
The Moderating Effect of Halal Traceability System on Halal Food Supply Chain Management and Halal Integrity Assurance Relationship

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Abstract

Purpose: The main purpose of this study is to empirically investigate the effect of halal food supply chain management on halal integrity assurance with moderating variable of halal traceability system.

Design/ methodology/ approach: This study employed a quantitative research approach, in which survey questionnaires were distributed to 475 Malaysian halal food and beverages companies. A moderated hierarchical regression technique was applied to examine the moderating effect of the hypotheses.

Findings: The results revealed that halal traceability system was found to moderate the halal food supply chain management and halal integrity assurance. Halal traceability system had also been found to significantly moderate the supply chain logistics control and supply chain resources on halal integrity assurance relationships.

Research Limitations/ Implication: This study focuses on the halal industry in Malaysia specifically for food and beverages producers, its findings cannot be generalized to other business categories. Issues of applicability of this study to other countries also need to be considered.

Practical Implication: This study addresses the assurance of halal integrity as a crucial element in managing a halal food supply chain in halal food industry. It has empirically identified the moderating role of halal traceability system to strengthen the halal food supply chain integrity assurance in halal food industry.

Social Implications: The study has successfully filled the gap in literature by empirically establishing the moderating role of halal traceability system on halal food supply chain integrity assurance. This result has presented a better understanding of halal integrity assurance concept application in society.

Originality/Value: This study is one of very few studies which have empirically link halal traceability system, halal integrity assurance and halal food supply chain management in the halal food industry. The paper's primary contribution is the finding support to the integration

of halal integrity context as an important determinant in present halal food supply chain model in accordance with Islamic requirements.

Keywords: Halal traceability system, Halal food supply chain integrity assurance, Halal food supply chain management, Halal food product, Halal food industry

1. Introduction

Food quality and its safety are among the major concerns to many consumers around the world.

Consumers are more concerned about such issues than anything else because of their beliefs, values and eating habits (Muhammad *et al.*, 2009; Zailani *et al.*, 2010a). *Halalan-toyyiban* product means any product which are not harmful and safe to be consumed as underlined by *Shariah* law, and thus is allowable and permissible (Omar *et al.*, 2013). The beliefs in *halalan-toyyiban* concept made Muslim consumers become aware on the status of halal food products they consume. Among them are the issues related to halal integrity assurance whereby the halal food producers must comply with all the regulations set by Malaysian halal authorities (Arif and Sidek, 2015; Zailani *et al.*, 2010a). Good management can guarantee quality (Norazmi *et al.*, 2019; Norazmi, 2020; Zaid *et al.*, 2020; Fauziyana *et al.*, 2021; Zaid *et al.*, 2021).

The country was once shocked by the finding of two popular brands of Cadbury chocolate products found containing pig DNA (porcine) following random testing made by the Ministry of Health (MoH) on the product taken from the shelves (Lai and Nawawi, 2014). In a similar case, Muslim consumers were stunned when freshwater catfish, raised in an aquaculture farm were fed with pig carcasses and other cross-contaminated food sources (Mok, 2019). The issue get triggered when it started to viral off in the newspaper and the social media. Even a butter manufacturer was also faced with cross-contamination issue where pig DNA (porcine) was found in their products. It was then traced back to the repackaging plant in Malaysia where the cross-contamination occurred during the packaging process (Ling, 2011). Problems of inefficient leadership and management may be a factor to this (Rosnee *et al.*, 2021; Roszi *et al.*, 2021; Saadiah *et al.*, 2021).

These events have led some consumers questioning the integrity assurance of halal food products produced in Malaysia. Investigations into the production process revealed weaknesses in sustaining halal food integrity. As a response, the Department of Islamic Development Malaysia (JAKIM) proposed the need for critical monitoring of every halal food product as well as random inspections to ensure halal compliance. With the increasingly available brands and varieties of food in the market, the authenticity of halal food products also has elevated the concerns among Muslim consumers around the world (Fadzillillah *et al.*, 2011; Azlisham *et al.*, 2021; Nik Nurharlida *et al.*, 2021). The status of halal food products has also become suspicious with the growing numbers of non-Muslim producers and foreign multinationals dominating the halal food industry. It seems that the suppliers and producers do not understand the special requirements in handling of halal food products (Arif and Sidek, 2015; Ishak *et al.*, 2021).

