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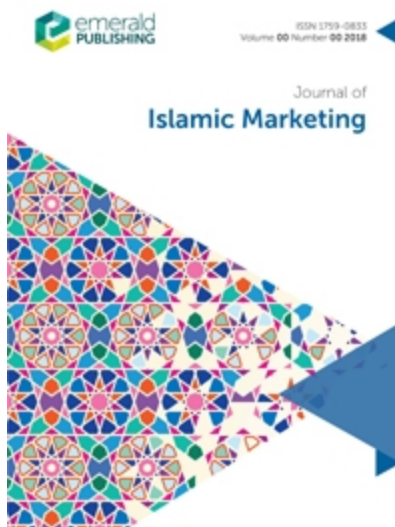
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Impact of Supply Chain Integration on Halal Food Supply Chain Integrity and Food Quality Performance

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Impact of Supply Chain Integration on Halal Food Supply Chain Integrity and Food Quality Performance

Abstract

Purpose – The current complex halal food supply chain has caused food scandals, which have illustrated the weakness of multiple Food quality standards and certification, and audits in ensuring food safety. Drawn on the resource-based view theory (RBV), this study has aimed to explore the impacts of supply chain integration on halal food supply chain integrity and, consequently, food quality.

Design/methodology/approach - Empirical data were collected from 275 halal-certified food companies in Malaysia and analysed using structural equation modelling - SmartPLS3.0.

Findings – The results confirmed that supply chain integration including internal, supplier, and customer integrations, have significant effects on the dimensions of the halal food supply chain integrity which, in turn, lead to halal food safety and quality.

Practical implication –The importance of supply chain integration in halal food supply chain is highlighted in this study. The impact of supply chain integration is contexted in halal food supply chain integrity and food quality. Therefore provides a clear understanding to managers of supply chain applicability in the halal food industry.

Originality/value – Based on the RBV theory, this study contributes to the limited body of research of the relationships amongst supply chain integration from the context of the halal industry with a specific focus on food supply chain integrity and food quality.

Keywords: Supply Chain Integration, Food Integrity, Food Quality, Halal Food

1. Introduction

In ensuring food quality and safety, policymakers imposed myriad certifications, standards, and regulations on food manufacturers. From the context of food industry, literature has highlighted the importance of food standards and certifications (Ab Talib *et al.*, 2015; Hosseini *et al.*, 2019; Wilson, 2014). However, the recent plethora of food scandals across the globe, such as Malaysia's fraudulent non-halal meat cartel (2020), Australian's rockmelon listeriosis outbreak (2018), Europe's Fipronil eggs contamination (2017), and the United Kingdom's horsemeat scandal (2013), have heavily challenged the reliability and integrity of the food industry and suggest that the current standards and controlling mechanisms are insufficient to ensure food integrity. In response to food scandals and incidents, the customers' concerns on

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3 food quality and safety have increased tremendously (Aung and Chang, 2014; Iranmanesh *et*
4 *al.*, 2018). Additionally, Muslim customers as one of the big targeted markets of food
5 companies, demands assurance on the food they consume is holds the integrity of Islamic
6 principles manifestation (Hosseini *et al.*, 2019; Wilson *et al.*, 2013; Tieman, 2011; Zailani *et*
7 *al.*, 2017). As such, food companies need to establish a mechanism to ensure halal food
8 integrity (Mohamed *et al.*, 2020; Solatnian *et al.*, 2016), which addresses the safety, quality,
9 and *Shariah* compliance concerns of Muslim customers.

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16 The over the competition in the food industry forces food companies to outsource their
17 logistics activities and source more cost-effective raw materials, as well as, to export products
18 to a vast geographical area to enhance revenue (Ali and Suleiman, 2018; Greenberg, 2017;
19 Yunan *et al.*, 2020). Although the involvement of more suppliers and logistics service providers
20 can enhance the profit of food companies, food integrity becomes a challenging task due to the
21 complexity and length of today's' global supply chains (SC) (Ali *et al.*, 2017; Manning, 2016).
22 The previous studies have shown that supply chain integration (SCI) is crucial to address
23 uncertainties (Flynn *et al.*, 2016; Kim and Chai, 2016). SCI enables firms to develop high levels
24 of interaction and collaboration with suppliers and customers which have been regarded as key
25 enablers of SC success (Lu *et al.*, 2018; Tyagi *et al.*, 2015; Wilden *et al.*, 2013). Considering
26 the impacts of current food SC complexity on halal food integrity and the role of SCI in
27 addressing SC uncertainties, in this study, SCI was proposed as a potential enabler of food SC
28 integrity and, consequently, halal food quality.

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38 The findings of this study contribute to the literature in two ways. Firstly, the study has
39 extended the literature on food integrity by providing empirical evidence on the impacts of SCI
40 on food SC Integrity. Secondly, the findings have determined the role of halal raw material
41 integrity, halal production integrity, and information integrity, on halal food quality. From the
42 practical perspective, the findings have shed light on the impacts of SCI on halal SC integrity
43 and halal food quality and safety and will help managers to mitigate food quality, safety, and
44 contamination risks.

