



Sustainable supply chain performance of Pakistan's halal meat industry: intermediating role of global technical standards (gts) in the framework of quality function deployment (qfd) model

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Abstract- The present study aims to investigate the mediating role of Global Technical Standards (GTS) on Voice of Customers (VOC) and Sustainable Supply Chain (SSP) in halal meat industry of Pakistan. This study used mixed methodology in a two-phase investigation, results of analysis have focused on the Halal Meat Industry. In phase-I, study has generated QFD model through Qualitative Content Analysis (QCA). The participants were fourteen domain experts of Pakistan Halal Meat Industry. In phase-II a total of 250 responses were generated from domain experts of Pakistan's halal meat industry using a five-point Likert scale for quantitative analysis. The findings show that the top management and domain experts of halal meat industry need to incorporate global quality standards. It will surely lead to high productivity and exports. This article serves as a guide to acquiring sufficient knowledge of the global technical standards to make sure sustainable supply chain performance.

Keywords: Halal Meat, global quality standards, voice of customers, mediation, sustainable supply chain structure

I. INTRODUCTION

Halal is an Arabic word which refers to the set of rules related to permission according to Islam (Ali, et al., 2020). According to these rules, halal meat must be slaughtered as per the predefined guidelines and principles of Islam (Ajay, 2020). Halal meat has a large market potential and total revenue from global trade of halal food industry is projected to grow up to US\$ 3 trillion and halal meat is projected to grow by US\$ 600 billion by 2024 (Sohaib & Jamil, 2018). At present, the global production of halal meat contributes 86 percent to total global value of Halal products. Due to the increasing population of Muslim Consumers' and the resulting increase in demand for Halal food, the halal meat industry both in Muslim and non-Muslim worlds has grown up steadily over time. In recent years, a noticeable increase in trade of Halal food and Halal meat has been witnessed globally. The increasing trend in global trade of halal food is due to the Hygienic concerns (Mirza, 2020). However, Pakistan's contribution to total global trade of halal meat is not proportional to the country's abundant halal food resources and the business-friendly environment she offers. Pakistan stands at number 33 in the list of global Halal Meat Exporters.

Pakistan is an agrarian economy and livestock is considered as an important part of the economy. In Pakistan, livestock accounts for 59 percent of the total agricultural production and 12 percent for the total GDP (Rehmana, Jingdonga, Ali, & Hussain, 2019). A significant portion of the Agri population is linked with livestock (Arif, 2017). Additionally, livestock sector can also add to the diversification of the various existing and potential risk and reduction of poverty initiatives (ITC, 2019). Pakistan's red meat is in global demand due to its unique taste, organic nature and hygienic production. However, due to poor supply chain practices, very limited availability of advanced machinery, lack of technological development, old and contaminated

machines (for slaughtering, cutting, freezing, packing), lack of financial mobility/business models, outdated vaccination practices and small farms, Pakistan's production and processing of meat is significantly below potential. According to (Ali, et al., 2020), the domestic supply of meat is lower than demand.

Issues of Halal Meat Industry in Pakistan

Previous research studies have identified a number of issues faced by halal meat industry as recounted ahead. One of the major issues is the underutilized sector that is cattle farming (Rehmana, Jingdonga, Ali, & Hussain, 2019). Total unauthorized farm animal population is approximately 46.1 million cattle; 38.8 million buffaloes, 30.5 million sheep, 74.1 million goats and 1.3 million camels (Mirza, 2020). The second major issue with the halal meat Industry is that in Pakistan, the supply chain structure of this industry is very complex in terms of **actors and participants**(Wani & Jafar, 2019). The industry is comprised of many actors which include farmers at villages, village mandi investors, middleman from village(Zhang, Baker, & Griffith, 2020), bakar-mandi, large in-slaughter houses, slaughter house whole sale markets, butchers, retailers, processing companies, hotels, bakeries, large retail stores and end consumers(Bradfield & Ismail, 2020). Many researchers have highlighted that major portion of meat and meat products is wasted due to the inefficient supply chain. For example, Naseer, et al., (2019) and JAMEEL, MEMON, SHAIKH, & AHMED, (2017) show that approximately one-third of meat and meat products is lost every year worldwide because of inefficient supply chain practices especially in underdeveloped economies.

In Pakistan, livestock and poultry are raised in rural areas. Due to poor transportation facilities and non-availability of animal health centers in rural areas, farmers have less access to these vital services Khan, Zhang, & Nathaniel, (2020);Arifeen, (2018); Zahra, (2018). It was further highlighted that in Pakistan, the conditions for raising hygienic poultry are not favorable. Therefore, Pakistani poultry does not conform to the international quarantine standards. As a result, trade performance of this sector is not satisfactory despite its high production potential.

Another big challenge faced by the livestock sector in Pakistan is lack of advanced and well-equipped laboratories for diagnosis and treatment of animal diseases(Arijo, 2020). Nutritional-deficiency in animals is common in Pakistan because, mostly, farmers rely only on green fields to feed animals (Randhawa & Magsi, 2018). They are not aware of the measures for achieving spread of a balanced diet, drinking water accessibility and safety, therapeutic vaccination and availability of maximum-yielding varieties of Grass Range as pointed out by (Arif, 2017).Unlike Pakistan, the developed economies have well organized and developed livestock sectors. They adopt supportive policies and attractive supply chain systems for farmers. Farmers in those countries also avail marketing facilities from private sector agents as well as promotion from the friendly government policies (Thomson & Chabot, 2005). In contrast, livestock marketing in Pakistan is based on traditional means and methods (Randhawa & Magsi, 2018). Pakistan's halal meat industry is facing issues also due to lack of hygienic packing materials which are in line with ISO and WTO standards (Randhawa & Magsi, 2018).

