating variable (M)

Discussion

The study on the role of intellectual capital in mediating the impact of knowledge management and innovation on SMEs in the batik industry of Yogyakarta provides valuable insights into how these elements interact to influence business performance. The findings indicate that intellectual capital significantly mediates the relationship between knowledge management and innovation. Intellectual capital, which includes human capital (skills and knowledge of employees), structural capital (organizational processes and databases), and relational capital (relationships with customers and suppliers), forms the backbone that supports and enhances innovation within SMEs. This emphasizes the importance of investing in intellectual capital to ensure the effective implementation of knowledge management practices, which in turn fosters innovation. These findings are supported by Handayani (2020), who reinforces that human capital influences the innovation process in companies. Additionally, structural capital, an indicator of IC, also impacts innovation, as supported by Beltramino et al. (2020). Lastly, relational capital affects company innovation performance, according to Ryu (2021). Previous research findings reinforce that IC significantly strengthens innovation.

Effective knowledge management is crucial for fostering innovation within organizations. The study highlights that knowledge management practices, such as the recruitment of knowledgeable personnel, continuous training, and knowledge-sharing mechanisms, are essential for building intellectual capital. When organizations manage their knowledge effectively, they enhance their intellectual capital, which drives innovation. This finding aligns with the Resource-Based Theory, which emphasizes leveraging valuable, rare, and inimitable resources, such as knowledge, for competitive advantage. Effective knowledge management ensures that the tacit and explicit knowledge within the organization is effectively utilized to create new products, improve processes, and maintain a competitive edge in the market (Barney, 1991). For the batik industry in Yogyakarta, where there has been a decline in export values, the research provides a pathway for revival through the enhancement of intellectual capital and effective knowledge management. By focusing on these areas, batik enterprises can enhance their innovative capabilities, which may help counteract the decreasing export trend. Integrating knowledge management and intellectual capital could lead to the development of new products, improvement in processes, and overall better performance, thereby sustaining and potentially growing the batik industry. This strategic focus on intellectual capital and knowledge management is critical for the industry's adaptation to market changes and technological advancements, which are essential for long-term sustainability. The study suggests practical steps for SMEs in the batik industry to enhance their intellectual capital and innovation capabilities. Firstly, investing in human capital through training and development programs that enhance employees' skills and knowledge is essential. Secondly, strengthening structural capital by implementing efficient knowledge management systems and processes that support knowledge creation, storage, and application is crucial. Lastly, building relational capital by fostering strong relationships with customers, suppliers, and other stakeholders to facilitate

knowledge exchange and collaboration is essential. These theoretical steps provide a practical roadmap for SMEs to improve their innovation performance.

The findings are also supported by [Karchegani \(2013\)](#) who emphasizes the significant influence of intellectual capital on innovation. The paper highlights that companies can achieve competitive advantage by recognizing and understanding the critical role of intellectual capital and innovation. Consequently, senior managers must preserve and protect intellectual capital and actively develop and manage it to foster organizational innovation, a cornerstone for establishing a sustainable competitive edge. The study suggests that intellectual capital comprising knowledge, skills, and competencies plays a pivotal role in driving innovation. It enables companies to generate novel solutions, enhance efficiency, and adapt to dynamic market demands when effectively harnessed. Therefore, it is imperative for top management to strategically invest in and nurture intellectual capital, as this not only boosts innovation capacity but also positions the organization to outperform competitors and maintain long-term success in an increasingly complex business environment. Furthermore, [Dost \(2016\)](#) highlights the significant role of intellectual capital in driving innovation, concluding that companies with well-managed intellectual assets—such as knowledge, expertise, and competencies—are better equipped to develop innovative solutions and maintain competitiveness. These insights align with the focus of our research, emphasizing that intellectual capital is vital for large organizations and crucial for fostering innovation within micro, small, and medium enterprises (MSMEs). By effectively leveraging intellectual capital, MSMEs can enhance creativity, improve operational efficiency, and quickly adapt to market changes, thereby supporting sustainable growth and strengthening their competitive advantage. Another finding confirms that an organization's intellectual capital, which consists of its human, social, and organizational capital, is likely to affect Innovation capability ([Wu, 2013](#)). Another finding suggests that an organization's intellectual capital—comprising human, social, and organizational capital—significantly impacts its innovation capability ([Wu, 2013](#)). This reinforces the relevance of the indicators chosen in our research, which represent these latent variables individually and show a positive relationship with the company's ability to innovate. [Wu's \(2013\)](#) insights highlight that human capital, which involves employees' skills, knowledge, and expertise, directly contributes to idea generation and problem-solving. Social capital, encompassing networks, relationships, and trust, facilitates collaboration and knowledge exchange, which is essential for fostering creativity. Meanwhile, organizational capital, which includes internal processes, systems, and culture, ensures the efficient capture, sharing, and application of knowledge to drive innovation. The positive correlation between these elements and innovation underscores businesses' need to manage intellectual capital strategically. Companies that invest in employee development, cultivate networks, and enhance internal structures are better equipped to innovate and maintain competitiveness in dynamic markets. These findings also offer practical implications for policymakers, who can design programs encouraging SMEs to strengthen their intellectual capital, enhance innovation capacity, and ensure sustainable growth.