51 52 **2. Literature review**

53 *2.1 Halal supply chain*

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55 Tieman (2011) and Wilson and Liu (2010) defined halal as permissible, lawful, or allowed.
56 Following Islamic law, Muslims should consume halal products and avoid consuming haram
57 ones. Scholars have shown that Muslim behaviours are significantly influenced by Islamic law
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(Atal *et al.*, 2020; Iranmanesh *et al.*, 2018; Wilson and Liu, 2011). Accordingly, Muslims' utmost importance on food selection is product compliance with Islamic principles (Ali *et al.*, 2017; Tan *et al.*, 2017; Zailani *et al.*, 2019). According to Wilson and Liu (2010) and Atal *et al.* (2020), as behaviours of Muslims are affected by Islamic law, marketers should understand Islamic Law. The halal status of the foods does not only depend on their ingredients and the contamination can be occurred at the entire supply chain process including farming, manufacturing, warehousing, transportation, and retailing, as the consequence of contact between halal and haram products (Iranmanesh *et al.*, 2019). As such, halal SC has received attention as a way of reducing the risk of contamination. Segregation of haram and halal products should be practiced at post-production points namely transportation, warehouse, and store (Ab Talib *et al.*, 2015; Tieman, 2011). Tieman *et al.* (2012) proposed terminal operation, storage, and transportation as critical points of halal SC.

The customers purchase products at stores and the halal food products are certified based on their status at the manufacturing stage of SC. Zailani *et al.* (2018) explained that the contact of halal products with non-halal products or contaminated equipment causes contamination. For example, using the equipment used for transporting or storing non-halal products can cause contamination after production (where the product is certified). Halal practices should be considered in the entire SC from the time that halal products are produced and certified. Fathi *et al.* (2016, p.465) defined halal SC as “a combination of business activities from the point of origin to the point of consumption performed in accordance with the Islamic law, known as Syariah”. Khan *et al.* (2019) and Selim *et al.* (2019) categorized the halal supply chain activities to halal sourcing, halal manufacturing, halal transportation, and halal warehousing. Halal supply chain management (SCM) guarantees the halal integrity of the product at the consumption point and offers Muslim consumers the confidence that they consume halal food (Tieman, 2011). Mohamed *et al.* (2020) found a positive association between halal SCM and halal integrity.

2.1 Halal food supply chain integrity

Food integrity refers to “ensuring that food which is offered for sale or is sold is not only safe and of nature, substance, and quality expected by the purchaser but also captures other aspects of food production, such as the way it has been sourced, procured, and distributed, and being honest about those elements to consumers” (Elliott, 2014, p.84). Manning (2016) introduced four factors that need to be considered in safeguarding integrity that involve product, process,

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3 people, and data integrity. As, in response to competitive pressure, the food SC complexity and
4 length has increased and food companies use global sources and export their products to
5 various regions of the world, food integrity should be considered in the terms of the food SC.
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7 Azmi *et al.* (2019) highlighted halal integrity as one of the objectives of halal SCM. (Ali, Tan,
8
9 *et al.*, (2017b) proposed raw material, production, service, and information integrity as four
10 dimensions of food SC integrity. Raw material integrity focuses on ensuring that raw materials
11 are safe, pure, and traceable to the origin. Production integrity focuses on ensuring internal and
12 manufacturing integrity, including the integrity of the facilities, management systems, and
13 processes. Service integrity focuses on safeguarding the integrity of the food served is meeting
14 the customers' demand. Finally, information integrity is related to transparency and accuracy
15 of communication between customers and manufacturers. Commonly, manufacturers provide
16 concise information on food descriptions to customers. In this study, three dimensions of food
17 SC integrity, namely, raw material, production, and information integrity were considered and
18 service integrity was excluded as this dimension is more related to restaurants and not food
19 manufacturers.
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30 In the context of halal food, Muslim customers, in addition to food safety, want to ensure
31 that the food products meet Islamic requirements (Yusof *et al.*, 2020; Wilson *et al.*, 2013).
32 Halal food integrity is jeopardised if the followings four situations occur in SC: “a) the presence
33 of a prohibited animal (i.e., pig, boars, swine, carnivorous animals and birds, and animals that
34 have died from natural causes); (b) contamination with blood or *najis* (filth) (i.e., carrion and
35 dead animals); (c) the presence of intoxicants (alcohol); and (d) the use of the wrong method
36 of slaughter or the wrong blessing” (Tan *et al.*, 2017). Food safety is a part of halal food
37 integrity as according to Islamic law, the food should be pure, good for human consumption,
38 and lawful (Soon *et al.*, 2017). In this study, halal food SC integrity was operationalised by
39 integrating the halal concept with three dimensions of food integrity (raw material, production,
40 and information integrity). Around 400 halal-certifying bodies exist worldwide but there is a
41 lack of globally accepted criteria (Zailani *et al.*, 2017) and, consequently, this has undermined
42 efforts for halal food integrity (Halim and Salleh, 2012). Considering the weakness of halal
43 certifications to ensure halal food integrity, this study proposed SCI as a measure to achieve
44 halal food integrity.
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2.2 Supply chain integration

Supply chain integration (SCI) has received increasing attention from scholars and practitioners (Lii and Kuo, 2016; Mora-Monge *et al.*, 2019; and Wiengarten *et al.*, 2016). SCI is defined as “the extent to which SC members work cooperatively together to achieve mutually beneficial outcomes” (Kannan and Tan, 2010, p. 207). The previous studies have shown the importance of SCI in achieving competitive advantages, such as reducing operational costs (Kim and Schoenherr, 2018) and improving product innovation (Wong *et al.*, 2013), and enhancing SC performance (Lu *et al.*, 2018; Yu *et al.*, 2018).

SCI can be collapsed into three components; internal integration (II) and external integration. II denotes the degree of a company are able to structure its procedures, behaviours, and practices into manageable, synchronised, and collaborative processes to achieve the company’s goals and fulfill customer requirements (Huo *et al.*, 2015; Zhao *et al.*, 2011). External integration is further calssified into two main dimensions; customer integration (CI) and supplier integration (SI). CI refers to “the extent to which customers and manufacturers coordinate decisions related to inventory level, production planning, demand forecasting, order tracking, and product delivery” (He *et al.*, 2014, p. 261). SI refers to “the extent to which suppliers and manufacturers coordinate decisions related to inventory management, collaborative planning, forecasting, replenishment, and the flows of physical resources” (He *et al.*, 2014). From the perspective of halal food industry, the lack of internal and external integration may prevent a firm from achieving its halal food integrity goal due to the existence of incompatible goals and objectives amongst the SC partners (Ali *et al.*, 2019).