The government of Pakistan has undertaken various initiatives for the development of livestock sector and increase in meat production through the concerned departments like the Livestock and Dairy Development Board (LDDDB), Pakistan Agricultural Research Council (PARC) and Punjab agriculture and meat company (PAMCO)(Arif, 2017). The government has allocated a Kissan Package of Rs 341 billion, to these departments for the development of Livestock Sector to enhance the meat production.Pakistani meat production cannot meet the international standards, primarily due to the lack of value addition, lack of modern laboratories and processing units, lack of trained staff, lack of proper sanitation system and traditional slaughter houses (Sohaib & Jamil, 2018). Moreover, the study of(Khan & Shah, 2019) emphasized on effective and appropriate initiatives to prevent the loss of animals and meat due to an appropriate means of transportation, unsustainable production methods, post harvesting issues, poor marketing strategies and increasing prices.

Unfortunately, due to lack of best practices in Pakistan on the part of both public and private sector, the distribution channels and the whole supply chain structure are very poor and inefficient (Haque, et al., 2020). Poor R&D is another binding factor of the poor performance of livestock sector in Pakistan and thus there is strong need of research and development in livestock sector to understand the global supply chain practices and global technical standards to sustainable supply chain systems in Pakistan halal meat industry(Khan & Shah, 2019).Distribution channels play an essential and crucial role in the supply chain process. They affect the physio-chemical, microbiological quality, shelf life, preservation process, meat safety, traceability and accessibility of meat.

In the above-mentioned background, the primary focus of the current paper was to investigate the mediating role of global technical standards (GTS) and Voice of Customers (VoC) in the sustainable chain performance. Pursuant to that, the paper aims to study issues faced by the various stakeholders in halal meat industry of Pakistan, i.e., issues faced by farmers, suppliers, distributors and exporters and to investigate the requirements of halal meat industry from the consumers' end and to learn about the requirements of domain experts. For this purpose, initially QFD model was applied to shortlist most required issues as VOCs and global technical standards to address selected issues. Many studies have applied QFD model to address issues related to different organizations i.e., Ford, Nokia, Adidas, Daedo, KFC, McDonalds, Pizza hut and many other brands to improve their products quality and services. These studies include (Mehrabi-Kandsar, Mirzazadeh, & Qadikolaei, (2016); Grunert, (2011); Gupta & Duggal, (2020); Mehrabi-Kandsar, Mirzazadeh, & Qadikolaei, (2016); Gandara, Muri, & Purba, (2019). Many studies have discussed issues in halal meat industry of Pakistan which was apparent from literature. But not even a single study has investigated global technical standards and strategies to overcome existing issues. Results of this study have investigated global technical standards and suggested very important strategies to improve supply chain structure of Pakistan's halal meat industry. Moreover, also suggested some important recommendations to improve Pakistan's share in global halal meat exports markets.

II. LITERATURE REVIEW

There exists a vast literature on the implications of the QFD model for meat industry. This section reviews the relevant literature on the QFD model and its implications. For the purpose of easing understanding of the issue, the literature is divided into literature on Customer's voices and their implications in meat industry, literature on global technical standards and their use in the meat processing industry.

Voice of Customers (VOC)

Meat is an important diet of human being and source of proteins, vitamins, minerals, micronutrients, and fats that are fundamental needs for physical and mental nourishment of people. Pakistan is one of the big producers of meat as it is rich in livestock. However, due to several issues pertaining to livestock and meat processing and lack of innovation, meat industry in Pakistan is unable to achieve sustainable performance (Ocampo, Labrador, & Jumao, 2020) and (Haregot & Jilcha, 2019). Khan, et al., (2020) reported that domain experts requirements are not properly addressed by the meat industry of Pakistan and due to non supportive policies of government and competent authorities the consumer trust is also damaged. They further reported that due to social, economic and technical issues, high cost of production and transportation approximately 1.3 billion metric ton halal products including halal meat processed and raw meat is wasted annually (Khan, Kumari, Selamat, Shameli, & Sazili, 2020) same issues were highlighted by (Aslam, Alarcon, Yaqub, Iqbal, & Häsler, (2020); Ma, Liu, Tu, & Wang (2020); Arifeen (2018); Silva, Jeffery, & Julie, (2020) reported these issues.

Bahadorestani, et al., (2020) have applied QFD model to design product requirements for planning and sustainable engagement of stakeholders by way of assessing their conflicts of interests. They have concluded that ultimate goal of designing customer requirements is to ensure sustainable development by creating integration between organizational requirements and stakeholders' preferences (Bahadorestani, Naderpajouh, & Sadiq, 2020). It was also supported by (Haregot & Jilcha, 2019). Karsak, et al (2003), emphasizes that understanding customer requirements is essential for the identification of global standards based on experts' opinions. They further said that identification of customer requirements and technical standards ultimately lead to sustainable development in organizations (Karsak, Sozer, & Alptekin, 2003); (Jin, Ji, Liu, & Lim, 2015). The purpose of identifying customer requirements for this sector was to highlight issues related to halal meat industry of Pakistan by learning about requirements of domain experts

Bergquist, et al (2015) said that halal meat industry is becoming the global force and receiving positive response from customers. In addition, Muslims and even Non-Muslims purchase Halal food because of hygiene and nutrition concerns (Bergquist & Abeysekera (2015); Zainuddin, Saifudin, & Deraman (2019). This offers a great opportunity for Muslim world to capture the halal meat's untapped potential in global market. However, there are several issues in halal meat sector at global level as well (Bradfield & Ismail, 2020). Vatthanakul et al (2020) said that one of the major issues in global halal meat industry is Non-Muslim suppliers of Halal meat products. It is further highlighted that no Muslim economy is included among top 10 global suppliers of halal meat (Vatthanakul, Suteera; Jangchud, Anuvat; Jangchud, Kamolwan; Therdthai,

Nantawan, 2010). (Ali, et al., 2020).Nadia,et al (2014) highlighted that halal meat products are available in packed and open forms as well and there is no surety about packed meat whether it was slaughtered in line with Islamic ways. They further emphasize that Muslims definitely require halal meat but due to lack of Muslim suppliers they purchase products of Non-Muslim brands with Halal logos (Nadia, Yunusa, Edura, Rashid, & Ariffina, 2014).

