

Halal Food Sustainability between Certification and Blockchain

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Halal food sector accounts for more than 57% of global Halal expenditure, attracting investments for more than USD 5.5 (52% of total amounts invested). Such a number of investments have been addressed by the increasing interest in Halal products by several non-Muslims countries, either for Muslim or non-Muslim consumers.

halal food products

certification

blockchain

food safety

sustainability

integrative literature review

1. Introduction

“Halal” is an Arabic word which means lawful or permitted according to Islamic principles, whereas the contrary is “Haram”, which defines what is forbidden. Such a word is used not only in the context of commodities consumption or production but also refers to a wider range of human activities, influencing all aspects of Muslim daily life. In the context of Halal commodities and services, religious beliefs and cultural identity play a significant role in people’s lifestyles and habits. Specifically, among other professed faiths, Islam imposes a precise living code which affects Muslims’ everyday decisions, from food consumption habits to financial investments. Indeed, Islam requires Muslims to preserve their purity, their mentality and to maintain their self-respect and integrity under social, economic and religious perspective. As a consequence, all Muslims choices are influenced (or conditioned) by specific words, which are Halal (lawful), Haram (unlawful) ^{[1][2]} and “Mushbooh” (uncertain) ^[3]. Halal goods and services appeal and interest are growing fast because of strong escalation of Muslims’ distribution on a global scale, so there are new challenges in terms of social integration and economics, as well as innovative challenges to increase already existing market shares and enter completely new marketplaces. Under the demographic perspective, Muslims’ growth and emigration flows in the last sixty years have been impressive ^[4]. The latest statistics ^{[5][6]} have estimated more than 1.9 billion Muslims all around the world, making Islam the second most widespread religion in the world behind Christianity. In addition, the number of babies born to Muslims is expected to exceed births to Christians and Muslims have higher fertility rates than other religions. Therefore, Muslims are estimated to double by 2060, supporting the expectations of achieving roughly 3 billion believers (i.e., 31% of the expected global population) included among the “young generation” category (only 16% of consumers over 60 years old by 2050) ^{[7][8][9]}.

2. Halal Blockchain

The current Halal certification model requires several attempts to reach a total protection of food safety and healthy lifestyles, considering its malfunctioning under social (e.g., waste of time, uncertain commodities) and financial (e.g., expensive processes) perspectives. As analyzed by De Boni and Forleo [10], some barriers are still affecting domestic markets, for instance the scarce familiarity with Halal commodities and activities, the lack of trust towards the Islamic background and the expensive costs of Halal-certified products (compared to not certified products). Further, customers and manufacturers ask for more data with reference to natural resources and raw materials sources, technologies applied and transparency with regards to Halal standards and certification bodies, considering the existing confusion about applicable standards among manufacturers.

Several opportunities to increase Halal food reliability and traceability could regard the adoption of the blockchain technology, which makes it possible to boost commercial opportunities by adopting open protocols and standard procedures [11]. Overall, this technology can facilitate the certification process according to its scrupulous structure, which consists of: (i) block, containing data and transaction lists; (ii) chains, linking block through cryptography; (iii) transactions, changing blocks [12]. Such as tool, defined as “a public ledger consisting of all transactions taking place across a peer-to-peer network” [13], can be described as a decentralized and transparent peer-to-peer distributed database secured by cryptography, where transactions are registered in a constantly growing list of records, also called a “chain of records”, which are immutable and append-only. Records can be updated through specific agreements among peers, and untrusted transactions are not agreed and not included in the chain [14][15]. The first attempts of blockchain technology were addressed to support the cryptocurrency trade, but later such technology has been introduced to store all information related to several commodities and service sectors, such as automotive, banking and finance, healthcare, life sciences, manufacturing and agribusiness [16]. The blockchain has been applied with success, even in education, privacy and security, as well as in governance (e.g., notary, law). Among its goals, it is aimed at increasing transparency and visibility for all stakeholders from agricultural production to distribution and final consumption stage. Through its application, all raw materials suppliers, manufacturers, distributors, wholesalers, retailers and final consumers increase their chance to store all transactions and obtain a (quite) complete guarantee on the trustworthiness of products and contacts. Blockchain records procedures and makes documents unalterable, providing certification cost savings from 70 to 90% [17], but some efforts from local governments, industrial associations and dominant customers are needed. **Figure 1** illustrates the input flows which must be traced and tracked from agricultural production to final consumption stage. The blockchain technology can be accessed by any of the supply chain actors, but none of them can modify the succession of the information shared among all nodes in the system. It means that the history of the network is immutable [12].