3. Resource-based view theory

The resource-based view (RBV) theory is grounded on resources and capabilities as two drivers of competitive advantage and performance. A resource is considered as the core in the RBV theory due to its main role in providing inputs to the firm’s processes and activities (Barney, 1991), whereas capabilities arise as a result of the firm’s ability in creating value of the process through utilising and combining the resources (Amit and Schoemaker, 1993). The RBV theory suggests that a firm contains resources and some of these resources are called strategic resources that are rare, valuable, and imperfectly imitable, and substitutable (Barney, 1991). Strategic resources may cause heterogeneity amongst firms and result in sustainable competitive advantages. According to SC scholars, internal and external integration with

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3 suppliers and customers can be considered as internal strategic resources that can result in a
4 competitive capability and, consequently, improve firm performance (Barney, 2012;
5 Leuschner *et al.*, 2013). Due to Muslim customers' calls for food safety and *Shariah*
6 compliance, and high competition in the industry, halal SC integrity is considered as a valuable
7 competitive capability that may enhance the food quality. As such, according to the RBV
8 theory, internal, customer, and supplier relationships are strategic resources of halal food
9 manufacturers that affect halal food SC integrity as a valuable and rare capability that affects
10 food quality performance.
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19 **4. Conceptualisation and hypotheses development**

20 Drawn on the RBV theory and literature, this study has explored SCI in the context of internal
21 integration (II), supplier integration (SI), and customer integration (CI), that have effects on
22 the halal SC integrity dimensions, including halal raw material (RMI), halal production (PI),
23 and information integrity (INFI) which, in turn, will lead to halal food quality performance
24 (QP) as depicted in Figure 1. The hypotheses were developed and explained in the following
25 sub-section.
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38 *4.1 Internal integration and external integration*

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40 Amongst the three types of SCI, II is viewed as a top priority in establishing an effective SCM
41 before extending synchronisation between the supplier and the customer. The capability of a
42 company to integrate with its suppliers and customers depends on the level of its II (Zhao *et*
43 *al.*, 2011). From the organisational capability perspective, the company that has a high level of
44 integration is capable of interpreting and evaluating new knowledge from customers and
45 suppliers and, consequently, learning from external partners and coordinating with them (Lane
46 *et al.*, 2006). From the information sharing perspective, the firm that already has access to
47 internal systems for sharing information amongst their internal functional units is capable of
48 and has a foundation to link with customers and partners (Zhao *et al.*, 2011). From the strategic
49 cooperation perspective, the interaction amongst employees of different functional
50 departments facilitates the integration with customers and suppliers (Swink *et al.*, 2007). From
51 the working together perspective, internal teamwork may enable a firm to communicate with
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3 its partners and address the SC issues more effectively. Literature have shown that II has a
4 positive relationship with external integration; SI and CI (Horn *et al.*, 2014; Huo, 2012;
5 Rodrigues *et al.*, 2004; Stank *et al.*, 2001; Zhao *et al.*, 2011). Accordingly, the positive effect
6 of II on external integration amongst halal food firms was proposed in this study as follows:
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11 H1. II has a positive effect on (a) SI and (b) CI.
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14 15 16 *4.2 Internal integration and halal food SC integrity* 17

18 II smoothens the progress of sharing firms' aims and enables the utilisation of each functional
19 area's capabilities (Schoenherr and Swink, 2012; Williams *et al.*, 2013). Additionally, the
20 adoption of other quality management concepts, such as total quality management and lean, is
21 facilitated with II (Zhao *et al.*, 2011). Through II, a firm may ensure that all departments and
22 employees understand the strategic goal of the firm (i.e., food integrity) and have compatible
23 goals and objectives for food integrity (Johnson, 1999). II enhances the visibility of the firm,
24 accuracy of the information flow (Zhang *et al.*, 2018), and the firm's capability to prevent
25 potential conflicts (Moyano-Fuentes *et al.*, 2016) which, in turn, will enhance the
26 understanding of the firm's objectives, especially regarding the food integrity. Joint decision-
27 making and planning also enable employees of a company to identify the issues and challenges
28 (Williams *et al.*, 2013) that may enhance the extent of food integrity. Halal integrity is an
29 example of companies' strategic goals that require inter-departmental collaboration, thus,
30 developing and enhancing II is vital. Donk *et al.* (2008) have strongly argued that food integrity
31 is closely associated with SCI via three main dimensions, namely, raw materials, production,
32 and information. In light of this, this study hypothesised that:
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45 H2. II has a positive effect on (a) RMI, (b) PI, and (c) INFI.
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50 51 *4.3 Supplier integration and food supply chain integrity* 52