Hanzaee, et al (2011)said that bacterial contamination and Antioxidants in fresh meat during the slaughtering, packing and transportation of meat are also major issues which affect quality, color, texture and taste of meat (Hanzaee & Ramezani, 2011). Hashim, et al (2019) said that halal compliance is a crucial issue worldwide especially in underdeveloped economies including Pakistan. They further said that many countries including Malaysia as a leading country in halal meat markets is also suffering the quality compliance certification issues (Hashim, Saad, Khalid, & Laluddin, 2019). Other issues include lack of international halal certification, halal meat imports and exports permit certification and lack of trust. It has been further highlighted that more than 100 halal food certification companies are operating in different Muslim and Non-Muslim countries. But still halal meat certification issue is faced by less developed economies (Sirin, Gunduz, & Moussa (2020); Delgado, Rosegrant, & Meijer (2020).

For this study, Voice of Customers (VOC) represented "Requirements of local market domain experts derived from previously existing secondary data from literature on halal meat industry and also from primary data. The participants for primary data collection were fourteen domain experts of Pakistan Halal Meat Industry. Out of those, eight were experts from halal meat processing companies and six were directors from various member companies of All Pakistan Halal Meat Exports and Manufacturing Association (APHMEMA).

Global Technical Standards (GTS)

It has been highlighted in various previous studies that global demand of halal meat is projected to increase by 7 percent by 2023, therefore, the economies with high application of global quality and compliance standards would be able to achieve competitive position (Arijo, 2020);(Giyanti, Indrasar, Sutopo, & Liquiddanu, 2020).It has further heighted in in light of previous studies that competing global economies are taking higher place in halal meat export markets because they are strictly following WHO, WTO, ISO, QMS, GB, GSO standards. Previous studies shows that top suppliers of halal meat like U.S.A, Brazil, Australia, Netherland, Germany, Spain, Poland, New Zealand and even India have more efficient Supply Chain systems(Rafique, et al (2020); Rosa, et al (2020); Ocampo, Labrador, & Jumao, (2020).

Juned, et al (2020), said that halal meat industry of Pakistan due to lack of global standards implementation is facing several issues i.e., social, economic, technological and environmental. Ghafoor, et al (2020) said that in Pakistan animals are mostly produced in rural areas where people are not aware of international standards for breeding, feeding, slaughtering, animal husbandry, animal vibes and transportation. They further emphasize that due to these issues one third of animals in Pakistan are lost during production and transportation from farms to slaughter houses and processing companies (Ghafoor, Mehdi, Ahmad, & Ali, (2020); Aalipour&Mirlohi, (2013); Bakhsh & Kamran, (2019). Research further revealed that middlemen involvement in the whole supply chain structure of Pakistan halal meat (Chicken, Fish, Mutton, Beef) also harms sustainable supply chain performance as 90 percent of meat is handled by middlemen in Pakistani markets. In addition, some other issues are also due to high involvement of middlemen i.e., treatment with animals before slaughtering, food safety issues, lack of trust associated with the supply and traceability of meat, lack of awareness about halal products, poor packing materials, food contamination and preservation issues (Zainuddin, Saifudin, &Deraman, (2019); Yuliani, Arwati, &Riski (2019); Zailani, Iranmanesh, & Aziz (2017); Zainalabidin, et al (2019); Shackell (2008); Wani&Jafar (2019) reported above issues.

It is clear from the review above that research and development is needed for sustainable development in halal meat industry of Pakistan. As among top 17 industries of Pakistan in research and development, halal meat industry is standing at number14th(Karsak, Sozer, & Alptekin, 2003);(Juned, Vanany, & Maftuhah, 2020) and (Sohaib & Jamil, 2018) reported same issues. Therefore, there is strong need of learning about global technical standards related to halal meat industry.The participants were invited to identify requirements of halal meat industry. Keeping in view the nature of the research, 8 Global Technical Specifications (GTS) were shortlisted on the basis of group discussions, cross conferencing and application of QFD model in phase-II of this investigation. Previous studies also reveal that many organizations at global level have learned competitive strategies and global quality standards to improve their performance (Moubachir&Bouami,

(2015); Moldovan (2014); Sularto, Wardoyo, & Yunitasari (2015); Ighravwe&Oke (2016) highlighted issues in different sectors by implemented QFD model.

Sustainable Supply Chain Performance (SSP)

Developed economies have supportive policies and attractive supply chain systems for their halal meat industry domain experts (farmers, distributors, manufacturing and exporters). Literature shows that global trends are changing and top players of meat industry are moving towards value addition in halal meat industry by Improving overall supply chain structure. Previous studies i.e. (Arijo, (2020); Sohaib& Jamil (2018); Thomson & Chabot (2005). Shows that as compare to other world the halal meat Industry of Pakistan has very non-supportive supply chain structure. They further stated that different factors are responsible for poor supply chain performance of Pakistan in meat industry like traditional and contaminated slaughter houses, poor marketing system, business by product mafia, lack of hygienic measures at all stages, lack of workers personal safety, contaminated slaughtering machines, poor production and poor transportation facilities. In addition, packing of halal meat and processed products is also an issue. As in Pakistan's meat processing and packaging industry foreign packaging players like India, China, Malaysia, Germany and Japan are taking place(Wani & Jafar, 2019)(Randhawa & Magsi, 2018)(Mirza, 2020) and(Arijo, 2020)also reported above issues.

Rafique, et al (2020) said that trade agreements can also play important role in promoting trade relations and developing livestock sector. They further added that USA, Brazil, Australia and Germany have trade agreements with many countries to promote their halal meat sectors especially in advanced machinery and processing units. In addition, top suppliers of halal meat industry are providing exports promotion programs to facilitate their exporters (Rafique, et al., 2020)(Bisio, et al., 2020). Emberson, et al., (2020) stated that nation branding and marketing play vital role in achieving high position in global halal meat markets. Global suppliers are providing various facilities to their exporters i.e., exports facilitation certificates, quality assurance certificates, exports compliance certificates, high quality packing and labelling facilities, export quality certification (Cezar, 2020)(Jakobsen & Hansen, 2020) and (Emberson & Pinheiro, 2020)supported these points. Rosa, et al., (2020) stated that trade to promote halal meat meat sectors in many Non-Muslim suppliers like Brazil, USA and Australia have declared them as Muslim friendly suppliers in raw and processed halal meat product(Rosa, et al., 2020). However, due to lack of supportive policies by government and poor supply chain structure Pakistan is not meeting global standards of halal meat. With the support, it has been highlighted that there is strong need of modern husbandry practices, feeding resources, advance breeding methods, modern technology for cattle farming, better nutrition plans for animals, quality control laboratories, exports promotion programs to make sure sustainable supply chain structure in Pakistan halal meat industry (Sohaib & Jamil, 2018).