Food products are produced and come from all parts of the world. The food products travel a greater distance and involve a lot of handlings along a supply chain before they reach the consumers, thus the integrity assurance of halal food products must therefore be monitored and controlled to satisfy consumers with the authentic halal food products. Muslims consumers are aware that the *halalan-toyyiban* concept is not only restricted to the sources of food ingredients, but also includes processing, food handling, packaging, storing and delivering (Alam and Sayuti, 2011; Firkhan et al., 2021). It could not be considered as halal in the event that the food product was not handled or stored correctly.

In order to develop a clean, reliable and untainted halal food supply chain, there is a need for every party of the supply chain i.e. supplier, manufacturer, logistics service provider and end-user to be monitored, so that consumers can satisfy with the authenticity of the halal food products (Bahrudin *et al.*, 2011). Therefore, the adoption of halal traceability system as a halal tracking and monitoring mechanism along a supply chain is highly sought both from the side of producers and consumers as the key component towards safeguarding the halal integrity of the supply chain in accordance with *Shariah* compliant. According to Zulfakar *et al.* (2014) the traceability also can be used to trace the *halal* status of particular food products at every stage of the supply chain and can increase the *halal* transparency and strengthens the *halal* integrity assurance.

Although numerous studies have been conducted in halal integrity assurance, halal food supply chain management and halal traceability system, there is no empirical study so far that has examined the moderating role of halal traceability system on the relationship between halal food supply chain (HFSC) management and halal integrity assurance (HIA). Thus, in order to help bridge the literature gap, this study attempts to evaluate the role that the halal traceability system plays in halal food supply chain integrity assurance.

2. Halal Integrity Assurance (HIA)

One of the main and unique characteristics of halal products is the aspect of halal-ness or a term called halal integrity. Halal integrity means that the product remains halal from the upstream to the downstream supply chain, free from any activities and processes that might breach the halal status; intentionally or unintentionally (Zulfakar *et al.*, 2012). The halal integrity clearly presents the details of the halal status of a product and assures that the requirements for halal as stated are met (Mohamed *et al.*, 2016; Soon *et al.*, 2017). Tieman (2011), Khan (2009), Lodhi (2009) agree that halal integrity assurance is the key factors in developing a well trusted halal food supply chain in the current complex and competitive environment. Alserhan (2015) pointed out that halal integrity ensuring the entire supply chain should be perfect that brings the assurance of the manufactured product are truly halal according to *Shariah* law.

Halal products, when compared to other products, are produced according to the concept of *halalan-toyyiban* (according to the principles of Islamic laws and health quality). The concept requires the product to meet the essential element of *halal* and *toyyib* that is good, hygienic, clean, high quality and safe for human consumption. This is a holistic approach that not only

focuses on the product's physical attributes but also stresses on the moral behavior throughout the halal food supply chain management (Mohamad and Hassan, 2011). The word *toyyiban* is translated as good, pure, wholesomeness, healthy and nutritious, meaning pure both in the physical and the moral aspects. This study is intended to empirically investigate the impact on halal integrity assurance (HIA) due to halal food supply chain (HFSC) management with moderating role of halal traceability system.

3. Halal Food Supply Chain (HFSC) Management

The primary indicator of a successful halal industry is the assurance of halal integrity. The halal integrity offers assurance, thus create more demand for authentic and genuine halal products. There are a number of supply chain processes that determine halal integrity assurance. This is why importance is placed on sustaining halal integrity along a supply chain from production to consumption. The processes along the supply chain include sourcing of ingredients, procurement, manufacturing, and handling of product, storage, transportation, delivery, and distribution which must follow the *Shariah* principles. For the supply chain to be deemed satisfactory for halal food, it must follow all the Islamic dietary laws from production to consumption stages. Intentionally including forbidden ingredients or substance in any amount is prohibited and all stages of the supply chain must be strictly regulated to guarantee halal product integrity (Lodhi, 2009).

Pahim *et al.* (2012) stated that consumer consumption trends have widened their focus from halal products to include the supply chain for the purpose of ensuring product integrity, hence the recognition of the halal food supply chain. Studies also have showed that consumers are more conscious about their food intake and demand more from the halal food supply chain to extend the integrity of halal products (Talib and Razak, 2013). In addition, Shafie and Othman (2006) pointed out due to cases that questioned the status and integrity of halal products made it imperative for halal food supply chain management to be taken seriously. This study expects HFSC management to have positive influences the HIA. Thus, the relationship between the halal food supply chain management and halal integrity assurance needs to be further explored.