53 Lee *et al.* (2007) have suggested that management should focus more on SI and II before
54 integrating downstream with customers. Recently, many product recalls were rooted in the
55 upstream of the SCs (Tse and Tan, 2011). SI can be a beneficial tool to mitigate the risk causing
56 the product recalls by enabling better SC transparency and visibility (Ali *et al.*, 2017; Tse and
57 Tan, 2011). According to Devaraj *et al.* (2007), SI contributes significantly to operational
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3 performance such as product quality. SI enables suppliers to understand the goals and
4 objectives (i.e., halal food integrity) of the focal firms (Flynn *et al.*, 2010). Through SI, the
5 suppliers can become aware of the buyers' operational activities and meet their needs (Ralston
6 *et al.*, 2015). Suppliers involvement in companies' activities such as product development and
7 improvement projects, enabling mutual understanding of the customers' needs (i.e., halal food
8 integrity) and how to fulfill their needs (Schoenherr and Swink, 2012).
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14 A firm can develop strategic SI by structuring its strategic goals and plans and involving
15 the suppliers in developing and adjusting competitive strategies (Swink *et al.*, 2007; Wong *et*
16 *al.*, 2011). Developing competitive strategies jointly with suppliers allows a firm to meet its
17 objectives and customer needs by leveraging the suppliers' capabilities (Schoenherr and Swink,
18 2012). Literature highlights the significant role played by SI in increasing food integrity
19 (Storoy *et al.*, 2013). This research has attempted to analyse the relationship between SI and
20 performance which was evidenced by Frohlich and Westbrook (2001), Rosenzweig *et al.*
21 (2003), and Wong *et al.* (2011) in the context of food integrity and quality. There have been
22 remote cases in which studies did not support the SI effect on quality performance (e.g.,
23 Koufteros *et al.*, 2005; Swink *et al.*, 2007). However, in food SCs, quality and integrity
24 parameters are complex to ascertain and the product is not able to be modulated (Grunert, 2005;
25 Tunçer, 2001), therefore getting the production right from the very beginning is crucial where
26 SI plays a bigger role. For that reason, this study hypothesised that:
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37 **H3.** SI has a positive effect on (a) RMI and b) PI.
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41 *4.4 Customer integration and food supply chain integrity*

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43 CI involves understanding customers' needs and wants and tailoring internal activities to meet
44 these requirements (He *et al.*, 2014; Jayaram *et al.*, 2011). Previous operation management
45 literature concerning SCs has shown that relatively less research has concentrated on CI alone,
46 compared to the other two SCI typologies. The importance of CI cannot be disregarded since
47 many researchers have claimed that it is directly related to quality performance, such as product
48 quality and cost of quality (Ali *et al.*, 2017; Tan *et al.*, 2017; Wong *et al.*, 2011). Furthermore,
49 consumers have a strong influence on product development and product offerings, especially
50 from the context of health, diet, religious beliefs, and other sensitive issues (Iranmanesh *et al.*,
51 2019; Premanandh, 2013). A strategic CI is needed for the food manufacturers as insurance in
52 regaining consumer trust in the aftermath of any scandal or amid speculations that may have
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3 arisen, leading towards significant losses (Marucheck *et al.*, 2011). This argument leads to the
4 development of the following hypotheses:
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6 **H4.** CI has a positive effect on (a) PI and (b) INFI.
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10 *4.5 Halal food SC integrity and quality performance*

11 The growing market and limited supply within the halal food industry has led the halal
12 manufacturers to seek solutions in fulfilling demands (Tan *et al.*, 2017). The promising and
13 untapped market has led to the extension and global complexity of the halal food SC. The more
14 complex SC can be the cause and avenue of frauds, mishandlings, and contamination with non-
15 halal products that can happen at any stage in the SC. The halal-related scandals exemplify that
16 halal labelling cannot be relied solely upon as a guarantee to the food integrity and quality (Ali
17 *et al.*, 2017; Fathi *et al.*, 2016). As such, RMI is needed to ensure the halal integrity and safety
18 of the raw materials and ensure products on the market are reliable of its status quo that meet
19 the regulations and customers' needs. Furthermore, PI enables firms to eliminate the risks of
20 contamination during the production stage (Ali *et al.*, 2017). INFI is needed to enhance
21 visibility by exchanging the origins, history, and traceability of food products (Trienekens *et*
22 *al.*, 2012). Accordingly, this study proposed RMI, PI, INFI as drivers of quality performance,
23 and the following hypotheses were developed:
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34 **H5.** RMI has a positive effect on QP.

35 **H6.** PI has a positive effect on QP.

36 **H7.** INFI has a positive effect on QP.
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41 **5. Research methodology**

42 *5.1 Measurement of the constructs*

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44 To measure the constructs of the study, a structured questionnaire was used. The items of the
45 constructs were adapted from previous studies (as shown in Table 3) in ensuring content
46 validity. A seven-point Likert scale anchored by “not at all” to “very great extent” was used
47 in this study.
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54 *5.2 Sample and data collection*

