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Consumer Perception of Halal Products Availability in Traditional Markets: The Role of Traceability

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Abstract: This research aims to examine how traceability affects consumer trust in halal products and traditional markets. A survey questionnaire was developed and a Total of 300 completed responses were collected using cross-sectional quantitative research methodology through structured questionnaires, with the help of Partial Least Squares Structural Equation Modeling (PLS-SEM) to verify if technology bringing convenience into our lives has impact on healthcare delivery service providing organizations. The findings reveal that product, process, genetic, and input traceability has a moderate to high effect on trust of the consumer behavior towards purchasing halal products. Product traceability to guarantee the safety, halal certification and regional origin of indicated products; process at technical integrity level that incorporates cleaning measures in food processing including hygiene control as well technical integrity also assured the cleanliness or production processes trustworthy (fits with / conducive); genetic contribute on verifying authenticity and quality assurance whereas input involved on confirming sourced-origin raw material. This study has several limitations such as the convenience sampling, which may not perfectly reflect on overall traditional market consumers; and it was a cross-sectional design so that we cannot track changes in consumer confidence. Similarly, there is potential social desirability response bias in the responses which may further compromise data authenticity. Longitudinal studies tracking changes in consumer confidence as traceability systems are improved, and comparative approaches between original/traditional market set-ups versus modernized etc. would be future areas of investigation to discern the effectiveness/impact that quality assurance programs have on improving value chains for small producers worldwide. Adding block chain could provide records that more secure, transparent and cannot be changed. This also would increase trust between companies and consumers even further.

Keywords: Consumer Confidence, Product Traceability, Process Traceability, Genetic Traceability, Input Traceability.

تصور المستهلك حول توفر المنتجات الحلال في الأسواق التقليدية: دور إمكانية التتبع

إيكى يوغى[1]، و رئيس ثانى محرمى[2]، و أدى ستياون[3]
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الملخص: يهدف هذا البحث إلى دراسة كيفية تأثير إمكانية التتبع على ثقة المستهلكين فى المنتجات الحلال والأسواق التقليدية. تم تطوير استبيان لجمع البيانات، وتم جمع 300 استجابة مكتملة باستخدام منهجية بحث كمية مقطعية من خلال استبيانات منظمة، بمساعدة نموذج المعادلات الهيكلية للمربعات الصغرى الجزئية (PLS-SEM) للتحقق مما إذا كانت التكنولوجيا التى تجلب الراحة إلى حياتنا لها تأثير على منظمات تقديم خدمات الرعاية الصحية. تكشف النتائج أن تتبع المنتجات، وتتبع العمليات، وتتبع الجينات، وتتبع المدخلات لها تأثير معتدل إلى كبير على سلوك الثقة لدى المستهلكين تجاه شراء المنتجات الحلال. يضمن تتبع المنتجات السلامة، وشهادة الحلال، والمنشأ الإقليمى للمنتجات المحددة؛ بينما يتعامل تتبع العمليات مع مستوى النزاهة التقنية الذى يشمل إجراءات التنظيف فى معالجة الأغذية بما فى ذلك مراقبة النظافة. كما تضمن النزاهة التقنية نظافة أو عمليات الإنتاج بشكل موثوق (ملائمة / مواتية)؛ يساهم التتبع الجينى فى التحقق من الأصالة وضمان الجودة، بينما يتضمن تتبع المدخلات تأكيد مصدر المواد الخام. لهذه الدراسة عدة قيود مثل عينة الراحة التى قد لا تعكس تمامًا سلوك جميع المستهلكين فى الأسواق التقليدية؛ كما أنها كانت ذات تصميم مقطعى، مما يعنى أننا لا نستطيع تتبع التغيرات فى ثقة المستهلكين. وبالمثل، هناك احتمال وجود تحيز استجابة الرغبة الاجتماعية فى الردود مما قد يضر بمصداقية البيانات. قد تكون الدراسات الطولية التى تتبع التغيرات فى ثقة المستهلكين مع تحسن أنظمة التتبع، والمقاربات المقارنة بين الإعدادات التقليدية الأصلية مقابل الحديثة، مجالات بحث مستقبلية لاستكشاف فعالية وتأثير برامج ضمان الجودة على تحسين سلاسل القيمة للمنتجين الصغار فى جميع أنحاء العالم. يمكن أن يضيف استخدام تقنية البلوكشين سجلات أكثر أمانًا وشفافية ولا يمكن تغييرها. وهذا من شأنه أيضًا أن يزيد من الثقة بين الشركات والمستهلكين بشكل أكبر.

الكلمات المفتاحية: ثقة المستهلك، تتبع المنتج، تتبع العملية، تتبع الجينات، تتبع المدخلات.

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Introduction

Previous research on supply chain management proposed several ideal models to tackle supply chain problems. Gharaei et al., (2022) introduced the null-space method (NSM) model for optimizing the supply chain by using linear programming to find the optimal point for the number and economic period of inventory. The availability and economic period are also reported. Askari et al., (2021) introduced a method of optimizing production with limited storage through the development of an economic production quantity (EPQ) model. In addition to production issues, the supply chain is a complex integration process involving suppliers, manufacturers, distributors, and sellers, each with their respective roles in maintaining supply chain stability. This argument was supported by Gharaei et al. (2021), who developed the Integrated SC (ISC) model. Askari et al. (2021) expanded the four-supply chain integration model, adding one more element to the supply chain through the hyper-scale Mixed Integer Nonlinear Programming (MINLP) model, which was used to optimize the quantity and stock of production. To ensure the continuity of the supply chain, production and cost factors play a significant role. Costs influence supply chain strategic decisions, including operational activities such as those conducted by Taleizadeh et al. (2022). The findings Asfa et al. (2022) revealed that these supply chain performance management tributes including reliability, responsiveness, agility, cost, and asset management strongly influence the operational performance of the company based on the SCOR model. Given the demands of consumers, industries must increase flexibility in the supply chain, which leads to rapid response to circumstances, opportunities, and threats in the external environment, to improve their competitiveness.

Apart from the several optimization models mentioned, there are models based on producers and their roles in the supply chain. Besides the role of producers, there is also the role of consumers in the supply chain, including end-level consumers, so their presence needs to be maintained in supply chain management (Al-Diabat, 2022). This fact motivated this research to use a consumer base, making it different from optimization methods on a producer basis. Consumers need confidence in the products they consume. Based on this assumption, this study posits that increasing consumer confidence in the products they consume necessitates all information, including the physical form of the product and how it is produced. This information enhances product traceability, boosting consumer confidence that the product is really the product they want, including when consumers want halal products. This is driven by the results of research conducted by Alfoqahaa (2018) which found that one of the factors that can minimize a consumer's move to another product is satisfaction in choosing that product, which in this study satisfaction will be formed when consumers have confidence in the product. Confidence will grow when consumers find and get information about the product. This information will make it easier for consumers to search for products that will increase their confidence in consuming these products.