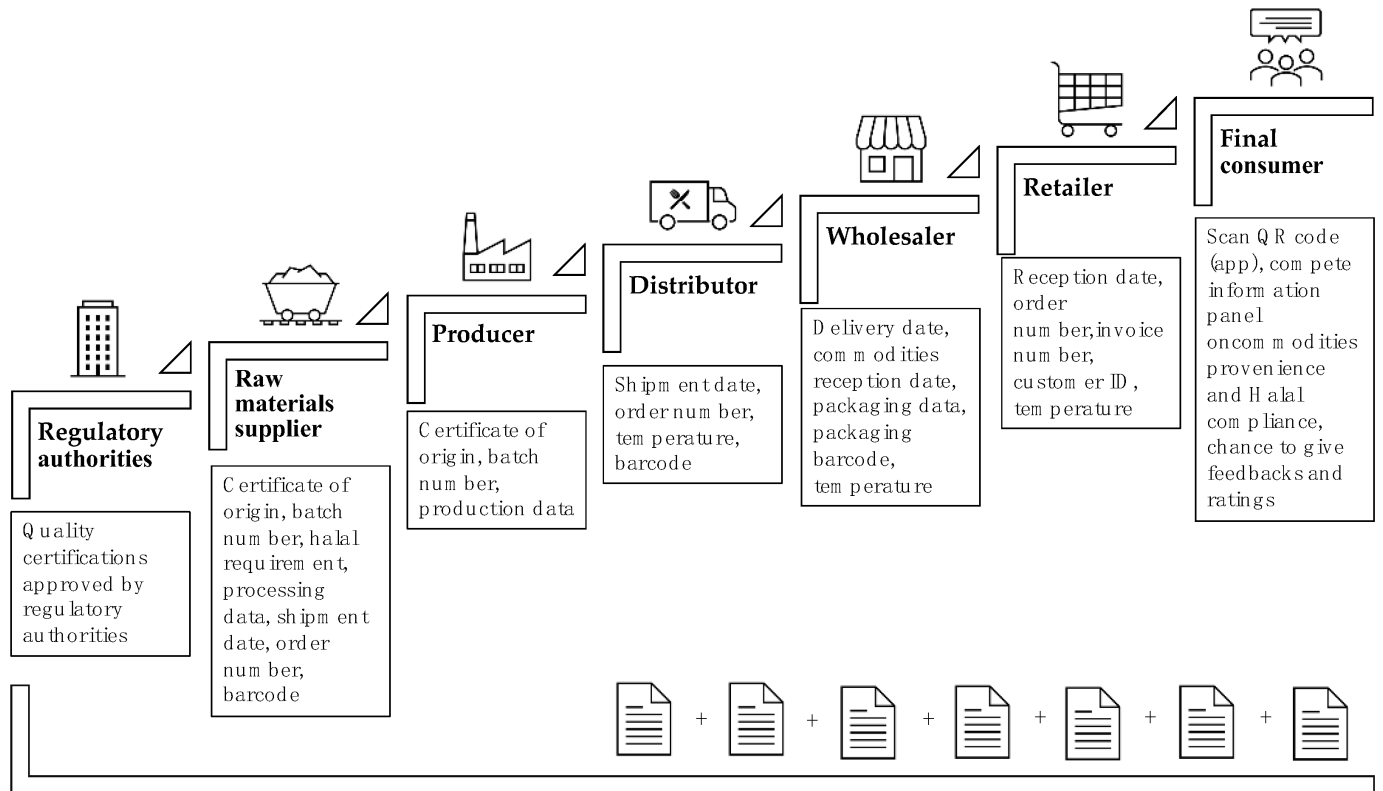


Figure 1. Input Flows Along the Food Supply Chain. Source: Personal elaboration by the authors.