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56 The population of this study consisted of all halal food companies in Malaysia that were
57 certified by *Jabatan Kemajuan Islam Malaysia* (JAKIM), the Malaysian halal certification
58 body. JAKIM and their food standard are recognized all over the world (Latif *et al.*, 2014;
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3 Zailani *et al.*, 2017). This study limits and framed the sample to the companies certified by
4 JAKIM to ensure the respondents have adequate knowledge to answer the questions about halal
5 integrity. From the JAKIM halal directory, approximately 4,200 halal-certified firms listed in
6 the JAKIM halal directory. This study targeted SC managers, production managers, and quality
7 managers as they were directly involved in SCI and food integrity, which made them
8 knowledgeable and experienced to answer the questionnaire items.
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14 The targeted companies were called to obtain the appropriate respondents' information
15 such as names and email addresses. The link of the questionnaire was emailed to 750 randomly
16 selected halal-certified companies, which were followed up by phone calls at one-month
17 intervals. An online survey method is designed for this research to reach a broader and more
18 diversified population at a relatively low cost. In total, this research managed to collect 275
19 useful responses (36.7 percent response rate). According to Podsakoff *et al.*(2003), a low
20 response rate may cause non-response bias. It means those who participate in data collection
21 are different from those who do not respond to the questionnaire. To investigate the non-
22 response bias, we compare early and late respondents by running the Mann-Whitney U test on
23 several variables. Table 1 and the p-values (greater than 0.05) indicate the early responses and
24 responses of this research are not statistically different. Therefore, the collected data were not
25 affected by the time of responses, and non-response bias did not cause bias.
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41 The short questionnaire enables this research to scrutinize the completeness of the
42 feedback form. The majority of the responses were obtained in person, thus reducing the
43 possibility of missing data. For data collected through the online survey, an effort was taken in
44 getting back the responses on the missing data were made through telephone calls. In all, there
45 were 7 cases of missing data (more than 15% of the questionnaire) which led the author to
46 exclude them from further analysis. Nevertheless, the author was unable to track and get the
47 feedback for the 7 cases stipulated above. Otherwise, all the feedbacks were confirmed for
48 completeness. Following Podsakoff *et al.* (2003) recommendation, this study tested the
49 common method variance (CMV) using Harmann's one-factor test. The CMV result indicates
50 the value of 36.045 percent, therefore suggesting CMV was not a major concern and not
51 affecting this research validity (Esmailifar *et al.*, 2020; Subramaniam *et al.*, 2019).
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3 The profile of firms is provided in Table 2. According to the descriptive analysis, small-
4 medium enterprises (SMEs) (of less than 200 full-time employees) dominated the study's
5 respondents (87.3%). Regarding the sales revenue, around 63.6% of the companies' sales
6 revenues were less than USD 1 million and only 12% were above USD 5 million.
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15 5.3 Data analysis 16

17 To test the hypotheses, the study conducted the partial least squares (PLS) technique using
18 SmartPLS 3.0 software (Ringle *et al.*, 2015). According to Hair *et al.* (2019) recommendation,
19 the PLS technique was used in this study due to the exploratory nature of the study and also
20 the ability of PLS to test both reflective and formative constructs. Accordingly, the two-step
21 approach: (1) measurement model and, (2) hypotheses testing using a non-parametric
22 bootstrapping technique, was used to test the proposed model of the study (Nikbin *et al.*, 2015;
23 Iranmanesh *et al.*, 2017).
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33 6. Results 34

35 6.1 Measurement model evaluation 36

37 For the reflective constructs, the convergent validity was assessed by three criteria, namely,
38 each item loading should have been above 0.7 and each construct composite reliability (CR)
39 and average variance extracted (AVE) values should have been greater than 0.7 and 0.5,
40 respectively (Hair *et al.*, 2019). According to the results, all items and constructs met the
41 thresholds and the convergent validity was established. For the formative constructs (Table 3),
42 following Hair *et al.* (2019) criteria guideline, convergent validity, indicator collinearity, and
43 statistical significance of the indicator weight were investigated. Based on the results, the
44 correlation of the formative constructs and single-item constructs were above 0.7, the variance
45 inflation (VIF) values were less than 3, and all indicators were statistically significant and
46 relevant (Hair *et al.*, 2019).
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3 Heterotrait-monotrait (HTMT) analysis was used to evaluate the discriminant validity
4 (Henseler *et al.*, 2015; Foroughi *et al.*, 2019; Kim *et al.*, 2019). The HTMT values (less than
5 0.85) are depicted in Table 4 indicating the discriminant validity of all the constructs (Kline,
6 2015). Also, this research is not suffering from the multicollinearity, where the VIF value of
7 all constructs was below 3 established in Table 5.
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21 6.2 Assessment of the structural model 22

23 The predictive accuracy of the model was evaluated based on the explained variance portion
24 (Ali *et al.*, 2019; Zailani *et al.*, 2015), and the R² values were illustrated in Table 3. To test the
25 hypotheses, non-parametric bootstrapping was applied (Wetzels *et al.*, 2009) with 2,000
26 replications (Min *et al.*, 2013; Zainuddin *et al.*, 2017; Batouei *et al.*, 2019). All the paths were
27 found significant and all the hypothesis is supported (Figure 2 and Table 6).
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33 [Insert Figure 2 about here]