Consumers' confidence in the halal products they consume has increased over time. Consumers don't just look at the halal label on the final product they consume, but they want to know more about how the product is produced and the entire production process, which must be guaranteed to deliver a truly halal product. This shows that the concept of Halal Supply Chain Management is needed to ensure and guarantee that the halal concept is attached to the products produced and to all processes involved in it from upstream to downstream (Handayani et al., 2022; Sulaiman et al., 2018). Halal Supply Chain Management, as the main theme of research, has been widely studied, especially by researchers in Malaysia, because the development of Halal Supply Chain Management in Malaysia has rapidly advanced, supported by robust regulations. A study by Omar & Jaafar, (2011), stated that the demand for halal products is increasing rapidly globally, which is not only needed by Muslims but also by non-Muslim communities. Hence, it requires an adequate chain (Halal Supply Chain Management) to answer the challenges of meeting these needs. The concept of "halal-toyiban," according to Omar & Jaafar, (2011), encompasses health, safety, quality, cleanliness, and logistics processes (Hisham Mohamed & Rahman Abdul Rahim, Abdul Ma'aram, 2020).

Conceptually, the Halal Supply Chain Management (HSCM) framework was investigated by Harwati & Permana (2017). Halal Supply Chain Management (HSCM) relies on the key performance indicators of the Balanced Scorecard. It is measured by four main perspectives: the selection of Islamic financial institutions, consumer payment mechanisms, the number of products and types of certified halal products, and the accuracy of payroll time (Abdalla & Almelaih, 2022). In addition, Ali et al. (2017) expanded on the HSCM concept from the strategy-structure performance paradigm, where they attempted to integrate the conventional supply chain and Halal Supply Chain to affect the company's performance. No less important from the management side is how producers choose suppliers that support their production processes. Ali et al. (2017) showed that several factors influence supplier selection to support the creation of a halal supply chain system, namely religiosity, supplier competence, traceability, beliefs, and cultural influences (Khairani Zahra et al., 2019). Additionally, the existence of motivation, both internally and externally, supported by the availability of resources within the organization, makes the Halal Supply Chain system a critical part of the organization's competitiveness in the industry (Ab Talib et al., 2015). Halal integrity is an important part of the implementation of Halal Supply Chain Management. The halal integrity of a product is protected and guaranteed through great involvement from the government and the organization that certifies the product as halal (Zulfakar et al., 2014). Guidelines are crucial for implementing the Halal Supply Chain at every stage of the production process, from initial manufacturing to retail (Saleh et al., 2016).

The implementation of HSCM as a complex process to produce a halal product requires measurement and evaluation to determine whether all are properly executed to ensure the halal status of the products developed. To calculate the success of HSCM implementation, (Nafiah et al., 2020). Khan et al. (2018) developed a measurement of HSCM implementation through critical success factors (CSFs), where HSCM implementation is assessed using 12 indicators. One part of implementing the halal supply chain that can increase consumer confidence and trust in halal products in traditional markets is the traceability of all supply chain activities (Walaszczyk & Galinska, 2020). This traceability includes product, process, genetic, and input traceability. These four types of traceability enhance consumer confidence and trust in a product (Qian et al., 2022). In connection with this, the present study, titled "Halal Supply Chain Management (HSCM) based on traceability systems" aims to boost consumer confidence in halal products in traditional markets through product traceability, process traceability, genetic traceability, and input traceability.

Assurance of safety and halalness of the products consumed makes product traceability crucial for consumers. Information related to traceability is expected to be provided in supply chain management (Hisham Mohamed & Rahman Abdul

Rahim, Abdul Ma'aram, 2020; Qian et al., 2022). To improve product traceability, a comprehensive information system should be utilized by leveraging advances in information technology (Anastasiadis et al., 2021; Mwanga et al., 2020). The development of Block Chain-Based Traceability Systems offers information related to product traceability that is continuously available. This system provides assurance about the safety of consumer products (Anastasiadis et al., 2021; Iftekhar & Cui, 2021; Lin et al., 2021; Singh et al., 2022; Xu et al., 2020). Available product traceability information enhances product assurance and ensures consumers receive the desired product, including product guarantees through certification (Magalhaes, 2021). Martuscelli, M; Serio, A; Capezio, O; Mastrocola (2020) disclosed that product labeling, including halal labels, might be is one proof of product traceability that can provide guarantees for consumers. The presence of such a traceability system is common in modern markets but rare in traditional markets (Suhandoko et al., 2021). This argument prompted this research to reveal that traditional market consumers also need traceability information on the products they consume.

This research introduces a novel contribution to the field of Halal Supply Chain Management (HSCM) by implementing block chain-based traceability systems specifically in traditional markets. Unlike previous studies that primarily focus on modern markets and large-scale industries, this research targets traditional markets, which are often underserved by advanced technological solutions. Traditional markets are defined as local, physical marketplaces where small-scale vendors sell goods directly to consumers, often characterized by a lack of advanced technological infrastructure. In contrast, modern markets include supermarkets and hypermarkets, which are typically part of larger retail chains with advanced logistics and supply chain systems. Block chain technology provides a secure, transparent, and immutable record of transactions throughout the supply chain, thereby enhancing consumer trust in the halal status of products. This study bridges a significant gap by offering practical solutions for integrating block chain in traditional market contexts, thus improving the traceability and assurance of halal products. By focusing on consumer involvement, the study enhances transparency and accountability in the halal supply chain, particularly in traditional markets where access to traceability information is often limited. The findings offer valuable insights for market participants, governments, and halal certification bodies to formulate policies and adopt technologies that enhance the integrity and competitiveness of halal products in traditional market settings.

Commenting on the previous studies

Previous studies have examined various aspects of consumer confidence in halal products involving different forms of traceability. Choe et al. (2009) found that product traceability significantly reduces product uncertainty and enhances consumer trust. Similarly, research by Matzembacher et al. (2018) emphasized the importance of process traceability in fostering customer trust and confidence. Genetic traceability, as highlighted by Chen et al. (2013), plays a crucial role in verifying product authenticity and quality, thus increasing consumer confidence. Input traceability, as discussed by Miarka et al. (2019) is essential for providing assurance about the origins and handling of raw materials, which is critical for maintaining consumer trust in halal products.

