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Blockchain Solution for Halal Certification and Food Security During the Covid-19 Pandemic

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Abstract

Covid-19 pandemic outbreak caused massive disruptions globally impacting border closure and lockdowns across all industries including the food industry. The Muslim community was not spared, with challenges in Halal validation/certification, from food security, supply chain and to proving a sustainable eco-system. Blockchain provides a digital tool to supplement a sustainable Halal validation, certification, and auditing of food from farm to fork. This is especially important, as the pandemic has shifted Muslim consumers to move online which created new challenges for the Halal authorities to support the Muslim community. Using a case study, Netnography was applied to qualitatively explore 'Big Data' from a current blockchain on the information of halal consumer behaviour during the pandemic. This study suggests that during Covid-19 lockdown and current pandemic circumstances, Halal consumers have shifted to greater online know-how. This crisis has highlighted a need for Halal issuing authorities to adopt new technologies, such as blockchain to provide better decision making for Muslim consumers in relation to Halal food.

Keywords: *Blockchain, consumer behaviour, Covid-19, food security, Halal certification*

INTRODUCTION

Covid-19 pandemic played a pivotal role on food security and supply chain challenges around the world. Disruptions in the food supply, production to the supply chain or commonly coined as 'farm to fork'. Societal factors need to review on how we respond to such global crisis. Systemic changes affect end users and/or consumers on their buying behaviours. This has transformed how we buy food during the lockdowns/quarantines, with borders closed around the world and almost everyone is affected by this change and even after this pandemic. In this new global pandemic era, many industries, such as education, health, and food, had to shift online. Consumer behaviour, as such, also moved to online purchases. The Halal industry was also affected, as consumers turned to online purchases with an increased interest in Halal Certification of food, production, and contamination that may exist in the supply chain. The pandemic crisis on 'food security' started to show an increased commitment of food security policies in trade and development in the Halal food chain. This has created a new challenge on managing the Halal food industry as it is substantially large.

According to the latest report of Standard Dinar (2020, p. 12), State of the Global Islamic Economy Report, the Islamic community spent US$2 trillion in 2021 across the pharmaceutical, fashion, travel to food industry. Notwithstanding the pandemic issues, this trend is anticipated to grow in 2022, by 9.1% for the Islamic economy, which does not include the Islamic Financial Sector.

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Muslim consumers expenditure on food alone increased by 6.9% in 2021, or US$1.19 trillion. The Organization of Islamic Cooperation (OIC) economic sector of both the OIC and non-select markets increased by 118% from US$11.8 billion in 2019/20 to US$25.7 billion in the 2020/21 report, where the Halal food sector covers 15.5%.

Food security remains the key challenge, including the Halal certification of the food sector. The Organization of Islamic Cooperation (OIC) together with the Islamic Organization of Food Security (IOFS), *Vision 2031: 10 Year Strategic Plan*, assigned *5 Strategic Pillars* that relates to *16 Strategic Programs* (OIFS, 2021). Most notably, improving "*production, traceability of agri-produce*", and the challenges of the supply chain and digitalisation which highlights procurements with the halal food, increased use of digitalisation within the supply chain from 'farm to fork'(OIFS, 2021, p. 13)

The existential challenge during the pandemic raised questions about quality, and traceability of food security, and the digitalisation of technology as a means of traceability and supply chain issues (Standard Dinar, 2020), to validate the food security of Halal food. This paper argues and highlights the 'trust issues', and the importance of 'Blockchain' as a tool to ensure the validation of Halal food from 'farm to fork'.

LITERATURE REVIEW

Halal food

The Islamic world, has the most online searches on reviewing agendas and the use of social interaction through digital data/digital communications to make brand choices and decisions (Kozinets, 2002). This highlights Muslim consumers concerns, but also their Islamic beliefs, business, and commerce (Wilson et al., 2013). Moreover, aligns with the global '*ummah'* (Arabic for community), that relates to '*asabiyyah*' (Islamic cohesion). For Muslims, Halal branding is inseparable from their faith and has to be in line with their beliefs (Alserhan, 2010), where the product needs to adhere to Sharia standards (Wilson et al., 2013). Covid-19 has brought about new challenges and opportunities in Halal branding on consumer behaviour in the food sector, from food production to supply chain, where Halal certification should synchronise to a sustainable eco-system (Hidayat et al., 2021).