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39 7. Discussion 40

41 The length and complexity of the SC in the current halal food industry have caused food
42 scandals and contamination with non-halal products. The food scandals exposed the
43 vulnerability of the laws, policies, and standards on food safety in ensuring the safety and
44 integrity of halal food. Consequently, the situation has attracted practitioners and scholars to
45 venture into alternatives and supplementary techniques that may mitigate the risks of such
46 scandals to reoccur. In this study, SCI, including II, SI, and CI, were introduced as a strategic
47 source of a halal food company that may have an influence on the halal RMI, PI, and INFI
48 which, in turn, could lead to halal food QP.
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55 The impacts of internal integrity on SI and CI were supported. These results corroborate
56 with the findings of Huo (2012) and Zhao *et al.* (2011). These results imply that, the more
57 extensive of II in halal food companies, the more extensive of SI and CI can be achieved. As
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3 such, the companies need to pursue II before planning to enhance SI or CI. Furthermore, the
4 results indicate that II has positive direct effects on RMI, PI, and INFI. II is a critical driver of
5 SI and CI that can further enhanced halal SC integrity. In other words, halal food companies
6 need to progress from effective II to more extensive SI to achieve halal RMI and PI, whilst
7 progressing to more extensive CI to achieve halal PI and INFI. The significant effect of SI on
8 RMI and PI was consistent with the findings of Frohlich and Westbrook (2001), Rosenzweig
9 *et al.* (2003), and Wong *et al.* (2011) who showed the important role of SI to quality
10 performance, which this study evidenced in the context of food integrity and quality.
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18 All three dimensions of SCI had positive effects on PI. These findings were in line with
19 the finding of Donk *et al.* (2008) who indicated that food integrity is associated with three
20 dimensions of SCI. The magnitude of both the supplier and customer relationships' effects on
21 production integrity were mostly the same which indicates that halal food companies should
22 equally invest in and notice SI and CI in order to achieve their halal production integrity goals.
23 Although, internal integrity has less effect on production integrity in comparison to the external
24 integration factors, its high effect on both the supplier integrity and CI indicates its critical role
25 in achieving halal production integrity.
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32 The impacts of both II and CI on INFI were significant. These results were consistent with
33 the finding of Donk *et al.* (2008). As such, in addition to II, the food companies need CI, such
34 as process coordination with customers, communication and information sharing, strategic
35 alliance with customers, and customer relationships, because they directly influence
36 information sharing. In comparison to II, external integration (SI and CI) have higher direct
37 effects on all three dimensions of halal food SC integrity. This can be explained by the stages
38 of SCI as suggested by Stevens (Stevens, 1989). According to this theory, II is a low level of
39 SCI, whereas SI and CI are high levels of integration, in which external partners of the SC are
40 also integrated and, consequently, these two types of integration have more direct effects on
41 firms' capabilities, in this case, the halal SC integrity.
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51 According to the findings, all three dimensions of halal SC integrity had positive effects
52 on halal food quality performance. The findings were consistent with the results of Ali *et al.*
53 (2017) who found halal raw material integrity, halal production integrity, and information
54 integrity as being enablers of eliminating the risk of contamination amongst the SC processes.
55 As such, the halal food companies should develop and enhance food traceability, management,
56 and process systems, and communicate properly with customers to achieve higher levels of
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3 halal food safety and quality. Finally, it is important to highlight, SCI may facilitate halal SC
4 integrity and, accordingly, lead to food safety.
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10 **8. Theoretical and practical contributions**

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12 The findings of this study have both theoretical and practical contributions. From the
13 theoretical perspective, the findings of this study extend the literature on halal food safety by
14 exploring the impacts of SC integrity on quality performance. Specifically, halal raw material
15 integrity, halal production, and information integration have positive significant effects on food
16 quality. Amongst these three dimensions of food SC integrity, halal production plays the most
17 important role. Furthermore, this study extends the literature through investigating the SCI
18 impact on halal food SC integrity. This study found that indicate that halal RMI is not only
19 driven by SI, but is highly dependent on the II itself. Similarly, INFI depending upon both II
20 and CI. In a nutshell, all three SC integrations, namely, II, SI, and CI, play important roles in
21 shaping halal SC integrity.
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30 From a practical perspective, the findings of this study will be useful for managers of halal
31 food companies to mitigate the risks of scandals and contamination amongst SCs. The
32 significant effects of all three dimensions of halal food SC integrity on food quality indicate
33 that food companies should safeguard the integrity in the raw materials, production, and
34 information sharing. It means that the companies should ensure that their raw materials are safe
35 and pure and that the facilities and production process will not cause any contamination, and
36 finally, they must communicate properly with customers and provide a concise food
37 description to customers. To successfully achieve halal food SC integrity, SCI is needed. It is
38 important to highlight, that II is a driver of customer integrity and SI. It means that food
39 companies should establish a sound II prior moving on to external integration. For example, if
40 a weak II resides within a company, such as less teamwork and communication amongst the
41 functional departments or poor internal data integration, it will be a daunting case for the
42 company to work with suppliers and customers. Eventually, achieve halal food SC integrity
43 and food quality will be challenging. As such, II is the initial stage of external integration and
44 food integrity that needs special attention from the managers of food companies. Furthermore,
45 the significant effect of information integrity on quality performance suggests non-certified
46 companies that getting halal certification and sharing it with customers, as a practice of
47 information integrity, can lead to higher food quality performance.
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9. Limitations and future studies

Whilst the objectives of the study were successfully addressed in this study and the findings contribute towards the understanding of the relationships amongst SCI, halal food SC integrity, and halal food quality performance, some limitations should be addressed in future studies. Firstly, the study focused on SCI as a strategic resource of food companies, future studies are needed to investigate the impacts of supplier development practices, including supplier monitoring, supplier development, incentives, and supplier collaboration on enhancing the extent of food safety. Furthermore, the data were collected from halal-certified food manufacturers in Malaysia. A future study could test and validated the model used in this study amongst other food manufacturers in different food settings, such as kosher, vegan, and vegetarian, as well as in different countries. Finally, although the findings highlight the critical role of II in achieving external integration and, consequently, food integrity, the factors that may lead to the success of II were not investigated in this study. A future study should unravel the factors that halal food companies should consider to successfully integrate their functional departments throughout the firm.