Statement of the Study Problem

Supply chain management is basically a series of complex processes involved in creating a product, encompassing the entire value chain from the initial process to the formation of a product (Hussain et al., 2022; Tse, 1999). According to Vorst (2006) supply chain management implementation aims not only to create a product but also to provide added value for consumers. Supply chain management involves coordinating all parties involved to create an effective and responsive system with the ultimate goal of minimizing costs and maximizing profit (Parast & Subramanian, 2021; Pushpesh Pant et al., 2022). In a broader context, supply chain management is a systems-based approach companies use to create value and enhance performance by integrating relationships between companies, suppliers, and customers (Ahmed et al., 2022; Hussain et al., 2022; Kusrini et al., 2018).

The complex integration created by all processes in supply chain management involves all parties, from suppliers to customers. In general, the supply chain represents the flow of goods or services throughout the network between suppliers, companies, and customers (Ahmed et al., 2022; Hussain et al., 2022; Ruseell & Taylor, 2011). The integration process between the parties involved in the supply chain system determines the successful implementation of the system (Azlan Wan Hassan et al., 2016; Hussain et al., 2022). With increasing economic competition, the existence of supply chain management as an integrated system enables companies to create competitive advantages by successfully implementing and providing added value to consumers, allowing them to survive and compete (Pushpesh Pant et al., 2022). In general, the concept of halal supply chain management is a evolves from the concept of conventional supply chain management. However, it incorporates unique aspects by accommodating Islamic teachings (sharia), which dictate the distinction between what is halal and what is haram (Abdalla & Almelaih, 2022; Ali et al., 2017; Fujiwara & Ismail, 2018; Yeo et al., 2016).

Halal supply chain management is a supply chain system in halal network management with the main aim of maintaining the halal integrity of the products produced (Abdalla & Almelaih, 2022; Tieman & Ghazali, 2014; Zainuddin et al., 2020). Fundamentally, the principles of the halal supply chain system are developed according to the ideas of each researcher (Ab Talib et al., 2015). The halal supply chain includes all activities related to the production process of halal products until they reach the final consumer. The halal supply chain integrates several functional areas such as operations, manufacturing, procurement, logistics, and value-added initiatives within the halal framework (Abdalla & Almelaih, 2022; Azlan Wan Hassan et al., 2016). Halal supply chain management requires an inclusive approach that starts with producers and ends with consumption (Halaseh & Sundarakani, 2012). The halal supply chain involves formulating and implementing halal business policies and actions that strengthen market position and generate profits. Ensuring the integrity and quality of halal products is a fundamental idea that must be maintained in every element of the supply chain (Khan et al., 2022; Rasi et al., 2017). The halal supply chain approach is critical to ensure halal integrity at the point of consumption, so it requires careful attention to ensure the continuity and halal integrity of the supply chain. Halal integrity in the halal supply chain includes the integrity of materials, production processes, information, and capital related to products (Abdalla & Almelaih, 2022; Ali et al., 2017; Khan et al., 2018).

In all of its activities, the halal supply chain must consider all halal elements, such as faith, trust, cleanliness, safety for consumption, and the absence of non-halal ingredients, and ensure that these are maintained until the final consumer (Ali et al., 2022; Ali & Suleiman, 2018; Hayati et al., 2008). The production of halal products requires raw materials, additives, processes, handling, distribution, and transportation to meet

established halal criteria (Nusran et al., 2019). The development of halal supply chain management is increasing due to several reasons, including the need for the halal integrity of a product (Lam & Alhashmi, 2008). The complexity that occurs in the supply chain makes maintaining the halal integrity of a product challenging (Abdul et al., 2009; Hayati et al., 2008). The increasing need for firm value resulting from the implementation of halal integrity (Zakaria & Abdul-Talib, 2010). In its development, the halal supply chain must meet several special criteria as stated by Saifudin et al. (2017): (1) rules and policies regarding halal; (2) support from the government and the private sector; (3) halal hubs; (4) differences between halal and non-halal suppliers; (5) halal control and labeling; (6) logistics control; (7) halal control and labeling; (8) supply chain resources; (9) halal supply chain business processes; (10) supplier network structure; (11) Halal supply chain performance; (12) halal certification process and (13) halal tracking and tracing system.

Supply chain management traceability consists of product, process, genetic, and input traceability (Zainuddin et al., 2020). In this study, product traceability refers to the consumer's belief that the finished product is genuinely halal. The indicators used for product traceability variables are (1) the quality of the product; (2) the safety and the halal guarantee of the product; (3) the origin of the product; (4) the recommendation, and (5) the sense of security and comforts of the product. Walaszczyk & Galinska (2020) stated that product traceability is an important factor that can increase consumer confidence and trust in a product. In addition, this study supports research by Choe et al. (2009) that states product traceability will reduce product uncertainty and increase consumer confidence in the product. This study supports research by Choe et al. (2009) that states product traceability will reduce product uncertainty and increase consumer confidence in the product. This study is further supported by research from Lam et al., (2020) that states a product traceability system will help increase consumer confidence and trust in a product.

H1: There is an effect of product traceability on consumer confidence in halal products availability in traditional markets

The definition of process traceability used in this study is the consumer's impression of the manufacturing process for goods sold in traditional marketplaces genuinely made from halal ingredients. The indicators used in this variable are (1) the process of slaughtering; (2) the personnel; (3) the cleanliness of the place; (4) the point of sale, and (5) the supervision. Research by Matzembacher et al., (2018) indicated that process traceability is one of the components of the traceability system that plays a significant role in fostering customer trust and confidence. Garaus & Treiblmaier, (2021) showed that the process traceability of a product significantly affects consumer perceptions, especially when it is associated with quality. Lin et al. (2021) found that a traceability system increases consumer confidence in the safety and health of the products by disclosing information about the process of providing products. Curto & Gaspar (2021) revealed in their research that the availability of information when consumers want to know about process traceability increases consumer confidence, having an impact on increasing the economic value of a product

H2: There is an effect of process traceability on consumer confidence in halal products availability in traditional markets

Genetic traceability in this study is defined as consumer perceptions of the quality of products produced and sold in traditional markets. The indicators used in this variable are (1) product health and safety; (2) product freshness; (3) product purity; (4) product quality, and (5) product similarities with modern markets. Genetic traceability is related to the authenticity of products provided to consumers. Information related to the authenticity and originality of a product in genetic traceability increases consumer awareness and enhances trust in the product (Walaszczyk & Galinska, 2020). Research conducted by Chen et al. (2013)) showed that a traceability system containing genetic information increases the degree of consumer confidence in the product and the possibility of repeat purchases.