Aim of the research.

Many studies have discussed issues in halal meat industry of Pakistan but not even a single study has highlighted potential, strategies and way forward to gain high position in international markets of halal meat. In addition, many organizations have successfully implemented QFD model to improve their products and services but it has not yet been implemented in Pakistan. Many of the people aren't even aware of this word QFD. Furthermore, Pakistan has untapped potential to capture high share in global meat industry, so while picking up the articles it was also a matter to consider the similar strategies and standards applied by global competitor economies. Results of this study has investigated global technical standards and suggested very important strategies to improve supply chain structure of Pakistan's halal meat industry. Moreover, also suggested some important recommendations to exporters, and business community to improve Pakistan's share in global halal meat exports markets.

III. METHODS.

Conceptualization

Independent Variable:

The variable which has very strong effect on another variable is called as independent variable (Fouada & A. Loaiciga, 2020). The independent variable of research was "Voice of Customers (VOC)". It was categorized into twelve further requirements of halal meat industry of Pakistan i.e., Animal Production (Animal Fodder/Feed Production Plants, Farms Conditions, Treatment with Animals etc.), Animal Health Care Facilities plans and Diseases Treatments (i.e., Foot Mouth Disease), Slaughter Houses Availability, Logistics Process from farms to final exportation, Awareness about animal breeding practices and animal vibes, Hygienic Environment, Islamic Way of Slaughtering Animals, Animal Origin information, Bilateral Agreements Issues, exports/Imports Permit Certification, Traceability of Fresh Meat, Quality Compliance Certificates.

Dependent Variable:

The dependent variable is classified as criterion variable for current study (Egan, 2020). The dependent variable was "Sustainable Supply Chain Performance (SSP)" which was further divided into five dimensions i.e., Quality Compliance and Assurance Certificates, Chinese Standards GB, Gulf Standards GSO, Packing Materials according to WTO, WHO requirements, Cold Storage Facilities at every stage, exports Promotion programs and fit for consumption Certificates.

Mediating Variable:

The mediating variable clarifies that the independent variable affects the mediating variable which in turn affects the dependent variable (Gana, Liangab, Yanga, & Liao, 2020). In this research the mediating variable was "Global Technical Standards (GTS)" which has eight global standards i.e., USFDA standards, Environmental management standards, National Livestock Research Centers, Online Traceability Systems, Meat Safety Management Systems, Intermodal solutions (road, rail and barge), Hazard Analysis and Critical Control Points (HACCP) Certifications, ISO/ QMS Standards.

Instrument Development

Mixed methodological approach was used for data collection and analysis. At first stage Quality Functional Deployment (QFD) model through Qualitative Content Analysis was applied. This is qualitative method to identify requirements of domain experts. Secondly questionnaire survey was applied to test the results of QFD model and survey for sustainable supply chain performance in halal meat industry. Questionnaire survey approach is a quantitative method which is very popular and useful to conduct research (Gana, Liangab, Yanga, & Liao, 2020). Survey for research study begins with the formation of research instrument. The first section of the instrument described purpose of the study according to requirements of halal meat industry supply chain performance. Second consisted of the respondents' personal information i.e., emails, gender, age. The third part described requirements of Pakistan's halal meat industry.

Instrument Design

At first stage of pilot testing this study has proposed a conceptual model to gather and disseminate information for consumer preferences e.g., Voice of customers (farmers, suppliers, distributors, exporters) and Global Technical Specifications (GTS) by applying qualitative content analysis (QCA) in QFD model. Previous studies also supported application of QFD model for sustainable product development and performance improvement in different sectors. These studies include (Watz & Hallstedt (2020); Watz & Hallstedt, (2020); Sirin, Gunduz, & Moussa, (2020); Vanany, Maarif, & Soon, (2018); Cardoso, Filho, & Miguel, (2015); Aniqoh & Hanastiana, (2020)). The participants were fourteen domain experts of Pakistan Halal Meat Industry. Out of those, eight were experts from halal meat processing companies and six were directors from various member companies of All Pakistan Halal Meat Exports and Manufacturing Association (APHMEMA). The participants were invited to identify requirements of halal meat industry. Keeping in view the nature of the research, 12 customers' requirements as Voice of Customers (VOC), 5 requirements for sustainable supply chain performance and 8 Global Technical Specifications (GTS) were shortlisted on the basis of group discussions, cross conferencing and application of QFD model in phase-I of this investigation. In second part of the study a total of 250 responses were generated from domain experts of Pakistan's halal meat industry using a five-point Likert scale. Moderating variables were measured with Independent Variables. It was a cross-sectional study, and data was collected through questionnaire format from domain experts of Pakistan halal meat industry. Cronbach alpha was used to test the reliability of questionnaire.

Demographics

At the end of the empirical phase, survey data was ready for analyses indicated in Table 1. A total of 250 domain experts filled questionnaires. 78% respondents were male and 22% female respondents participated in survey. Most of the domain experts in the selected consumer panel had a university degree and more than 30 years of age. The level of knowledge about halal meat industry requirements was satisfactory (Naspetti,

Alberti, & Solfanelli, 2015): 82% of respondents were standing at high level of knowledge and 18% respondents were standing at medium level.

Table: 1. Domain Experts' Characteristics

Domain Experts knowledge about halal meat industry requirements		
Characteristics	Sample Grouping	Proportion
Gender	Male	78%
	Female	22%
Age	>30	100%
Education	No Formal Education	All have university degrees
	Medium	18%
	High	82%

Pre-testing of Questionnaire.