H1: HFSC management has a positive effect on HIA.

Following an extensive literature review and discussions on the existing supply chain models, the halal supply chain (HSC) management consists of the following dimensions.

Supply Chain Objectives (SCO)

Halal integrity is determined by various manufacturing processes along a supply chain. These processes play a huge role in safeguarding halal integrity from production to consumption (Tieman, 2011). According to Alserhan (2010), the halal supply chain approach should first ensure the right intention through a halal policy that serves as the basis for the organization's commitment to protect halal integrity along the supply chain. Tarmizi *et al.* (2014) added that the objective of the *halalan-toyyiban* supply chain is upholding halal integrity to make certain that Muslim consumers receive high-quality halal products. Therefore, this study expected SCO to have a positive effect on HIA.

H1a: SCO has a positive effect on HIA.

Supply Chain Logistics Control (SCLC)

The logistics control is necessary to preserve the integrity of halal products along a supply chain, especially at the delivery and distribution stages. Segregation of physical products is carried out in totality at the various storage spaces, be it warehouses, distribution centres, transit areas, or transportation units. Gubbins (2003) mentioned that dedicated halal assets referred to as a dedicated warehouse, transit place and transportation fleet as the important factors in the halal supply chain. The use of a transportation vehicles dedicated to halal goods enables seamless trade between different parties without compromising halal integrity and avoiding cross contamination. This makes it possible for worldwide marketing and delivery of local halal products.

According to Talib *et al.* (2013), assets exclusively dedicated to halal products are important to the supply chain to ensure full segregation thus improving the halal integrity assurance. In view of this, logistics service companies capable of ensuring halal product integrity are vital for halal industry to be successful (Tan *et al.*, 2012). Mixing halal and non-halal products together during transportation activities means that the halal status will prevail in a non-halal manner. The ideology of halal logistics companies is that halal integrity in the supply chain is restricted to storage containers and transportation vehicles (Tieman, 2013). Therefore, this study expects SCLC to have a positive effect on HIA. H1b: SCLC has a positive effect on HIA.

Supply Chain Resources (SCR)

The presence of competent human resources, knowledge of halal and halal logistics operation during halal food processing are crucial to the overall halal supply chain. This is to protect consumers from unintentionally consuming non-halal products, consequently it will enhance the halal product integrity. Foster *et al.* (2011) proposed that Human Resource Management (HRM) be used as a tool among supply chain and operation managers to preserve the supply chain quality. Tieman (2007a) proposed that third-party logistics (3PL) service providers be provided with proper training to make them aware of the correct way to handle halal products and services, thus reducing the cross-contamination. Moreover, producers of halal foods are to ensure every employee is knowledgeable on the halal concept to protect halal product integrity throughout the supply chain down to consumption. Therefore, this study expects a positive influence of SCR on HIA.

H1c: SCR has a positive effect on HIA

Supply Chain Business Process (SCBP)

The assurance of halal integrity is dependent on various processes along a supply chain from source to the point of consumer purchase. The processes at each stage of the supply chain inclusive of logistics operation are important to determine the integrity of halal products. Other business factors that are crucial to the halal supply chain are the procurement process, management of manufacturing flow, and fulfilment of customer order. These factors extend the integrity of halal products from production to the point of consumption. To guide companies in halal logistics operation for business purposes, warehouses, transportation, and product handling require halal control and assurance activities. Nakyinsige *et al.* (2012)

highlighted with halal certification, halal food companies can guarantee quality assurance to consumers by proving their compliance to the halal manufacturing process. Therefore, this study expects a positive influence of SCBP on HIA. H1d: SCBP has a positive effect on HIA

Supply Chain Network Structure (SCNS)