H3: There is an effect of genetic traceability on consumer confidence in halal products availability in traditional markets

The input traceability in this study is the consumer's perception that the products sold in traditional markets come from a good place. The indicators used in this variable are: (1) place of origin; (2) animal origin; (3) personal seller; (4) security and (5) transportation process. According to Curto & Gaspar (2021), input traceability information is crucial for eliminating consumer uncertainty or doubt and increasing consumer confidence in the availability of halal products. The availability of information related to input traceability is one of the important pieces of information needed by consumers (Miarka et al., 2019).

H4: There is an effect of input traceability on consumer confidence in halal products availability in traditional markets

METHODS

This article investigates the effects of traceability on consumer trust in traditional markets for Halal products using quantitative research. Cross-sectional design had been used for data collection from 300 consumers by accidental sampling. Five dimensions Used in the Analysis of Trust and Traceability These aspects are core values related to trust: consumer trust, product traceability, process trace ability, genetic traceability, input traceability as variables (measured on 7-point Likert-type scale using a semantic differential questionnaire). Data was collected through face-to-face interviews in a range of markets. This allowed for high levels of comprehension and response rates. Common method bias was assessed through VIF analysis, while content validity of the constructs used items adapted from well-established literature. Specifically, this study will use PLS-SEM to analyze data including descriptive statistics, measurement model evaluation and structural model examination in order to assess four hypotheses that pertain the effect of traceability on consumer confidence.

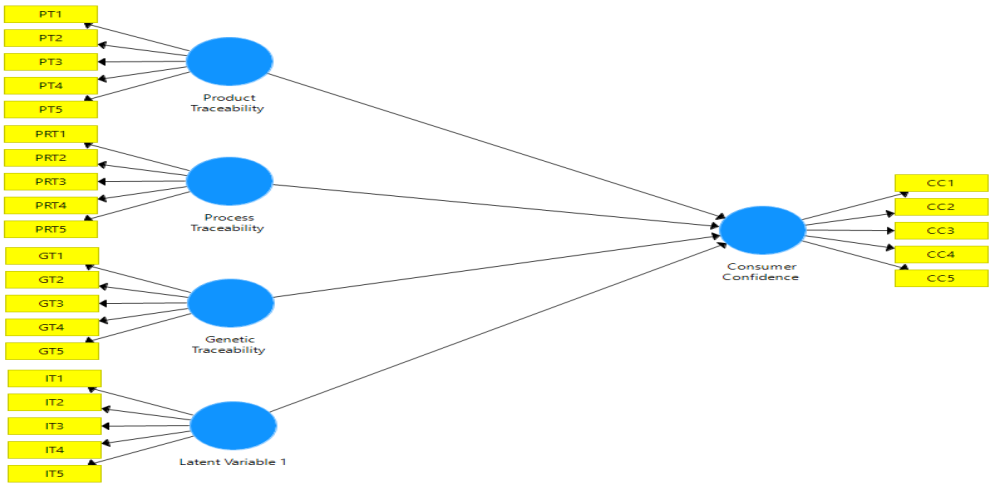

Figure (1): Research Modelling.

Study Findings

Sample Profile

As shown in Table 1, a higher proportion of the sample was female (72%) and aged between 30–40 years old (62.34%). Most of the answers come from housewives (40%), beside that there are also civil servants (27.67 %), and then smaller groups of private employees, students and entrepreneurial-threat signaled. Here, we can see from the data a distinct female demographic in their 30s who are mainly responsible for running household chores.

Table (1): Respondent's Description.

Gender	Frequency	Percent	Occupation	Frequency	Percent
Male	84	28	Housewives	120	40
Female	216	72	Civil Servants	83	27.67
Age			Private Employees	43	14.33
< 20 yrs.	25	8.33	Students	25	8.33
20-30 yrs.	49	16.33	Self-employed	29	9.67
30-40 yrs.	187	62.34			
>40 yrs.	39	13			

Measurement Model

The model used in this study is shown in Figure 1. This study's assessment of the model consists of factor loading, composite reliability, average variance extracted (AVE), and discriminant validity estimated. The measurement results obtained using the PLS-SEM application are shown in Table 2. The analysis of the measurement model, as detailed in Table 2, provides insight into the internal consistency, composite reliability, and convergent validity of the constructs related to traceability and consumer confidence.

Table (2): Measurement Model.

Construct		Loading	Cronbach's Alpha	Composite Reliability	AVE
Product Traceability (PT)	The product quality	0.764	0.752	0.833	0.502
	Safety and halal certification of the product	0.761			
	Origin of the product	0.731			
	Product recommendations	0.630			
	Sense of safety and comfort	0.645			
Process Traceability (PRT)	The production process	0.790	0.677	0.801	0.488
	Personnel involved in production	0.819			
	Cleanliness of the production premises	0.762			
	The point of sale	0.747			
	Supervision of the production process	0.091			
Genetic Traceability (GT)	Health and safety of the product	0.727	0.776	0.848	0.528
	Freshness of the product	0.732			
	Purity of the product	0.752			
	Quality of the product	0.716			
	Similarities with modern market products	0.704			
Input Traceability (IT)	Origin of raw materials	0.750	0.781	0.850	0.533
	Safety of raw materials	0.798			
	Distribution process of the product	0.710			
	Handling of the product	0.704			
	Transportation of the product	0.681			
Consumer Confidence (CC)	I feel confident in the halal products available in traditional markets.	0.718	0.812	0.870	0.572
	I trust the quality of halal products sold in traditional markets.	0.749			
	I believe that halal products in traditional markets are authentic.	0.749			
	I am reassured about the safety of halal products available in traditional markets.	0.787			
	I have no doubts about the halal status of products in traditional markets.	0.776			

The results show different psychometric properties for each one of the traceability constructs. Seven constructs (PT, PRT, GT, IT and CC) generally show good values in terms of internal consistency composite reliability as well as AVE: these are PT

Process Traceability [PRT] Genetic traceability Input traceability [IT], Consumer Ni consumer confidence [CC], with the last three performing particularly quite well. PRT, for example, has an AVE score just above the threshold where reliability might be questioned. Particular items, such as "Product recommendations," sense of safety and comfort (PT), Supervision of the Production Process (PRT), and Transportation of product (IT) have factor loadings < .5 so they ought to be omitted to enhance construct validity. In general, improving these constructs by removing weak indicators will increase this model in reliability and validity.

By excluding these items from the research model, the overall measurement quality of the constructs will improve, leading to more reliable and valid results. This enhancement will ultimately bolster the robustness and interpretability of the research findings. The measurement results after the items were removed can be seen in table 3.

Table (3). Measurement Model.