Prior to data collection from all respondents of halal meat industry for data analysis, a random sample of 25 domain experts were selected in order to confirm the reliability and validity of the data and adapted questionnaire.

Table 2. Pre-testing analysis

Cronbach's Alpha	N of items
0.800	25

The value of Cronbach's Alpha for selected sample was greater than 0.7. therefore, it was ensuring reliability of the research instrument for current study.

Data Analysis Tools and Techniques

Data Analysis process was conducted by world renowned software, Statistical Package for Social Sciences (SPSS) version 23 and Smart PLS.3 (Partial Least Square). SPSS is an appropriated data analysis software which helps in organizing and analysis of quantitative data. SPSS research tool is famous for comparing and exploring the differences between responses of two or more hypothesis (Sivam, Loganathan, Saravanan, & Umasekar, 2020). SPSS is a very easy software to figure out the difference between two sets of data (Sivama, Loganathanb, Harshavardhanaa, Kumarana, & Prasanna, 2020). Partial least square (PLS) is an advance software uses structural equation model (SEM) which helps users for easy analysis of data by compare results of each set off data. Here is this study author used SPSS software for demographic data PLS software data analysis purpose. Data was collected from 250 respondents. Appropriate tests were performed according to the requirement of this study which will be discussed in detail in the next chapter.

IV. DATA ANALYSIS AND RESULTS

Qualitative model measurements

Quality Function Deployment (QFD) Model

For initial survey Voice of Customers (VOC) were collected based on previous studies and in-depth interviews of domain exporters. Ten requirements were related to performance of halal meat industry, ten were related to supply chain structure and last ten requirements were related to Pakistan's exports of halal meat. In total these thirty requirements were representing domain experts interests to make sure sustainable supply chain structure. Literature also supported these requirements i.e., (Cardoso, Filho, & Miguel, (2015); Bergquist & Abeysekera, (2015); Bradfield & Ismail, 2020)). The domain experts were asked to self-declare how much they felt they relied on each of the requirement to improve overall performance of industry. All domain experts (respondents) had to rate the frequency of selection of each VOC, by using a 5-point Likert scale (5, strongly agree; 1, strongly disagree). This method was adapted by (Vatthanakul, Jangchud, & Jangchud, 2010).

Global Technical Standards (GTS) were also constructed by team of 14 experts. Out of those, eight were experts from halal meat processing companies and six were directors from various member companies of All Pakistan Halal Meat Exports and Manufacturing Association (APHMEMA). Selected fifteen global standards for halal meat industry were generated by data available on websites of WTO, WHO, The International Meat Trade Association, united State-Food and Drug Regulatory Association (USFDA), International Beef Alliance,

International Meat Council - Union of International Associations, and International Organization for Standardization (ISO). All technical experts after considering technical specifications were asked to create a relationship matrix between each VOC and each GTS for halal meat industry ranking the frequency of relationship according to table 3. This method was also supported by existing literature including (Hause & Clausing, (1988); Naspetti, Alberti, & Solfanelli, (2015); Coasta & Dekker, (2001) and (Paryani & Cudney, 2010).

Table 3. Degree of Relationship

Strength	Symbol	Score
Strong	⊙	9
Medium	○	3
Weak	△	1

This stage calculated Absolute importance based on weights and degree of Importance between VOC and GTS mentioned in figure 3. **Absolute Importance/ weights** were calculated as follows:

$$Aw_i = \sum_{j=1}^m (pw_j * X_{ij}) \quad (1)$$

where PW_j is the j -th customer requirement, X_{ij} is the correlation coefficient between the j -th Voice of Customer (VOC) and the i -th Global Technical Specification (GTS), and $i = 1 \dots n$ (n , total number of global technical specifications) and $j = 1 \dots m$ (m , total number of voice of customers). The normalized mean value of each standard requirement is reported in the absolute weight column of the House of Quality (ferrell, 1994). Relative weights (RW) identified the most important GTSs based on the highest weights to make sure sustainable performance improvement and Customer Satisfaction (Paryani & Cudney, 2010). The Relative Weights were reported in the last row of the HOQ, for the i -th global technical specification, and was normalized as follows:

$$Rw_i = \frac{w_i}{\sum_i^n w_i} \quad (2)$$

The priorities for the VOCs were estimated by multiplying the impact of GTSs for supply chain performance improvements in Halal meat industry on each VOC by the normalized raw weight of the VOC (Djekic, et al., 2017). This method was also supported by previous studies including (Yuliani, Arwati, & Riski, (2019); Vatthanakul, Jangchud, & Jangchud, (2010); Baran & Selami Yildız (2015). Complete detail of QFD model has given below in figure 1.

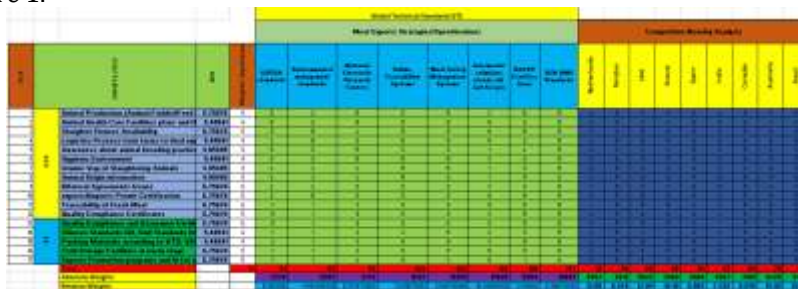


Figure 1. QFD model for VOCs and GTSs

Keeping in view the nature of the research, 12 customers' requirements as Voice of Customers (VOC), 5 requirements for sustainable supply chain performance and 8 Global Technical Specifications (GTS) were shortlisted on the basis of group discussions, cross conferencing and application of QFD model in phase-I of this investigation for further analysis.