Food security

Food security is the involvement of political determination, agriculture capabilities, smooth supply chain flow, and international collaboration (Prosekov & Ivanova, 2018). 'Farm to fork' supports over a billion Muslims, who rely on climate change, agriculture eco-systems and good governance of policies (Mbow et al., 2019). The previous Global Financial Crisis brought changes to poverty and challenges to hunger (Gohar & Cashman, 2016; Lipton & Saghai, 2017; Myers & Caruso,

2016). In addition, Muslim consumers, must attach to Halal origins for food security (Jalil et al., 2017). Food security in Malaysia involves proper planning and ensuring the safety of 'farm to fork' from the Islamic perspective (Ishak, 2005).

The Islamic Organisation for Food Security (IOFS) in the 'Vision 2031: 10 year strategy", presented 16 programs under five pillars of "*food governance, food crisis response, capacity building, industry development, and resource mobilization*" (OIFS, 2021). Food security is important for OIC members within the global food system, where the IOFS states "*farm to fork*", as "*Gene to fork*" (OIFS, 2021, p. 5). Moreover, it encapsulates consumers' buying behaviour, supply chain, food production, and wastage (Standard Dinar, 2020). Food security remains central to the IOFS mandate on proper managed food eco-system, to ensure sustainability of a holistic international food system, that connects the same interests and policies, investments and legal aspects of all parties concerned.

In lieu of the IOFS 10-year vision strategy, food security must transform to a digital food system. Moreover, Halal verification on food is currently a common feature on the digital space of mobile phones, for verification purposes, using the applications to substantiate barcode as a means to determine the Halal status (Junaini & Abdullah, 2008). Critical success factors must be placed in the supply chain (Ab Talib et al., 2015), such as Halal certification, transparency of standards and guidelines adhering to Sharia law (Ab Talib & Mohd Johan, 2012; Aziz & Chok, 2013; Noordin et al., 2009) and Halal traceability on the integrity of the Halal status within the supply chain, encapsulating the tracing and safety of food, transparency, tracking, monitoring, and information technology (Bourlakis et al., 2012; Shafii & Khadijah, 2012; Shafii et al., 2013). However, there are vulnerabilities within the Halal supply chain (Tieman, 2011), where non-Halal issues may exist if there is a disruption in the Halal supply chain (Ab Talib et al., 2015). This was further exacerbated during the pandemic, where blockchain could be a tool for validation.

Blockchain Technology

Blockchain provides a solution to maintain the integrity and transparency of the Halal supply chain. Moreover, blockchain provides supply chain transparency of 'farm to fork' (Gligor et al., 2022), providing traceability, and a mediating role of supplier trust (Rashid et al., 2022). Moreover, blockchain posit the functions of immutability, decentralisation, enhance security authenticity on the proof of work, transparency, smart contract, which considerably improves the efficiency of the supply chain and the food source of origin, where food systems continue to evolve (Duan et al., 2020). Furthermore, it was noted that when utilising blockchain within the Halal supply chain, it met consumer demands of data visibility, transparent logistics/supply chain, types of data to collect, and easy authentication of auditing and reporting (Rashid et al., 2022). This provides validation, trust, and transparency for the Halal food consumers.

RESEARCH METHOD

This paper is based on a case study approach on a current blockchain system of ehalal.io. Case study was appropriate to review social and epistemological context (Denzin, 2008; Denzin & Lincoln, 2011), and big data analysis, using big data sets (Kubick, 2012) from the blockchain, to explore data to unearth new information (Russom, 2011).

This study intends to explore the blockchain system of ehalal.io using Netnography: Individual experience/s in a network digital space and to increase our understanding of human experiences (Kozinets, 2010; Kozinets, 1997, 2002; Kozinets & Gretzel, 2022). Moreover, presents an ethnography of the digital space to determine social changes, and research on the online community and culture. An "*observational and non-participatory*" study of online community across a variety of participants in the online arena (Costello et al., 2017). Furthermore, ascribes to the Association of Internet Researchers' ethical guiding principles (Markham & Buchanan, 2012). This can be best summed up by the originator's quote: *"the key elements is not to forget the participative, reflective, interactive and active part of our research when using the communicative function of social media and the internet"* (Kozinets, 2015, p. 97). As such, Halal online communities have similar shared/learned values, customs, and beliefs that are explicitly a behaviour (consumer traits) of a particular community (Kozinets, 2010, p. 12).