Barratt (2004) identified trust, mutuality, openness, exchange of information and communication as the success factors for the assurance of halal integrity. For example, trust between partners in the halal food supply chain is essential because halal integrity and status are guaranteed as long as it is under the control of the halal logistics service provider, but when the halal logistics service provider changes hands, cross-contamination may occur when the receiving party does not engage in halal practices. To be effective in the halal food supply chain, supply chain partners will have to trust each other by exchanging information, transparent or honest, with clear communication that will benefit each other mutually (Marzuki *et al.*, 2012). As pointed by Jaafar *et al.* (2011), the success of the halal food supply chain is the result of the collaboration and joint efforts among halal stakeholders. Therefore, this study expects SCNS to have a positive effect on HIA. H1e: SCNS has a positive effect on HIA

4. Halal Traceability System

The foundation of a successful halal industry, regardless of the types of halal products, is halal integrity. Without halal integrity, there will be no halal market, thus no halal industry. Halal product integrity is the result of various activities along a supply chain and therefore the supply chain approach is essential to safeguard halal integrity from sources to consumer purchases (Tieman, 2011). However, various parties involved in the supply chain have admitted to having difficulty safeguarding the halal integrity (Zulfakar *et al.*, 2014). This is due to the likelihood of cross-contamination or the high tendency of halal and non-halal elements being handled together along the supply chain.

Ali *et al.* (2014) viewed that the production stage of the halal food supply chain is the most important for halal integrity because it involved multiple processes. These stages consists of incoming ingredients and raw materials, mixing, processing, packaging, labelling, and storing of finished products. If minor changes are observed in the incoming ingredients for example, the halal integrity of products that were previously certified halal will be called into question. Also, halal integrity assurance can be tampered by the equipment, tools and machines used during the production. Therefore, producers of halal food should be transparent about the production process, and ensure resources are trained on how to preserve the halal integrity along the supply chain.

Zailani *et al.* (2010a) proposed the implementation of a traceability system for transparency and visibility of the production chain. With the implementation, customer trust can be gained when more information is added into the activities of the supply chain. Similarly, Zulfakar *et al.* (2014) stated that having an extensive and dependable system in the halal food supply chain increases transparency and strengthens integrity. This is because, halal traceability

system assists in sustaining halal product integrity (Melatu Samsi *et al.*, 2011; Zulfakar *et al.*, 2014). Zulfakar *et al.* (2012) proposed a conceptual framework which incorporated factors like traceability system, quality assurance system, asset specificity and trust to increase halal integrity of food supply chain.

McKean (2001) added that the objective of the traceability system is to improve transparency and visibility for data capturing along the supply chain for better halal integrity. Halal supply chain traceability is beneficial because it adds value to the supply chain and logistics (Talib *et al.*, 2015). Moreover, the traceability system guarantees the halal integrity by increasing food and production quality, and employees' awareness of the process of data capture and documentation (Donnelly and Olsen, 2012). Bevilacqua *et al.* (2009) suggested incorporating traceability into the system, along the supply chain by applying data to regulate and improve business process. Attaining halal integrity in the food supply chain requires monitoring of every party of the supply chain process, so consumers can be satisfied with the authenticity of the halal product (Bahrudin *et al.*, 2011).

According to Talib *et al.* (2015), traceability and transparency are vital to safeguard halal integrity. Various parties along the supply chain must ensure traceability of halal products to avoid any incidence of cross-contamination. This will assure consumers and risk of possible cross-contamination can be identified and rectified immediately. For an extensive halal supply chain management with minimal exposure to contamination, every stage of the supply chain from the supply, production, and logistics must be monitored so consumers can be satisfied with the authenticity of halal products. Therefore, this study expects a significant moderating effect of HTS on the relationship between HFSC (*SCO, SCLC, SCR, SCBP and SCNS*) management and HIA. Accordingly, the following hypotheses were developed.

H2: HTS moderates the effect of HFSC on HIA

H2a: HTS moderates the effect of SCO on HIA

H2b: HTS moderates the effect of SCLC on HIA

H2c: HTS moderates the effect of SCR on HIA

H2d: HTS moderates the effect of SCBP on HIA

H2e: HTS moderates the effect of SCNS on HIA

5. Research Methodology

Sample and Data Collection

The population for this study consists of halal food and beverages (F&B) industry in Malaysia. The list of the industries involved in this study was obtained from *Malaysia Halal Industry Directory 2017*. The unit of analysis of this study is the organizational level consists of halal producers that have been certified halal by JAKIM. The survey questionnaires were distributed to the respondents of various food and beverages industries in Johor, Kuala Lumpur, Selangor, Melaka and Penang in Peninsular Malaysia. A total of 475 survey questionnaires was distributed to the respondents via mail and face-to-face from June to December 2017. Most of the respondents are the halal executives, halal officers, halal auditors, quality assurance executives, and operations personnel.