Construct		Loading	Cronbach's Alpha	Composite Reliability	AVE
Product Traceability (PT)	The product quality	0.819	0.716	0.841	0.639
	Safety and halal certification of the product	0.821			
	Origin of the product	0.755			
Process Traceability (PRT)	The production process	0.793	0.788	0.863	0.611
	Personnel involved in production	0.822			
	Cleanliness of the production premises	0.765			
	The point of sale	0.745			
Genetic Traceability (GT	Health and safety of the product	0.727	0.776	0.848	0.528
	Freshness of the product	0.732			
	Purity of the product	0.752			
	Quality of the product	0.716			
	Similarities with modern market products	0.704			
Input Traceability (IT)	Origin of raw materials	0.774	0.759	0.846	0.580
	Safety of raw materials	0.823			
	Distribution process of the product	0.732			
	Handling of the product	0.712			
Consumer Confidence (CC)	I feel confident in the halal products available in traditional markets.	0.718	0.812	0.870	0.572
	I trust the quality of halal products sold in traditional markets.	0.749			
	I believe that halal products in traditional markets are authentic.	0.748			
	I am reassured about the safety of halal products available in traditional markets.	0.786			
	I have no doubts about the halal status of products in traditional markets.	0.777			

After eliminating the instrument items identified in Table 2 as not meeting the required standards, the analysis based on Table 3 shows that all remaining constructs exhibit strong internal consistency, convergent validity, and composite reliability. Specifically, the Cronbach's Alpha values range from 0.716 to 0.812, indicating good internal consistency across constructs. The composite reliability values, all above 0.8, further confirm the reliability of the constructs, while the Average Variance Extracted (AVE) values exceed the 0.5 threshold, demonstrating adequate convergent validity. Consequently, the refined measurement model is both valid and reliable for use in the research.

The discriminant validity test using the Heterotrait-Monotrait Ratio (HTMT) presented in Table 4 assesses the distinctiveness of the constructs in the research model. According to the standards, discriminant validity is established if the HTMT values are below 0.90 for conceptually different constructs.

Table (4): Heterotrait-Monotrait Ratio.

	Consumer Confidence	Genetic Traceability	Input Traceability	Process Traceability
Genetic Traceability	0.849			
Input Traceability	0.913	0.806		
Process Traceability	0.916	0.799	0.860	
Product Traceability	0.926	0.736	0.785	0.822

The discriminant validity test using HTMT shows that most constructs in the research model have good discriminant validity, with HTMT values below the 0.90 threshold. Satisfactory discriminant validity is observed between constructs such as Consumer Trust, Genetic Traceability, and Input Traceability. However, issues arise with Consumer Confidence, where HTMT values with Input Traceability, Process Traceability, and Product Traceability exceed 0.90, indicating potential discriminant validity concerns. To address this, items with high correlations need to be closely examined.

Table (5): Correlation Matrix.

	CC1	CC2	CC3	CC4	CC5	PT1	PT2	PT3	PT4	PT5	PRT1	PRT2	PRT3	PRT4	PRT5	GT1	GT2	GT3	GT4	GT5	IT1	IT2	IT3	IT4	IT5
CC1	1.000																								
CC2	0.476	1.000																							
CC3	0.423	0.483	1.000																						
CC4	0.409	0.445	0.503	1.000																					
CC5	0.413	0.451	0.445	0.592	1.000																				
PT1	0.434	0.439	0.368	0.476	0.503	1000																			
PT2	0.422	0.387	0.411	0.484	0.431	0.535	1000																		
PT3	0.414	0.425	0.348	0.378	0.477	0.405	0.431	1000																	
PT4	0.318	0.273	0.251	0.328	0.302	0.322	0.317	0.366	1000																
PT5	0.328	0.321	0.297	0.392	0.351	0.327	0.314	0.351	0.409	1000															
PRT1	0.507	0.42	0.477	0.413	0.411	0.404	0.427	0.469	0.354	0.476	1.000														
PRT2	0.54	0.437	0.432	0.426	0.435	0.414	0.395	0.413	0.374	0.353	0.583	1.000													
PRT3	0.413	0.307	0.407	0.406	0.396	0.347	0.371	0.331	0.347	0.341	0.491	0.494	1.000												
PRT4	0.412	0.489	0.428	0.456	0.441	0.374	0.383	0.297	0.327	0.287	0.389	0.466	0.462	1.000											
PRT5	0.135	0.042	0.054	0.095	0.122	0.132	-0.01	0.052	0.046	0.03	0.005	0.009	-0.006	0.065	1.000										
GT1	0.376	0.433	0.395	0.386	0.456	0.329	0.322	0.376	0.22	0.198	0.35	0.436	0.363	0.501	0.051	1.000									
GT2	0.352	0.382	0.318	0.387	0.352	0.381	0.284	0.349	0.351	0.189	0.32	0.318	0.283	0.392	0.044	0.466	1.000								
GT3	0.317	0.384	0.374	0.384	0.437	0.345	0.244	0.278	0.219	0.23	0.296	0.338	0.338	0.374	0.097	0.366	0.465	1.000							
GT4	0.345	0.31	0.38	0.367	0.403	0.339	0.306	0.316	0.299	0.262	0.38	0.439	0.343	0.392	0.081	0.349	0.377	0.472	1.000						
GT5	0.304	0.39	0.294	0.342	0.39	0.325	0.311	0.27	0.202	0.24	0.269	0.362	0.203	0.392	0.012	0.397	0.357	0.424	0.422	1.000					
IT1	0.437	0.412	0.461	0.529	0.53	0.485	0.407	0.35	0.23	0.32	0.406	0.435	0.348	0.413	0.089	0.368	0.343	0.378	0.387	0.407	1.000				
IT2	0.418	0.393	0.431	0.522	0.498	0.41	0.362	0.357	0.271	0.329	0.445	0.473	0.422	0.47	0.026	0.364	0.342	0.371	0.43	0.361	0.543	1.000			
IT3	0.385	0.346	0.404	0.385	0.362	0.339	0.322	0.275	0.302	0.244	0.379	0.424	0.393	0.395	0.001	0.329	0.307	0.315	0.392	0.276	0.337	0.485	1.000		
IT4	0.346	0.358	0.314	0.346	0.38	0.388	0.257	0.275	0.16	0.228	0.38	0.341	0.293	0.322	0.029	0.272	0.299	0.346	0.237	0.324	0.374	0.42	0.485	1.000	
IT5	0.385	0.398	0.42	0.426	0.353	0.385	0.322	0.345	0.184	0.37	0.37	0.304	0.178	0.29	0.015	0.31	0.392	0.243	0.282	0.267	0.37	0.397	0.353	0.395	1.000

Based on the correlation matrix analysis, some items correlate weakly with other items in the same construct which means they might not be loading onto their respective constructs as sizeable clusters. Weak correlation is particularly evident in items CC1 (“Make a purchase”), PT4 (“Product recommendations”), PT5 („Sense of safety and comfort“), PRT1(„The production process“), PRT5 (Supervision of Production Processes"), IT1 ("Origin of place)”, IT 5 ("The distribution process"). Excluding these factors from the model can increase its reliability and validity — leading to higher internal consistency. Once items are removed, Table 6 shows this will likely lead to stronger HTMT (Heterotrait-Monotrait Ratio) values which means our model is more reliable and interpretable than before.