Quantitative Analysis:

Schematic diagram of overall analysis results

A total of 250 responses were generated from domain experts of Pakistan's halal meat industry using a five-point Likert scale. Moderating variables were measured with Independent Variables. It was a cross-sectional study, and data was collected through questionnaire format from domain experts of Pakistan halal meat industry. Below is the diagram of the results that shows the values of every question asked in the research questionnaire about VOC, GTS and SSP:

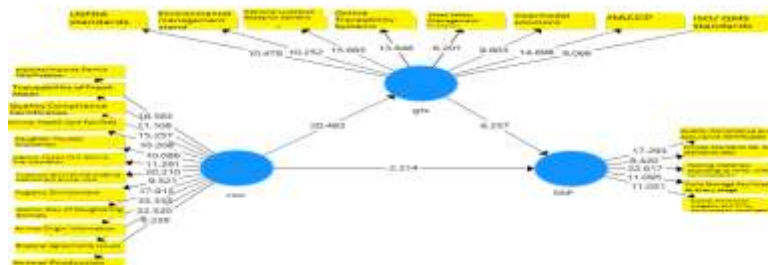


Figure 2. Schematic diagram of overall analysis results

According to above diagrams Voice of Customers served as independent variable and requirements as VOC from (1-12). Global standards played mediating role between VOC and SSP, standards as GTS from (1-8). Likewise, Sustainable Supply Chain Performance was selected as dependent variable and requirements as SSP from (1-5). Purpose of Schematic diagram was to highlight that factors loading for each requirement of questionnaire must be greater than 0.7 and the items with less values can be deleted. Results of analysis shows that, all of requirements for VOC, GTS, and SSP were greater than 0.7 which presented very strong results of composite reliability of the instrument.

Variables Measures

Construct reliability and validity

Table: 4. Construct reliability and validity

	Cronbach's Alpha	Composite
GTS	0.802	0.853
SSP	0.800	0.863
VOC	0.928	0.938

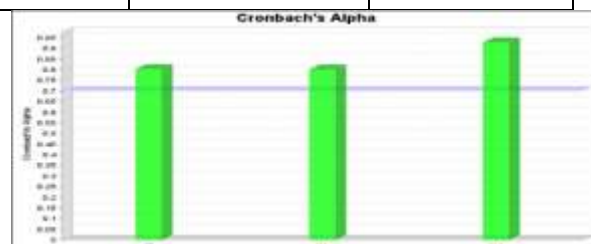


Figure 3. Cronbach's Alpha

Cronbach's Alpha for Voice of Customers (VOC) was (0.928) and composite Reliability was (0.938). twelve requirements were generated based on results of QFD model for analysis. These requirements were followed by (Susanty, Puspitasari, & Caterina, (2020); Bergquist & Abeysekera, (2015)). Responses were generated on a 5- point Likert Scale (where 1=strongly disagree and 5= strongly agree). The Cronbach's alpha for Sustainable Supply Chain Performance (SSP) was (0.800) with a composite reliability of (0.863). Here five requirements were generated for SSP based on QFD model results and previous literature including (Cardoso, Filho, & Miguel, (2015); Haleem, Khan, & Khan, (2020); DorukÖzdemir, Hårdtlein, & Eltrop (2020)). The Cronbach's alpha for Global Technical Standards (GTS) was (0.802) with a composite reliability of (0.853). Eight GTS were shortlisted for questionnaire based on previous literature including (Vanany, Iwan (2020); Maarif, Ghoffar and Soon, Jan, 2020). Results shows that values of Cronbach's Alpha were above 0.7 which indicated that our construct was very reliable.

Structural Model assessment

Path Coefficients:

Table: 5. Path coefficient

	Original Sample	Sample Mean	Standard Deviation	T-Statistics	P Values
GTS ->	0.552	0.558	0.088	6.257	0.000
VOC ->	0.760	0.762	0.037	20.483	0.000
VOC ->	0.246	0.237	0.106	2.314	0.021

Table: 6. Path coefficient

	GTS	SSP	VOC
GTS		0.552	

SSP			
VOC	0.760	0.246	

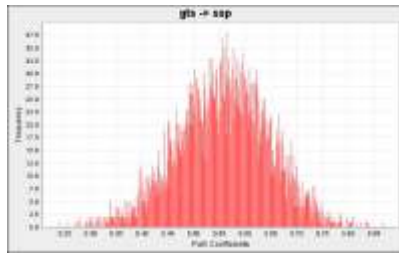


Figure 4. Path coefficient histogram

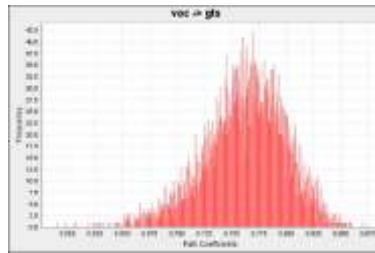


Figure 5. Path coefficient histogram
Figure

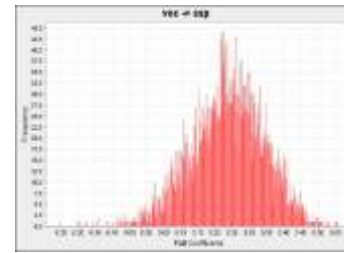


Figure 6. Path coefficient histogram

P- values for GTS, SSP and VOC were less the (0.05) which indicated that all values were highly significant with each other to make sure sustainable supply chain performance. In addition, path coefficient histograms were also bell shaped which shows the normality of research data.

R-Square:



Figure 7. R-Square

R-squared is a statistical tool to show how close the data sets are to the fitted regression line. R-squared is also called the coefficient of determination for multiple regression. In general, R-squared analysis shows the rate of dependency of a variable on an independent variable; the higher the R-squared, the better the model fits the data (Nazari, Ellahi, Sarafraz, Safaei, & Asgari, 2020). Results of figure 9 show that the highest level of dependent variables were Global Technical Standards (GTS) and Sustainable Supply Chain Performance (SSP), and Voice of Customer (VOC) was the independent variable.

Total indirect effects:

Table: 7. Total indirect effects

	GTS	SSP	VOC
GTS			
SSP			
VOC		0.419	

The value of the indirect path was (0.419), which was quite less than the value of the direct pathway which was 0.760. Thus, there was mediation between VOC and SSP by GTS.

Results

Significant relationship between Voice of Customers (VOC) and Global Technical Standards (GTS).