A total of 126 of the survey questionnaires were collected, but only 121 of them can be used for data analysis purpose. The other returned questionnaires are unusable because of partially completed. Only the respondents with good knowledge of the company and have halal certified product are qualified to complete the survey questionnaires. The respondents representing various companies for the survey questionnaire were presumed to hold specific halal operational activities in the halal food industry. The key respondents for this study will be ideally the middle and top management.

Regression Models

This study applied the standard procedure by Baron and Kenny (1986) to analyse the moderating effect of HTS on the relationship between HFSC management and HIA. The following three steps (Model 1 to Model 3) were used to assess the moderating effect of HTS by implementing a multiple hierarchical regression (Baron and Kenny, 1986; Frazier *et al.*, 2004).

Step 1: The effect of the predictor variables on dependent variable (Model 1):

Step 2: The effect of the moderator variable on dependent variable (Model 2):

(4.6)

Where:

HT = halal traceability system;

Step 3: The effect of the interaction among the predictor variables and the moderator on dependent variable (Model 3):

(4.7)

The moderated hierarchical regression analysis was adopted to determine the effect of moderating variables in the relationship between predictor and dependent variables. The analysis was employed to determine the moderating effects of these variables and to identify which variables react as expected.

6. Data Analysis

Table 2 presents the results of hierarchical multiple regressions linked to Model 1, 2 and 3 using least square regression with robust standard errors respectively. Model 1 includes the HFSC (*SCO*, *SCLC*, *SCR*, *SCBP*, and *SCNS*) as the independent variables (first step). Model

2 includes moderator variable (second step). Model 3 includes the interaction terms (final step).

Table 2: Result of the Least Square Regression with Robust Standard Errors to examine the effect of interaction of HTS and SCO, SCLC, SCR, SCBP and SCNS on HIA

Variables	Model 1 (Coefficient)	Model 2 (Coefficient)	Model 3 (Coefficient)
<i>SCO</i>	0.0006643	0.0427959	-0.1313682
<i>SCLC</i>	-0.1000089	-0.1412738	-1.4733680
<i>SCR</i>	0.0349477	-0.0030473	1.0548410
<i>SCBP</i>	0.2928137*	0.1798624	-0.0127077
<i>SCNS</i>	0.3129703***	0.2471671***	-0.3821607
<i>HT</i>		0.2773253*	-1.1031030
<i>SCOHT</i>			0.0739815
<i>SCLCHT</i>			0.3668437*
<i>SCRHT</i>			-0.2578699*
<i>SCBPHT</i>			0.0177518
<i>SCNSHT</i>			0.1349097
R^2	0.4221	0.4579	0.5666
Change in R^2	-	-	0.1090
<i>P</i> -value	0.0000	0.0000	0.0000
***significant at $p < 0.01$, **significant at $p < 0.05$, *significant at $p < 0.1$			

According to the results, the F statistic in Model 1 is significant (Sig. $F = 0.000$) and R^2 of 0.4221, indicating that the selected *HFSC* (*SCO*, *SCLC*, *SCR*, *SCBP* and *SCNS*) can explain 42.2% of variation in *HIA*. Model 1 reveals that both *SCBP* and *SCNS* (p -value < 0.05 , Coefficient = 0.2928137 and 0.3129703) significantly affect *HIA*. Therefore, it can be reasonably be concluded that hypotheses $H1$, $H1d$ and $H1e$ are accepted.

Model 2 shows that F statistic is significant (Sig. $F = 0.000$) and the impact of *HT* on *HIA* is significant (p -value < 0.1).

Model 3 which presents the impact of interaction terms (*SCOHT*, *SCLCHT*, *SCRHT*, *SCBPHT*, and *SCNSHT*) is significant and has stronger explanatory power of 0.5679. Model 3 shows 0.109 change in R^2 compared to Model 2, which mean that hypothesis $H2$ is accepted. Regarding the interaction terms (*SCOHT*, *SCLCHT*, *SCRHT*, *SCBPHT*, and *SCNSHT*), the impact of *SCOHT*, *SCBPHT* and *SCNSHT* is not significant (p -value > 0.1 , Coefficient = 0.0739815, 0.0177518, 0.1349097), but the impact of *SCLCHT* and *SCRHT* are significant (p -value < 0.1). Therefore, based on the results of Model 3 hypotheses $H2$, $H2b$ and $H2c$ are accepted, but hypotheses $H2a$, $H2d$ and $H2e$ are rejected.