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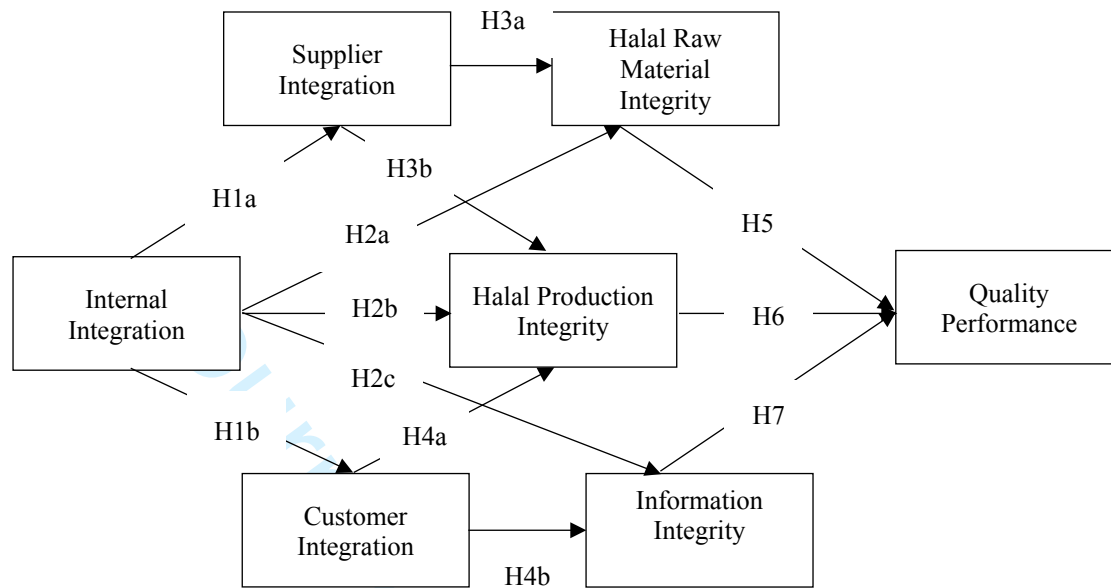


Figure 1. Conceptual Framework

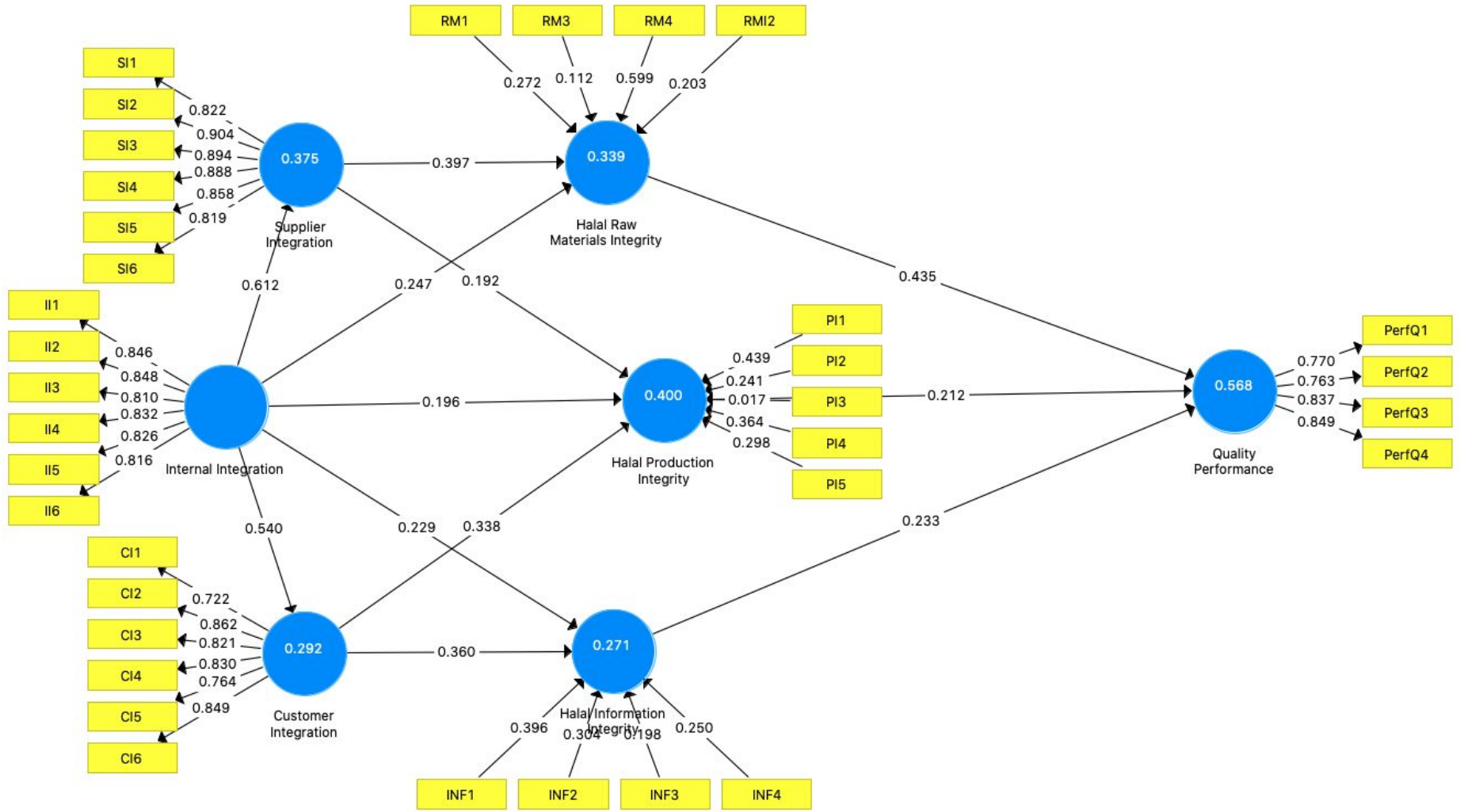


Figure 2. Hypotheses Results Summary Extracted from SmartPLS3.0

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Table 1. Assessing Non-Response Bias

	Comp. Status	Sales Revenue	Number of Product
Mann-Whitney U	1150.000	1095.000	1151.000
Z	-1.676	-1.122	-.719
Asymp. Sig. (2-tailed)	.094	.262	.472