FINDINGS AND DISCUSSION

This study aims to determine blockchain as a tool for Halal certification/validation. Bitcoin was founded by the pseudonym 'Satoshi Nakamoto' that avoids double spend issues, utilising distributed peer to peer connected hierarchies (Nakamoto, 2008). Similarly, eHalal Blockchain Network supports the international Halal industry by "*a decentralized network of computers' nodes of which each Halal certification organization has a copy",* that "*allows any Halal certification organization to run a fully automated audit*" (Irwan, 2021). Moreover, complies with the standards of the Organization of Islamic Cooperation (OIC) and The Standards and Metrology Institute for the Islamic Countries (SMIIC) which includes a wide area of Halal food products to management systems. The eHalal.cloud launched in June 2018 covers Germany, Malaysia, Singapore, Turkey and United Kingdom. Furthermore, the eHalal network provides: Food Traceability: precisely track suspect food, pricing, transparency on the food from 'Farm to Fork', consumption trends, and food security (Dholi, 2021).

This paper analyses a case study from Big Data drawn from the blockchain eHalal Network, "*Halal Quality Management System is available as a SaaS solution and follows the official Standard of OIC/SMIIC 18:2021 set by the SMIIC Technical Committee on Halal Management Systems by the Organization of Islamic Cooperation (OIC)*" (eHalal.io Token (HAL), 2022), and 'Marketplace.ehalal.io' (Marketplace ehalal, 2022)

The figures in Table 1 below, were taken from ehalal.io (eHalal.io Token (HAL), 2022) and marketplace.ehalal.io (Marketplace ehalal, 2022). Table 1 shows the rankings where number 1 has the lowest consumer trust as it has the highest number of enquiries (clicks) of Halal food certification/validation. Due to the high number of products searched (over 1000), we have decided to only present the top twenty searches as listed in Table 1.

Table 1. Organisations data drawn on November 12, 2022

Rank	Top Queries coming regarding	Clicks
1	Organisation A	307
2	Organisation B	146
3	Organisation C	128
4	Organisation D	125
5	Organisation E	121
6	Organisation F	100
7	Organisation G	91
8	Organisation H	79
9	Organisation I	77
10	Organisation H	67
11	Organisation I	66
12	Organisation J	59
13	Organisation K	56
14	Organisation L	55
15	Organisation M	55
16	Organisation N	53
17	Organisation O	53
18	Organisation P	51
19	Organisation Q	49
20	Organisation R	48

Table 1 presents the Halal food community on the products available on the ehalal.io blockchain. 'Organisation A' ranked as No. 1, has been Halal certified by the Malaysian Department of Islamic Development or Jabatan Kemajuan Islam (JAKIM). For two consecutive years, it remained on their approved list. JAKIM requires an assessor to perform on-site evaluation with an assessor drawing samples for lab analysis (Noordin et al., 2009; Tran, 2022). During the Covid-19 pandemic, when lockdowns were instituted, the Malaysian government instituted a Movement Control Order (MCO), to prohibit and restrict the movement of the population. Inevitably, this prevented the assessors to continue their on-site inspections, which resulted in several Halal certified organisations to be affected. In retrospect, 'Tea Garden Halal' had their Halal status removed by JAKIM instead of just listing it as expired. This caused confusion to Halal consumers, which was then alerted in the Marketplace.ehalal.io site. When an organisation receives the most clicks on the

website and signals via the blockchain, this indicates an issue on the validation of the Halal certification.

Table 2. Least trusted countries, data drawn on November 12, 2022

Rank	Countries	Clicks
1	Malaysia	13992
2	France	2634
3	Germany	2565
4	Spain	1144
5	United Kingdom	819
6	Italy	780
7	United States	758
8	Sweden	681
9	Singapore	659
10	Netherlands	572
11	Indonesia	562
12	Belgium	487
13	Denmark	465
14	Canada	434
15	Australia	419
16	Poland	400
17	Iran	379
18	Turkey	357
19	Bangladesh	337
20	Norway	303

Table 2: Top 20 countries listed from 231 countries (Marketplace ehalal, 2022)

Codex Alimentarius Commission had given Malaysia, the top accolade on Halal food. In contrast, Covid-19 brought about a 'chink in their armour', as Malaysia was unable to support their online community. The Halal food community product searches places Malaysia first, followed by France being second and Germany third on low trust. Trust is an important factor for customers to support the value chain process (Steven, 2002). The next Islamic nation was Indonesia, ranked 11th, with 562 clicks which is substantially lower than Malaysia who has 13,992 clicks.