Path coefficient value (P) was (0.00) with respect to the relationship of VOC and GTS, and it was less than (0.05). Results of analysis show that the value was most significant and also depicted the significance of the relationship. Regarding the path coefficient value, since the value was (0.760) which shows the strength of the relationship was very strong. Regarding R-squared, GTS was 76% dependent on VOC and 24% on other external factors. Literature also supported this significant relationship as (Post, et al., (2020) shows a very strong relationship of challenges of the meat industry and quality standards. They further added that global quality standards are needed to improve the halal meat industry's performance and sustainability. Aniqoh & Hanastiana, (2020) have stated that to meet international quality standards, manufacturers should address the requirements of domain experts.

Results of analysis shows that there is strong relationship between VOCs and GTS. So, if the global technical standards will be implemented in Pakistan's halal meat industry only then the industry will be able to address all issues highlighted by domain experts of halal meat industry and APHMEMA. QFD model results also shows that's the domain experts were fail to make sure welfare of their animals due to poor animal nutrition plan, poor veterinary systems, animal diseases (i.e., Foot Mouth Disease), middlemen involvement, Loss of animal/birds during transportation and traditional slaughter houses (Ali, et al., 2020). For performance improvement in Pakistan's Halal meat industry there is strong need to implement ISO Standards, Meat Safety Management Systems, Intermodal solutions (road, rail and barge), National Livestock Research Centers, United States Food and Agriculture Authority (USFDA) standards, Quality Compliance and Assurance Certificates, Online Traceability Systems Hazard Analysis and Critical Control Points (HACCP) Certifications (Naspetti, Alberti, & Solfanelli, (2015); (Ali, et al., 2020)

Significant relationship between Voice of Customers (VOC) and Sustainable Supply Chain Performance (SSP).

Concerning path coefficients, the P value for VOC and SSP was (0.020), which was less than (0.05). It shows that the relationship between VOC and SSP was significant. The path coefficient value was (0.246), which depicted that VOC and SSP has moderate to weak relationship. Concerning R square, sustainable supply chain performance (SSP) is 24.6% dependent on Voice of Customers (VOC) and 75.4% on global technical standards (GTS). Literature also supported the relationship between VOC and SSP. As Pellattiero, et al., (2020) has stated that 80 percent meat processing companies are working hard to produce quality meat. He also stated that top suppliers of halal meat are working hard to make sure sustainable development in their halal meat sectors. Halal meat manufacturing companies size matters a lot to make sure smooth and innovative life cycle (Aujla & Sadiq, 2018). Large meat processing companies are adaptable to changes more easily than small companies (Arijo, 2020). Small meat processing companies do not have much resources and financial mobility to implement new changes and also to train their employees according to global standards. Jalil et. al (2013), said red meat animals in Pakistan are brought into different markets through various channels which are not time and cost effective (Jalil & Hussain, 2013). Therefore, most of the business persons avoid to take different initiatives related to advance methods of livestock farming and meat production (Anwar, 2019). Therefore, there is strong need to address VOC to make sure sustainable supply chain performance.

Significant relationship between Global Technical Standards (GTS) and Sustainable Supply Chain Performance (SSP).

The p-value of both GTS and SSP was also (0.00), which shows high significance of results. Further value of coefficient with respect to relationship of Global Technical Standards (GTS) and Sustainable Supply Chain Performance (SSP) was (0.552). This value shows that the relationship between GTS and SSP was very strong. Literature also supported these results as Al-Tehniz, et al. (2020) stated that sustainable supply chain performance is results of global standards implementation, process improvement, product improvement and innovation measures from the top management (Al-Teinaz, Spear, & Al-Mazeedi, 2020). Hause & Clausing, (1988) said that sustainable supply chain performance can be achieved by improving overall structure according to competitor economies and global practices. They further said that application of advance practices of globally accepted standards is essential to achieve high position in global markets. In addition, (Coasta & Dekker, (2001); Kumar, Narwal, & Jarial, (2020); Giyanti, Indrasar, Sutopo, & Liquiddanu, (2020); Wahyuni, Vanany, & Ciptomulyono, (2020) also suggested that global practices should be implemented to overcome issues related to supply chain structure of halal meat industry and in other sectors as well.

Global Technical Standards (GTS) mediate the relationship between Voice of Customers (VOC) and Sustainable Supply Chain Performance (SSP).

Voice of Customers (VOC) has very strong relationship with Global Technical Standards (GTS) and also has moderate relationship with Sustainable Supply Chain Performance (SSP). Their p-value was (0.00) which indicated the significance of the relationships. But an important component of quantitative research is the path coefficient values which determines the strength of these relationships. Concerning indirect pathway and checking the mediation of GTS between VOC and SSP the path coefficient value of indirect pathway was (0.419) which shows that they have strong mediation. We can also say that GTS mediates the relationship between VOC and SSP. Literature also supported mediating role of global technical standards between requirements of halal meat industry and sustainable performance of halal meat industry. As many previous studies including (Ajay, (2020); Syazwan, Hamid, Bakar, & Too, (2019); Mirza, (2020) stated that in Pakistan mainly due to the scarce of efficient animal nutrition plan, animal fodder/feed production plants, animal vibes

awareness, transportation means, slaughter houses availability, hygienic requirements, traceability of fresh meat, packing materials and meat quality certification leads to very high production costs. Results of analysis also shows that the global technical standards (GTS) including ISO Standards, Meat Safety Management Systems, Intermodal solutions (road, rail and barge), National Livestock Research Centers, United States Food and Agriculture Authority (USFDA) standards, Quality Compliance and Assurance Certificates, Online Traceability Systems Hazard Analysis and Critical Control Points (HACCP) Certifications are highly required to address VOCs and to make sure sustainable supply chain (SSP) in halal meat industry of Pakistan.

V. DISCUSSION

This chapter has focused on the discussion of variables including VOC, GTS and SSP in the light of previous literature and results of mixed methodological analysis.