Table (6): Heterotrait-Monotrait Ratio.

	Consumer Confidence	Genetic Traceability	Input Traceability	Process Traceability
Genetic Traceability	0.833			
Input Traceability	0.827	0.760		
Process Traceability	0.885	0.828	0.837	
Product Traceability	0.885	0.736	0.721	0.794

Based on the HTMT results in Table 6, all constructs in the research model show satisfactory discriminant validity, as all HTMT values are below the standard threshold of 0.90. This indicates that each construct is sufficiently distinct from the others, confirming that the measurement model is robust and the constructs can be relied upon to capture different aspects of the phenomenon under study. This result supports the validity of using these constructs in the research model without any concerns of significant overlap, thereby enhancing the interpretability and credibility of the research findings. The subsequent research model as depicted in figure 2.

Common method bias

In quantitative research, especially those involving surveys and questionnaires as data collection methods, the issue of common method bias (CMB) is an important concern. Common method bias occurs when **variations** in the data **are** due more to the measurement method than the construct being measured. This **jeopardizes** the validity of the research results, leading to false or misleading conclusions. In this study, the tests **conducted VIF and** the analysis results are presented in the table 7.

Table (7): VIF Outer Value.

Construct		VIF
Product Traceability (PT)	The product quality	1.478
	Safety and halal certification of the product	1.517
	Origin of the product	1.296
Process Traceability (PRT)	Personnel involved in production	1.462
	Cleanliness of the production premises	1.455
	The point of sale	1.406
Genetic Traceability (GT)	Health and safety of the product	1.419
	Freshness of the product	1.503
	Purity of the product	1.552
	Quality of the product	1.445
	Similarities with modern market products	1.412
Input Traceability (IT)	Origin of raw materials	1.388
	Safety of raw materials	1.495
	Distribution process of the product	1.389
Consumer Confidence (CC)	I trust the quality of halal products sold in traditional markets.	1.404
	I believe that halal products in traditional markets are authentic.	1.508
	I am reassured about the safety of halal products available in traditional markets.	1.442

Table (8): VIF Inner Value.

	VIF
Product Traceability ➔ Consumer Confidence	1.694
Process Traceability ➔ Consumer Confidence	2.134
Genetic Traceability ➔ Consumer Confidence	1.933
Input Traceability ➔ Consumer Confidence	1.845

In analyzing the data in tables 7 and 8, the VIF values are all below 3.3, which indicates the absence of serious problems with collinearity or common method bias. This is in line with the approach proposed Kock (2015) which uses VIF as part of the full collinearity test to identify common method bias. The low VIF values indicate that the constructs measured in this study are not affected by high collinearity, thus maintaining their measurement validity.

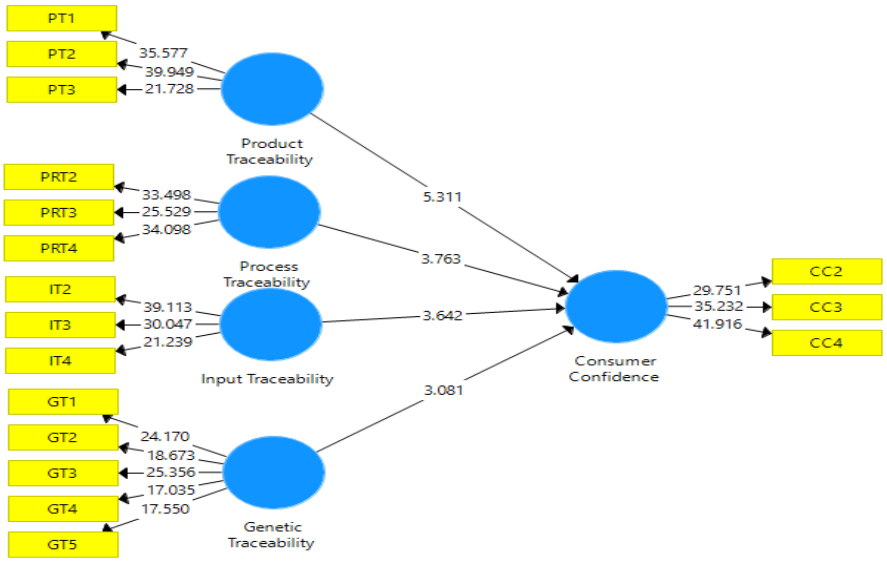

Figure (2): Structural model.

Figure 2 explains the structural model with Product, Process, Input and Genetic Traceability cause side on Consumer Confidence Specific indicators are shown for each construct, with their respective factor loadings. As indicated by their path coefficients, product Traceability has the most significant impact on Consumer Confidence followed closely by Process and Input traceability’s with Genetic after that. The model suggests that all constructs of traceability have a significant impact on Consumer Confidence. Table 9 provides the results of hypothesis testing.

Table (9): Structural Model Assessment (Direct Effect Result and Decision).

Hypithesis		Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Description
H1	Product Traceability ==> Consumer Confidence	0.293	0.294	0.059	4.981	0.000	Accepted
H2	Process Traceability ==> Consumer Confidence	0.229	0.229	0.067	3.395	0.001	Accepted
H3	Genetic Traceability ==> Consumer Confidence	0.216	0.216	0.073	2.963	0.003	Accepted
H4	Input Traceability ==> Consumer Confidence	0.190	0.192	0.052	3.685	0.000	Accepted

Regarding the structural model: as can be observed in table 9, our assessment assures that all four types of traceability-trace-to-product-level, process level, genetic level and inputted level- significantly increase consumer trust. We have strong statistical support for each hypothesized relationship, with all coefficients significant and the p values are low (i.e., < 0.05), meaning effective traceability across these dimensions increases consumer trust.

Table (10): R2 Value.

Variables	Variance R^2	Adjusted R^2
Customer Confidence	0.590	0.584

The results of Table 10 show that the R^2 is equal to.590, which means roughly 59% of Customer Confidence pares with model. A value of Adjusted R^2 = 0.584, that adjusts for potential bias indicates the wide explanatory power in consumer confidence by combined traceability constructs.