As stated by reference literature [18][19], blockchain technology can foster the Halal food sector, by ensuring digitalization of Halal certificates, and assure full-scale Halal integrity to consumers. Among others, it could open four different opportunities to small–medium food enterprises, as follows: (a) reduction in complexity and increase in capability; (b) reduction in costs and increase in competitive advantage; (c) development in change management and reduction in external pressure; and (d) adoption of Halal sustainable production and consumption.

In this latter field, the blockchain could reduce food safety risks and increase social benefits by enlarging information related to pesticides or fertilizers, and by enhancing the use of “sustainability certificates” [20]. Surjandari et al. [21] have tested the capabilities of a Blockchain Network in the field of Halal development, estimating the utility of such a tool in securing transactions from food safety risks, and speeding and rating transactions in an effective and transparent manner. However, its adoption in small–medium food enterprises requires huge financial investments and resources, which can prevent entrepreneurs from participating in blockchain-based Halal traceability programs. As a consequence, Hew et al. [22] has stressed the role of policymakers in encouraging the participation in blockchain programs by giving tax incentives.

At present, the blockchain as a tool to ensure food safety and food security has been recently included in the Foodwatch [23] platform, namely a platform aimed at enabling modernization and digitization of all aspects of municipalities’ food safety management. Such a platform manages and distributes food safety information, as well as nutritional information, among stakeholders (both private and public), and it is based on blockchain, smart contracts, artificial intelligence, big data analytics, end-to-end traceability and recall management. An additional

opportunity to guarantee that companies meet Halal standards is represented by the traceability software implemented by the Global Food Safety Resource (GFSR) strategy for specialty food products. As proposed by Burton [24], the food traceability software replaces the paper-based system with electronic data collection and record keeping. Data are collected through hand-held devices, and cloud-based systems automatically create the suitable report. The adoption of automated technologies (i.e., Internet of Things, IoT) represents a necessity of companies (and food companies) all around the world, since properly planned and applied food safety programs ensure sources of ingredients and amplify the adherence to regulations. As a consequence, the adoption of IoT technologies makes preparation for audits and inspections easier, removing those barriers related to binders and spreadsheets collection.

3. Sustainability in Halal

Some authors [25][26] have stated that sustainable practices are integrated in the Halal food supply chain, considering the need to guarantee food safety, hygiene, equality, fair trade and animal welfare from farm to fork. Indeed, this supply chain, under a social, environmental and economic perspective, encompasses good manufacturing and agricultural practices, as well as hazard analyses [27][28]. One of Halal sustainability's greatest strengths is related to the adoption of processing methods which eliminate poisonous, intoxicating and hazardous elements from Halal foods [18]. In the field of good agricultural practices, Alzeer et al. [29] states that a safety plan based on such practices (i.e., processes, ingredients and their sources must be traceable, clearly defined and controlled, and instructions must be written in a clear language) should be recognized as a prerequisite for obtaining a Halal certificate, creating a win-win situation either for producers or the consumers' needs. On the producers' side, the adoption of these practices can enhance competitive advantage through the development of sustainable strategies and environmental protection; whereas on the consumers' side it could increase trust, enrich cultural diversity and build bridges between countries, religions and traditions [29]. Further, Halal sustainability should be pursued by enhancing infrastructures to avoid physical contact with non-Halal products, as well as the management commitment from top management to employees. It emerges that sustainable procedures and good agricultural practices are closely related to the adoption of information and telecommunication technologies, which enable traceability and products' authenticity, highlighting the need to enhance blockchain technology [30]. To this extent, the blockchain could help farmers and manufacturers in reducing chemical inputs, fertilizers and hazardous elements [18]. However, as already discussed by the European Environmental Agency [13], the environmental and sustainability implications of this technology are under-explored, and still experiments to obtain data and monitoring to assess reliability are required on a global and local scale.

Regarding additional research in the field of Halal sustainability, Thamagasorn and Pharino [31] have explored the food waste issue in a Halal food production process, confirming that these products have been increasingly responding to market pressures coming from environmental movements, and enhancing environmental performances by creating value-added compounds from waste materials [31][32]. Mixed approaches based on mass-balance methods (i.e., material flow analysis) and blockchain technology could enhance food waste valorization towards sustainable practices and environmental savings [33] in the Halal food sector. As reported by Rejeb et al.

[33], digital food supply networks based on the blockchain could enable full transparency across the food supply chain and maximize shelf life, increase partnerships and enhance recall response efficiency.

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