The results of the data analysis show that *HFSC* (*SCO*, *SCLC*, *SCR*, *SCBP* and *SCNS*) management is significantly associated with *HIA*. It was also found, both dimensions of *SCBP* and *SCNS* to have significant effect on *HIA*.

To further strengthen the halal food supply chain, the moderating variable of HTS was adopted to increase the effect on HIA. The significant moderating impact of HTS on HFSC management and HIA is explained by the fact that companies which adopted HTS can trace their food ingredients from the consumer to the producer and back to the original suppliers. The result of this study supports the findings of Meuwissen *et al.* (2003) who mentioned that companies have the abilities to track product and food ingredients throughout their food supply chain, and this will lead to the increase of consumer confidence in the integrity assurance of halal products due to higher volume of information accessible to consumers and producers. The result is consistent with the previous study conducted by Zulfakar *et al.* (2014); Bahrudin *et al.* (2011); Zailani *et al.* (2010a) where they found that by introducing a robust and effective traceability system, the halal food supply chain would be improved and the halal integrity assurance increased.

Further, HTS as a moderating variable is empirically found to influence the relationships between *SCLC*-HIA and *SCR*-HIA, The significant moderating effect of HTS on the relationship between *SCLC* and HIA could be explained by the presence of halal logistics operation awareness on the importance of HTS on HIA among halal food producers. The intention is to prevent the mixing of halal and non-halal products not only at upstream but also during delivery, storage and distribution at downstream processes.

The finding also confirmed that HTS significantly moderates the relationship between *SCR* and HIA. The positive association effect of HTS could be explained by the companies having a halal dedicated workforce team to handle the food supply chain activities on a daily basis. Jaafar *et al.* (2011) stated that setting up a halal dedicated human workforce team to deal with halal products would decrease the potential of cross-contamination to a very low level and thus help safeguard the integrity of halal food supply chain.

Thus, HTS as a significant moderating variable will result in the increase of halal transparency and halal visibility throughout the food supply chain. This will lead to an increase in consumers' trust and confidence of the halal product integrity assurance due to the capability of HTS to trace and track potential non-halal sources throughout the food supply chain. HTS strengthens the halal food supply chain management toward a sustainable and robust supply chain that thrives for lower vulnerability of halal cross-contamination.

7. Discussion and Conclusion

This study has examined halal integrity assurance (HIA) from the perspective of halal food industry in Malaysia. It examined the influence of halal food supply chain (HFSC) management on HIA and has empirically proven the significant effect of HFSC (*SCO*, *SCLC*, *SCR*, *SCBP* and *SCNS*) management on HIA. Based on the results, both *SCBP* and *SCNS* had been found to have significant effect on HIA.

The model based on the relationships between HFSC management and HIA has been analyzed in the context of halal food industry, the model was able to explain variations in the HIA under study as a result of various activities along the halal food supply chain. The findings show that HFSC management, prescribed by the halal food industry, influenced on HIA and could be enhanced if appropriate approaches were employed. Based on the findings, the halal traceability system was found to have a significant moderating effect on the relationship between HFSC management and HIA. Specifically, HTS had also been found to significantly moderate the relationship between *SCLC*-HIA and *SCR*-HIA.

The practical contribution of this study is to demonstrate the effect of HFSC management in enhancing HIA where no empirical study so far has reported such effects. It is concluded that HFSC management is a crucial resource for achieving better HIA. The study has proven that halal food producers need to observe HFSC management to ascertain the impact on HIA. The results show that producers should focus on both *SCBP* and *SCNS* along their food supply chain. The findings also show that HTS moderated the relationship between *SCLC* and *SCR* on HIA.

Acknowledgement

This work was partially supported by the Research University Grant, Transdisciplinary Grant (TDR) under the Universiti Teknologi Malaysia and Ministry of Education (MOE) Malaysia with project code Q.J130000.3551.07G15.

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