Table (11): Effect Size (f^2).

	f squared	Effect size
Product Traceability → Customer Confidence	0.123	Small
Process Traceability → Customer Confidence	0.060	Small
Genetic Traceability → Customer Confidence	0.059	Small
Input Traceability → Customer Confidence	0.048	Small

Table 11 provides the effect size (f^2) analysis for the impact of various traceability constructs on Customer Confidence. The effect size is categorized based on Cohen's guidelines, where values of 0.02, 0.15, and 0.35 indicate small, medium, and large effects, respectively. Referring Cohen (1988). The results show that Product Traceability has an f^2 value of 0.123, which is considered a small effect size. This indicates that Product Traceability has a modest but notable influence on Customer Confidence. Similarly, Process Traceability has an f^2 value of 0.060, Genetic Traceability has an f^2 value of 0.059, and Input Traceability has an f^2 value of 0.048. All these values are also classified as small effect sizes, suggesting that while these factors do influence Customer Confidence, their individual impacts are relatively minor. In conclusion, the analysis shows that traceability constructs have a positive impact on Customer Trust, although the respective contributions are relatively small. These findings are consistent with the broader literature, which emphasizes the multifaceted nature of consumer trust and trust-building strategies.

Goodness and Model Fit

This evaluation can be done by looking at R Square, Q Square, SRMR, PLS Predict (Hair et al., 2021).

R-Square and Q-Square

The analysis of the predictive power displayed in the table10 reveals significant insights into the model's effectiveness in explaining customer confidence. The R2 value, which stands at 0.590, indicates that 59% of the variance in customer confidence can be explained by the model's predictors. According to standards put forward by Hair et al. (2021), this places the predictive power of the model in the moderate to substantial range, as values around 0.33 are considered moderate, and those around 0.67 are deemed substantial. Additionally, the Q 2 value of 0.570, which is greater than the threshold of 0.35 for high predictive relevance, demonstrates that the model has a high degree of predictive relevance for customer confidence. Thus, the model not only explains a significant portion of the variance in customer confidence but also shows strong predictive capabilities, underscoring its overall effectiveness

Table (12): R Square and Q Square.

	R Square	Q Square
Customer Confidence	0.590	0.570

Standardized Root Mean Square Residual

Table 13 shows the results of SRMR test which had satisfactory fit for both Full Model and Estimated Model (SRMR <. 08 (i.e. small discrepancy to fitted correlations). Additional fit indices dULS, G(dG), and Chi-Square are also reported to further confirm the model fitting seen above with an NFI score for this path mode! 0.751; this likely reflects good but not great value in the data set. Consequently, the fact this is true for both models raises our confidence level to model well the structure of data generation process.

Table (13): SRMR (Standardized Root Mean Square Residual).

	Saturated Model	Estimated Model
SRMR	0.070	0.070
d_ULS	0.760	0.760
d_G	0.281	0.281
Chi-Square	490.290	490.290
NFI	0.751	0.751

PLS Predict

According to Hair et al. (2021) . to see the PLS model has predictive ability, it needs to be compared with the linear regression model by looking at the RMSE and MAE values where the PLS model has predictive power if the RMSE MAE value is lower than the linear model (LM).

Table (14): PLS Predict.

	PLS				LM			
	Q^2_predict	RMSE	MAE	MAPE	Q^2_predict	RMSE	MAE	MAPE
CC2	0.364	0.881	0.692	14.536	0.344	0.894	0.694	14.620
CC4	0.408	0.894	0.691	14.220	0.371	0.921	0.716	14.656
CC3	0.338	0.859	0.679	14.318	0.277	0.898	0.707	14.914

Table 14 shows a comparison in terms of prediction performance between Partial Least Squares (PLS) and the Linear Model (LM), where it can be seen that PLS leads to higher Q^2_predict values, suggesting that this technique is better at describing variability among data not used for model building. Furthermore, PLS also has lower values of RMSE, MAE and MAPE that means better accuracy and consistency then tha LM. While the difference is not substantial, PLS typically works best when prediction accuracy is a primary concern; however, LM may be favored if simplicity and model interpretability are of paramount importance.

Goodness of Fit (GoF)

To evaluate the overall model fit, we calculated the

Goodness of Fit (GoF) value using the provided Average Variance Extracted (AVE) values for each construct and the R2 value for Consumer Confidence. The AVE values for Product Traceability, Process Traceability, Genetic Traceability, Input Traceability, and Consumer Confidence are 0.639, 0.611, 0.528, 0.580, and 0.572 respectively. First, we computed the average AVE by summing these values and dividing by the number of constructs, resulting in an average AVE of 0.586. Using the formula GoF=√Average AVE×R2 , we then calculated the GoF as √0.586×0.590=√0.34574≈0.588. This GoF value of approximately 0.588 indicates a good fit between the model and the data, suggesting that the model effectively explains and predicts the constructs within the study.

To evaluate the overall model fit, we calculate the Goodness of Fit (GoF) value using the provided R^2 value and assumed AVE values for each latent construct. The R2R^2R2 value for Consumer Confidence is 0.590. We assume the AVE values for the constructs are as follows: Product Traceability (0.6), Process Traceability (0.65), Input Traceability (0.7), Genetic Traceability (0.55), and Consumer Confidence (0.6). The average AVE is calculated to be 0.62. Using the formula GoF= √AVE x R2, we find that GoF=√0.62×0.59≈0.605. Therefore, the Goodness of Fit (GoF) value for the model is approximately 0.605, indicating a good fit between the model and the data. If actual AVE values are provided, a more precise GoF calculation can be performed.

Robustest

To prove that the PLS model is indeed the best model for testing this research, robustest is carried out by conducting a linearity test and heterogeneity test (Hair et al., 2021). The model can be said to be good if it has linearity between endogenous and exogenous variables.

Table (15): Linearity test.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Quadratic Effect Product Traceability -> Consumer Confidence	0.020	0.015	0.029	0.680	0.497
Quadratic Effect Process Traceability -> Consumer Confidence	0.056	0.060	0.042	1.348	0.178
Quadratic Effect Input Traceability -> Consumer Confidence	-0.011	-0.012	0.037	0.285	0.776
Quadratic Effect Genetic Traceability -> Consumer Confidence	-0.050	-0.050	0.044	1.148	0.252

The linearity test analysis results presented in Table 15 assess the quadratic effects of different types of traceability on consumer confidence. In summary, the quadratic effects of Product Traceability, Process Traceability, Input Traceability, and Genetic Traceability on Consumer Confidence are all found to be statistically insignificant, as indicated by the low T Statistics and high P Values in the analysis. This indicates that there is no significant non-linear relationship between these types of traceability and consumer trust or in other words, there is a linear relationship so the model is good to use.

Table (16): Heterogeneity test.