Conclusion

The study examines the pivotal role of intellectual capital as a mediator between knowledge management and innovation in small and medium-sized enterprises (SMEs) within the batik industry in Yogyakarta. The findings demonstrate that intellectual capital significantly enhances the impact of knowledge management on innovation, underscoring the importance of investing in and cultivating intellectual capital to drive organizational innovation. Intellectual capital—comprised of human capital (employee skills and knowledge), structural capital (internal processes and databases), and relational capital (relationships with external stakeholders such as customers and suppliers)—is identified as a critical resource that strengthens organizational capabilities and fosters innovation. The research highlights that effective knowledge management practices, such as hiring skilled personnel, continuous employee development, and fostering knowledge-sharing systems, are essential for building and utilizing intellectual capital. The practical relevance of these findings is particularly significant for Yogyakarta's batik industry, which is currently facing challenges such as declining export performance. By strategically integrating knowledge management and intellectual capital, SMEs can enhance their innovative capacity, leading to product development, process improvements, and improved performance—ultimately supporting sustainable growth and helping reverse declining export trends.

These findings carry several implications. For academics, this study expands the understanding of how intellectual capital serves as a mediator in fostering innovation, contributing to the literature on knowledge management and Resource-Based Theory (RBT). For practitioners, particularly SME owners and managers, the research offers actionable insights on how to leverage intellectual capital to sustain competitiveness through innovation. Regulators and policymakers can also benefit by using these insights to design policies and initiatives that support SMEs in optimizing intellectual capital and knowledge management. For example, incentives could be provided for employee training programs, knowledge-sharing networks, and collaboration between SMEs and larger enterprises or institutions. Additionally, the study aligns with RBT by illustrating that strategically managing valuable, rare, and inimitable resources like knowledge and intellectual capital can help organizations gain a competitive advantage. Future research could broaden the geographical scope and extend to more significant industries to further validate and generalize these findings, enriching both theory and practice across various contexts.

Limitations and Suggestions.

This study examines the role of intellectual capital as a mediator in the relationship between knowledge management and innovation. The research was conducted exclusively in the province of Daerah Istimewa Yogyakarta, Indonesia, with a specific focus on the SME Batik industry. By narrowing the scope to this particular region and industry, the study provides detailed insights into the local practices and the unique challenges these SMEs face. However, to enhance the applicability and robustness of the findings, it is recommended that future research should broaden the geographic scope to cover a larger area, such as the entire country. Additionally, expanding the research to include larger industries beyond SMEs would provide a more comprehensive understanding of how knowledge management and intellectual capital influence innovation across different contexts. This approach would help validate the theory on a broader scale, increasing its generalizability and relevance to various industrial sectors. Future studies can offer more generalized conclusions that inform policy-making and strategic planning in diverse organizational settings by encompassing a more comprehensive range of industries and regions.

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