Table 3. Devices used to make the enquiries, conducted on November 13, 2022.

S/No	Device	Impressions
1	Mobile	672753
2	Desktop	266416
3	Tablet	9802

Table 3. The main three devices listed (Marketplace ehalal, 2022)

Mobile phones, followed by the Desktops and Tablets were the devices primarily used by the Muslim community to search Halal certification/validation. During the pandemic, mobile phones were placed at the top of Table 3, as they already had Wi-Fi data available on their devices.

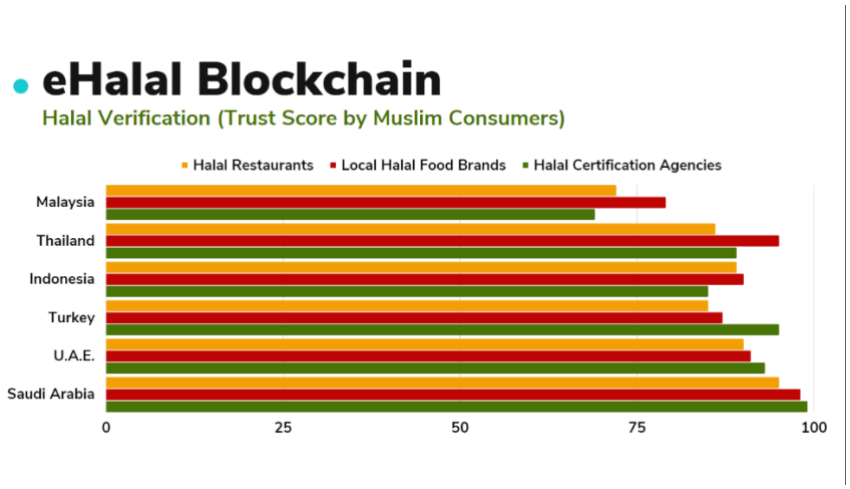

Figure 1. Halal verification from eHalal Blockchain (eHalal.io Token (HAL), 2022)

The trust scores of Halal verification indicates three areas, namely" i. Halal restaurants, ii. Local Halal Food Brands, and iii. Halal Certification agencies, where a maximum score of 100 indicates full confidence by the Muslim consumers.

Consumer behaviour is driven by their choice of food. The main reason lies with food security, where strong personal beliefs drive their values on their purchase outcomes of food and its origins (Nardi et al., 2019). Moreover, decision making by Muslim consumers is based on the assurance that food consumption must be *toyyib* or healthy, clean, and good (World Halal Forum, 2009).

Figure 1 shows Halal verification or trust scores of Malaysia being the lowest, as the Halal community lacks confidence in the Halal reliability. Malaysia was lagging in providing assurance to the Muslim consumers on the Halal verification trust scores, as it lacks Halal integrity in the supply

chain from farm to fork (Tieman, 2011). To date, JAKIM of Malaysia has not adopted the barcode technology that identifies and complies the verification of the Halal status of products. Technology plays a crucial role in tracking food security so as to distinguish or validate inventories by using the barcode technology or Radio Frequency Identification (Rfid) (Junaini & Abdullah, 2008). JAKIM should increase their standards on non-core aspects and resources of the Halal consumers expectations (Badruldin et al., 2012), such as a better process to conduct their Halal verification. Covid-19 has brought forth the weaknesses of the Halal verification system/process, on its ability to provide sound online resources. New technologies should be adopted, so as not to impede the Halal certification verification/process (Junaini & Abdullah, 2008). As food security increases with biohazards and increased agroterrorism, deliberate sabotage of plant and animal pathogens (Djurle et al., 2022), Blockchain technology can support the Halal food industry to manage biotechnological threats, which supports the OIFS 'gene to fork' concept.

Saudi Arabia ranks with a high score on their Halal verification and trust score. During the recent Saudi International, Halal Expo 2022 that showcased the eHalal.io Blockchain, Saudi Arabia intends to adopt the Blockchain technology (CASCI Arab-Swiss Chamber of Commerce and Industry, 2022).