Table 2. Profile of Firms

Classification		No. of respondents	%
Firm size	SME	240	87.3
	Large Enterprise	35	12.7
	Total	275	100
Sales Revenue (in USD)	<1m	175	63.6
	1m to 3m	44	16
	3m to 5m	23	8.4
	>5m	33	12
	Total	275	100
Number of Products	1 to 4	83	30.2
	5 to 9	105	38
	10 to 15	32	12
	>15	55	19.8
	Total	275	100

Table 3. The Results of Measurement Model Evaluation

Items	Scale Type	Loadings/ Weights	CR	AVE	R ²	GMC	VIF
Customer Integration (Flynn et al., 2010; Swink et al., 2007; Wong et al., 2011)	Reflective		0.909	0.625	0.289	NA	
Maintain close contacts with our customers		0.722					NA
Results of customer satisfaction surveys are shared with all employees		0.862					NA
Actively create opportunities for employee–customer interaction		0.821					NA
Have a formal “customer satisfaction” programme		0.830					NA
Have high level of information sharing (market information)		0.764					NA
Share our information (information technologies) with our customers		0.849					NA
Internal Integration (Flynn et al., 2010; Narasimhan and Kim, 2002; Wong et al., 2011; Zhao et al., 2011)	Reflective		0.923	0.668		NA	
Have high data integrations across functional areas		0.846					NA
Have an integrated system across functional areas		0.848					NA
Within our plant, we emphasize on information flows among departments (i.e. purchasing, production, sales, quality and distribution department)		0.810					NA
Within our plant, we emphasize on physical flows among		0.832					NA

departments (i.e. production, packaging, warehousing and transportation department)						
We involve cross-functional teams in process improvement and NPD	0.826					NA
We have periodic interdepartmental meetings across functional area	0.816					NA
Supplier Integration (Flynn et al., 2010; Narasimhan and Kim, 2002; Wong et al., 2011)	Reflective	0.892	0.580	0.373		NA
We share with our suppliers our quality information	0.822					NA
Our suppliers share with us their quality information	0.904					NA
Our suppliers share with us their production quality improvement process	0.894					NA
We have a high degree of strategic partnership with our suppliers	0.888					NA
We have a high degree of joint planning to obtain the quality standard with suppliers	0.858					NA
We involve our suppliers in product development process	0.819					NA
Raw Materials Integrity (Ali et al., 2017)	Formative	NA	NA	0.334	0.782	
High performance products that meet halal product	0.272					1.463
Produce a consistent quality of the halal products	0.112					1.506
Offer high reliable halal products that meet the regulations and customer needs	0.599					1.687
High quality product that meet our customer needs	0.203					1.844
Production Integrity (Ali et al., 2017)	Formative	NA	NA	0.394	0.793	
We are able to improve our critical point of production	0.439					1.857
We are able to eliminate halal risk from non-halal sources	0.241					1.550
We are able to do product recalls efficiently	0.017					1.782
We are able to verify halal quality	0.364					1.919
We are able to handle materials efficiently	0.298					1.594
Information Integrity (Ali et al., 2017)	Formative			0.266	0.847	
We share with our customers our business unit proprietary information	0.396					1.307
We share with our customers our halal certificates	0.304					2.480
We share current and true information	0.198					2.720
We share with our customers product ingredients	0.250					2.257
Quality Performance (Wong et al., 2011)	Reflective	0.867	0.621	0.563		NA
High performance products that meet halal product	0.770					
Produce a consistent quality of the halal products	0.763					
Offer high reliable halal products that meet the regulations and customer needs	0.837					
High quality product that meet our customer needs	0.849					

Table 4. Hetrotrait–Monotrait Ratio (HTMT) Test

	CI	II	SI	QP
CI				
II	0.595			
SI	0.781	0.663		
QP	0.617	0.337	0.457	

Notes: CI: Customer Integration; II: Internal Integration; SI: Supplier integration; QP: Quality performance

Table 5. Construct VIF value

	CI	II	INFI	PI	QP	RMI	SI
CI			1.411	2.107			
II	1.000		1.411	1.657		1.599	1.000
INFI					1.577		
PI					1.795		
QP							
RMI					1.705		
SI				2.389		1.599	

Notes: CI: Customer Integration; II: Internal Integration; SI: Supplier integration; QP: Quality performance

Table 6. Hypotheses Testing Result

Hypotheses and Relationships	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values	
H1a II → SI	0.612	0.614	0.046	13.360	0.000	Supported
H1b II → CI	0.540	0.542	0.047	11.391	0.000	Supported
H2a II → RMI	0.247	0.247	0.069	3.589	0.000	Supported
H2b II → PI	0.196	0.191	0.077	2.561	0.010	Supported
H2c II → INFI	0.229	0.232	0.076	3.002	0.003	Supported
H3a SI → RMI	0.397	0.400	0.070	5.680	0.000	Supported
H3b SI → PI	0.192	0.191	0.090	2.123	0.034	Supported
H4a CI → PI	0.338	0.349	0.091	3.721	0.000	Supported
H4b CI → INFI	0.360	0.362	0.076	4.739	0.000	Supported
H5 RMI → QP	0.435	0.433	0.059	7.361	0.000	Supported
H6 PI → QP	0.212	0.218	0.075	2.840	0.005	Supported
H7 INFI → QP	0.233	0.232	0.066	3.510	0.000	Supported

Notes: CI: Customer Integration; II: Internal Integration; SI: Supplier integration; QP: Quality performance

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3 **Reviewer(s)' Comments to Author (JIMA-08-2020-0250.R1)**
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6 Reviewer(s)' Comments to Author:
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8 We believe almost all of the changes have been made successfully. The only task not
9 undertaken is consideration/critique of the highly cited papers attached previously. Once this
10 has been done, then the manuscript should be ready for publication
11

12 Thank you. The manuscript was strengthened using the attached articles.
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