Fit Indices	1 segment	2 sgement
AIC	593.923	582.229
AIC3	598.923	593.229
AIC4	603.923	604.229
BIC	612.442	622.971
CAIC	617.442	633.971
HQ	601.335	598.534
MDL5	726.518	873.937

The heterogeneity test results in Table 16 show that the two-segment model performs better than the one-segment model, as indicated by the various fit indices being lower in the two-segment model. However, some criteria such as the modified AIC, BIC, and CAIC showed slightly higher or equivalent values, which may indicate that increasing model complexity does not necessarily improve the overall fit. The entropy index and other related criteria in the two-segment model showed better segment clarity, supporting the segmentation of the two-segment model. Overall, despite some improvement in model fit with two segments, the decision to choose this model should consider the balance between fit and model complexity.

Discussion

The positive effect of product traceability on consumer confidence can be attributed to the assurance it provides regarding the safety, halal certification, and origin of the products. Consumers feel more secure knowing that the products they purchase have been thoroughly verified and certified as halal. Process traceability enhances confidence by ensuring that the production process adheres to cleanliness and integrity standards, which are critical for maintaining the halal status of the products. Genetic traceability verifies the authenticity and quality of the products, reducing the risk of contamination and ensuring that consumers receive genuine halal products. Input traceability reassures consumers about the origins and handling of raw materials, which is essential for maintaining trust in halal products, particularly in traditional markets where such information is often lacking.

Based on the results of the t-test carried out, it was obtained that the level of significance generated in p-value < from the level of sig. 5%, so it can be concluded that the product traceability variable influences consumer confidence in the availability of halal products in traditional markets. This research supports research by Walaszczyk & Galinska, (2020), which states that product traceability is an important factor in increasing consumer confidence and trust in a product. In addition, this study also strengthens research conducted by Choe et al. (2009)) which states that product traceability will reduce product uncertainty and increase consumer confidence in the product. This study also supports research conducted by Lam et al. (2020) which also states that a product traceability system will help increase consumer confidence and trust in a product.

Consumer confidence in the existence of halal products in traditional markets is an implementation of a halal supply chain. It will increase consumer confidence to buy products in traditional markets, especially related to product traceability. Several things can encourage consumer confidence in halal products in traditional markets tied to product traceability, namely the belief that the product is good, healthy, and halal. Consumer confidence is also related to the product's origin from a decent place. Traditional market products deserve to be promoted to other parties with the feeling of pleasure, comfort, and security. In implementing supply chain management, product traceability will build and increase consumer confidence and trust that a product is of genuine quality (Matzembacher et al., 2018).

Based on the results of the t-test, it can be concluded that the process traceability variable influences consumer confidence in the availability of halal products in traditional markets. The positive results of this study support the research of Matzembacher et al. (2018), which states that process

traceability is one of the elements in the traceability system that has an important role in building consumer trust and confidence. Research from (Garaus & Treiblmaier, 2021) also shows that the process traceability of a product will greatly affect consumer perceptions, especially when it is associated with quality.

Lin et al. (2021) revealed that a traceability system that discloses information about the process of providing products would lead to increased consumer confidence in the safety and health of the products produced. Curto & Gaspar (2021), in their research revealed that the availability of information when consumers want to know related to process traceability increases consumer confidence and will have an impact on increasing the economic value of a product. The existence of information related to the process traceability of a product will increase consumer confidence and trust in a product. The factors that need to be disclosed are related to the process traceability required by consumers so that they can increase their confidence and trust in the product, including how the product process is carried out, who processes the product, how is the feasibility of the product supply process, how the product is distributed to consumers and how monitoring system carried out by related parties. Accurate information related to process traceability will build consumer trust and confidence in product quality.

Based on the results of the t-test carried out, it can be concluded that the genetic traceability variable influences consumer confidence in the availability of halal products in traditional markets. Genetic traceability is related to the authenticity of products provided to consumers. Information related to the authenticity and originality of a product in genetic traceability will increase consumer awareness and increase trust in the product (Walaszczyk & Galinska, 2020). Research conducted by Chen et al. (2013) shows that a traceability system containing traceability genetic information will increase the degree of consumer confidence in the product and the possibility of making repeated purchases. Some information from genetic traceability that can increase consumer confidence includes health and product safety assurance, product freshness, purity, and quality.

Based on the results of the t-test carried out, it can be concluded that the traceability input variable influences consumer confidence in the availability of halal products in traditional markets. According to Curto & Gaspar (2021), input traceability information has a very important role in eliminating consumer uncertainty or doubt to increase consumer confidence related to the availability of halal products. The existence of information related to input traceability is one of the important pieces of information needed by consumers (Miarka et al., 2019). Several things related to traceability input information can increase consumer confidence in the availability of halal products, namely information about the origin of the product, ingredients of product origin, distribution of product safety products, and product transportation to consumers' hands.

Conclusions

This study demonstrates the significant impact of traceability on consumer confidence in the availability of halal products in traditional markets. Product, process, genetic, and input traceability all play crucial roles in building and maintaining this confidence. Product traceability ensures that consumers trust the safety, halal certification, and origin of the products. Process traceability enhances confidence through guarantees of cleanliness and production integrity, while genetic traceability confirms product authenticity and quality. Input traceability reassures consumers about the origins and handling of raw materials, which is critical for maintaining trust in halal products.

To leverage these findings, integrating block chain technology can provide secure, transparent, and immutable records, thereby increasing consumer trust. Education and awareness programs are essential to inform consumers about the benefits of traceability systems. Additionally, governments and certification bodies must enforce strict regulations and provide clear guidelines to maintain the integrity of halal products. Collaboration with traditional market vendors is crucial to implement these traceability systems effectively, ensuring that even small-scale producers can comply with these standards. These steps will help build a robust traceability infrastructure that supports consumer confidence.

Despite its valuable insights, the study has some limitations. The use of accidental sampling may not represent the entire population of traditional market consumers, and the cross-sectional design limits the ability to capture changes in consumer confidence over time. Additionally, social desirability bias in responses might affect data authenticity. Future research should consider longitudinal studies to understand how consumer confidence evolves with improved traceability systems and conduct comparative studies between traditional and modern markets to provide deeper insights into the implementation and impact of these systems.

Disclosure Statement

- **Ethical approval and consent to participate:** This study was conducted in accordance with the applicable ethics guidelines and all participants provided informed consent prior to participation.
- **Availability of data and materials:** The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.
- **Author's contribution:** All authors conceived and designed the study, collected and analyzed the data and drafted the manuscript. All authors reviewed and approved the final manuscript.
- **Conflict of interest:** The authors declare that they have no competing interests.
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