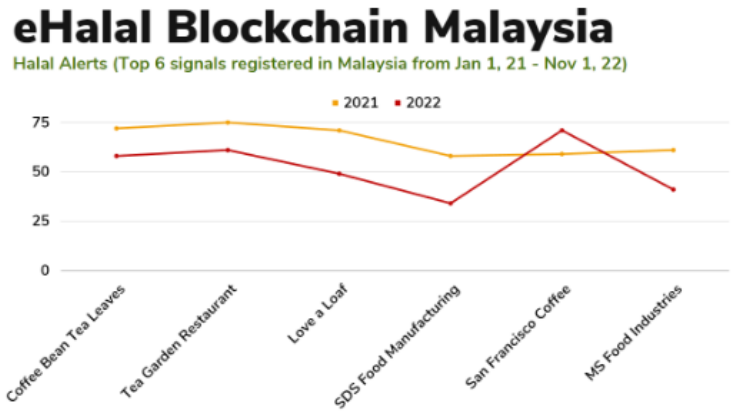

Figure 2. eHalal Blockchain Malaysia (eHalal.io Token (HAL), 2022)

The above figure shows the top 6 signals registered from Malaysia, during the period January 1, 2021, to November 1, 2022. The traffic seems normal on the 2021 line, however, the 2022 red line, shows a spike in San Francisco Coffee. This was despite JAKIM doing some housekeeping on their Halal verification processes/systems. However, few glitches still remain in their system, which has caused some confusion with the Malaysian Halal consumers.

Figure 3. Top ten weekly searches from November 7 to 12, in the year 2022 (eHalal.io Token (HAL), 2022)

This figure was presented to provide an indication of the popular Halal products. The 7th item from the left in Arabic characters represents the energy drink 'Monster', which is a popular product in the Middle East (the largest market on both the web and the eHalal blockchain). Both the Arabian and Indonesian markets represent the highest consumer of Halal products. The concept of Halal certification and/or verification should not be just tied up to the religious aspect, but also requires a shift to animal welfare, climate change, and food safety from a holistic approach toward Halal principles (Golnaz et al., 2012).

CONCLUSION AND FURTHER RESEARCH

This paper has argued that the advent of the Covid-19 pandemic, created a new set of issues faced by the Halal consumers and authorities alike. There were challenges that surfaced out of this crisis, and existential practices and processes of Halal certification and validation were unable to cope. Halal certification is not a domestic market issue, but today extends to the global market and must ensure certainty, assurance, and integrity to the Muslim consumers (Golnaz et al., 2012).

Muslim consumer behaviour on Halal food during the pandemic have transformed them to be more internet-savvy, which aligns with the consumer's cognitive processes. Blockchain technology, which is an easy, transparent, and reliable source, assures them to make Halal informed decisions, when searching for food products or food retail outlets. As the world shifts to online purchases, Muslim consumers will follow this trend. This trend will continue, even after the pandemic. Halal issuing authorities, such as JAKIM should accordingly adopt new technologies that will better serve the Muslim community in making sound informed purchasing decisions on Halal products.

As such, there should be some consensus from the Islamic community to decide on how to move ahead in the digital era of Web 3.0 of new technologies, such as Artificial Intelligence or AI,

Decentralised Hyperledger's, Big Data and more, as aligned with the vision of OIC. We can no longer wait and sit by the sidelines but should rather embrace these technologies to benefit the greater good for the Muslim community.

More quantitative research should be conducted to review the issues faced by the Halal certifying authorities that will meet the needs of Muslim consumers. Moreover, this research can also extend to Blockchain technology in Organic, Celiac/Gluten Free, Dairy/Lactose-Free, Egg Free, Ketogenic/Keto Diet, Low Fodmap, Nut free, Paleo, Pescetarian, Vegetarian and Vegan diets, from farm to fork. Moreover, study on the other Halal sectors of finance, tourism, and hotel, pharmaceutical, cosmetics, fashion travel and media/recreation (Standard Dinar, 2020)

It would be interesting to conduct further netnography on social media on the experiences of Muslim consumers in validating Halal food products.

This research is limited to one Blockchain system of eHalal.io, which entails Muslim consumers of Halal food.

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