At initial stage this study has conducted a qualitative survey by applying QFD model which is one of world-renowned model to understand customer requirements and to overcome issues. This stage has proposed a conceptual model representing requirements of local market domain experts i.e., farmers, suppliers, distributors, exporters of halal meat industry. The participants were fourteen domain experts of Pakistan Halal Meat Industry. Out of those, eight were experts from halal meat processing companies and six were directors from various member companies of All Pakistan Halal Meat Exports and Manufacturing Association (APHMEMA). The participants were invited to identify requirements of halal meat industry. Initially shortlisted thirty requirements and fifteen global technical standards for QFD model application. Keeping in view the nature of the research, 12 customers' requirements as Voice of Customers (VOC), 5 requirements for sustainable supply chain performance and 8 Global Technical Specifications (GTS) were shortlisted on the basis of group discussions, cross conferencing and application of QFD model in phase-I of this investigation. The requirements were also supported by previous studies including (Hause & Clausing, (1988); (Naspetti, Alberti, & Solfanelli, 2015); Haregot & Jilcha, (2019); Haregot & Jilcha, (2019); Ma, Liu, Tu, & Wang, (2020). Analysis initially discussed the significant relationship of the Voice of Customers (VOC) and the Global Technical Standards (GTS). Secondly discussed the significant relationship of Voice of Customers (VOC) and sustainable supply chain performance (SSP). At third stage results of analysis inquired the significant relationship of Global Technical Standards (GTS) and Sustainable Supply Chain Performance (SSP). At last stage analysis discussed the mediating role of Global Technical Standards (GTS) between Voice of Customers (VOC) and Sustainable Supply Chain Performance (SSP).

Previous studies highlighted that top suppliers are taking high position in global markets because they are strictly implementing global quality standards. As (Emberson & Pinheiro (2020) and Rosa, et al., (2020) stated that Brazil is the second largest exporter of halal food including halal meat. They reported that Brazil is strictly following quality and compliance standards. In addition, (Razzaq, Hall, & Prayag (2016); Wibowo, Hanafiah, Ahmad, & Khairuzzaman (2020); Aniqoh & Hanastiana (2020) revealed that Australia is third largest supplier of halal meat is producing very high-quality Meat (lamb, sheep and goat). Australian suppliers and exporters of halal meat are also highly satisfied with quality control and compliance strategies provide by their government. They further reported that Australia has been increasingly promoting itself as a Muslim friendly destination. India also has strong position in halal meat exports to Vietnam, Malaysia, Indonesia, UAE, ME and African economies. Although its halal meat exports have declined due to religious and political reasons but still has strong position because of high population, quality standards certifications and better cattle farming systems (Sohaib & Jamil (2018); Jakobsen & Hansen (2020). India is getting high position in global markets in halal meat because it has special focussed towards small farming, geographical distribution, regional trends, religious perspectives, animal feed development and many other perspectives.

Results of mixed methodology concluded that in Pakistan due to the scarce of efficient animal nutrition plan, animal fodder/feed production plants, animal welfare awareness, transportation means, slaughter houses availability, hygienic requirements, traceability of fresh meat, packing materials and meat quality certification lead to very high production costs. Therefore, the global technical standards (GTS) including ISO Standards, Meat Safety Management Systems, Intermodal solutions (road, rail and barge), National Livestock Research Centers, United States Food and Agriculture Authority (USFDA) standards, Quality Compliance and Assurance Certificates, Online Traceability Systems Hazard Analysis and Critical Control Points (HACCP) Certifications are highly required to address by the top management and domain experts of halal meat industry to make sure sustainable supply chain (SSP) in halal meat industry of Pakistan

VI. CONCLUSIONS

Three main conclusions can be drawn from the results of mixed methodology applied in the present study. First, analysis shows that meat industry is one of the most complexed and collectively diversified industries of the world. Because it needs innovation and continuous improvement according to customer requirements. Therefore, there is strong need to address domain experts' requirements to improve overall supply chain structure of halal meat industry in Pakistan. Results of study have concluded some important requirements as VOCs i.e., Animal Production (Animal Fodder/Feed Production Plants, Farms Conditions, Treatment with Animals etc.), Animal Health Care Facilities plans and Diseases Treatments (i.e., Foot Mouth Disease), Slaughter Houses Availability, Logistics Process from farms to final exportation, Awareness about animal breeding practices and animal vibes, Hygienic Environment, exports/Imports Permit Certification, Traceability of Fresh Meat, Quality Compliance Certificates etc.

Secondly results of analysis have suggested that the government of Pakistan with collaboration of different Ministries i.e., Food and Agriculture, Commerce, Exports Development Fund Program (EDFP), Halal Meat Association, Pakistan Agriculture Research Council (PARC), Pakistan Meat Processors & Exporters Association (APMPEA) and Livestock and Dairy Development Board (LDDDB) should focus on more extensive production systems. In addition, government of Pakistan should focus on Supply chain structure and exports enhancement programs by applying global quality and compliance standards according to requirements of WHO and WTO to make sure sustainable supply chain performance. Some important technical standards are highly recommended by results i.e., ISO Standards, Meat Safety Management Systems, Intermodal solutions (road, rail and barge), National Livestock Research Centers, United States Food and Agriculture Authority (USFDA) standards, Quality Compliance and Assurance Certificates, Online Traceability Systems Hazard Analysis and Critical Control Points (HACCP) Certifications.

At third, results of analysis concluded that increasing global demand of halal meat is a threat for those economies which are not producing sufficient quantity of livestock. Muslims and even Non-Muslims prefer halal meat because of hygienic and nutrition concerns and this is a great opportunity for Muslim world including Pakistan to capture untapped potential in global halal meat markets. Currently not even a single Muslim economy is included in top fifteen suppliers of halal meat in global markets. Therefore, there is strong need to learn about global players' strategies to capture high share in global halal meat markets. It is further concluded that competitor economies in global halal meat markets are taking high position because they have more efficient means of transportation, promotion programs, marketing, nation branding, exports development programs and overall strong supply chain structure. Further results of the analysis emphasized that there is a significant relationship of global technical standards with requirements (VOC) of halal meat industry to make sure sustainable supply chain performance (SSP). Therefore, top management and domain experts of halal meat industry need to incorporate global quality standards. It will surely help domain experts of halal meat industry of Pakistan to increase their productivity.

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