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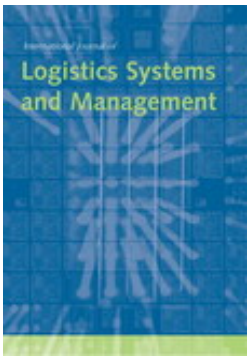

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Agri-fresh food supply chain quality and organisational sustainability: an empirical investigation

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Abstract: The purpose of this paper is to cultivate a base for agri-fresh food supply chain quality (AFSCQ) and organisational sustainability (OS) and to present a paradigm that incorporates the effect of AFSCQ practices on AFSCQ and OS. AFSCQ practices were defined from literature survey. These practices were grouped as: upstream side management (USM), logistics management (LM), downstream side management (DSM) and supporting practices like top management leadership (TML) and supply chain coordination using IT (SCCIT). The study promotes an innovative framework for AFSCQ and OS regarding the learning phase. The conceptual model was empirically tested with the help of structural equation modelling (SEM) approach and results provide support to consider the AFSCQ practices as a trustworthy mode for AFSCQ and OS.

Keywords: sustainability; supply chain quality; food; review; framework; model; blockchain.

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1 Introduction

The practices that enhance the quality of supply chain are recognised as the supply chain quality practices. It is a group of quality practices that stress on continuous advancement among the supply chain stakeholder to boost performance and attain customer gratification (Mellat-Parast, 2013). These clarifications about supply chain quality are related to manufacturing goods with limited work for food production industries. Siddh et al. (2015) indicated that various reviews of literature that target at the critical analysis on supply chain are conveyed, however, not even one of them concentrated absolutely on supply chain quality of perishable foodstuff. As well, it is noticed that scanty work had been showed on quality of food products supply chain (Mahajan et al., 2017). The food supply chain quality is tremendously complicated due to the extreme ambiguity in demand as well as price, perishability, vaster user immersion for security of foodstuffs, and dependence on the environmental condition (Van der Vorst and Beulens, 2002). Moreover, Darkow et al. (2015) analysed the supply chains in multifaceted and unstable business or commercial environs, wherever the sustainability requisites of customers in addition to legislation are growing. Siddh et al. (2017) stated that the mutual combination

of AFSCQ practices can enhance the competitive advantages of an organisation in terms of economic, social as well as environmental sustainability. From now there is an extreme necessity of advancing the area of food supply chain quality. Siddh et al. (2017) studied on the agri-fresh food supply chain quality then referred to as AFSCQ and analysed that there is no model or framework available for managing AFSCQ in the literature. Patidar et al. (2021) also reviewed literature on food supply chain management and discussed about the need of food security to maintain the quality of food product. Adams et al. (2022) focused on the implementation of sustainability in food supply chain in terms of considerable global environment and social impacts. Vern et al. (2022) stated that agri-food supply chain undergoes from multifaceted transparency, product quality, traceability, and coordination.

Food supply chain comprises various organisations, data, individuals, and events; that perform scheduling, tracking, engineering, and inventory management of goods from the raw stage to end use. To connect all the stakeholders in the supply chains, the use of ICT tools is required (Tanpure et al., 2021). Recently, the researchers recommended the use blockchain technology for the supply chain coordination; it is capable to provide transparent and reliable documentation of the transactions in the SC network of the various organisations, where no one should be able to tamper with the transaction data. It is noted that food supply chain will possibly support to improve the concerns regarding sustainability in a view of the development of the innovative approach of 'Implementing business' accomplishing significance not only in associations by means of capital but keeping a responsibility involving about the concern of sustainability for instance social and environmental views.

Present study aims to develop a paradigm for AFSCQ and develops a relationship between AFSCQ and organisational sustainability (OS). The construction of the paper is in such a way: Section 2 illustrates the literature on AFSCQ practices and OS. Section 3 discoursed AFSCQ practices and OS dimensions and also focuses on the structural model of AFSCQ and related hypothesis. Section 4 focuses on the data collection, analysis and results. Section 5 shows discussion for managing AFSCQ and OS and Section 6 depicts research implications. At last, the paper is concluded.

2 Literature review

The purpose of literature review is to put stress on the research gaps and develop theoretical support for current study. The entire literature was compiled from well reputed publishers. The AFSCQ has a considerable impact on OS in terms of economic, social, and environmental sustainability while traditional performance measures focus only on sales as well as return on investment, etc. (Siddh et al. 2017). The common tendencies that are prominent to enhance the importance of supply chain quality: development of quality creativities or innovations, liberalism in the transportation segment, and spreading out of logistics accomplishments. Es et al. (2018) stated that logistics activities are also concerned with economic and social sustainability of an organisation. Alimo (2021) discussed about the reducing of postharvest losses to improve the economic sustainability through supply chain performance evaluation. Tabaeeian et al. (2021) stated that eco-innovation impacts the supply chain in terms of sustainable consumption and production as well. Guersola et al. (2018) discussed about the supply chain performance measurement and management. Sreekumar and Rajmohan (2018) also

discussed about the sustainability of the supply chain by the utilisation of active leadership in addition to functioning collectively with their supply chain stakeholders. Chanchaichujit et al. (2019) reviewed literature on mathematical tools as well as techniques utilised in the area of supply chain sustainability. Kumar and Nath (2020) focused on IT adaption for improving the supply chain performance. Yadav et al. (2020) studied about the IoT-based agriculture supply chain for enhancing the sustainability. Yerpude and Singhal (2020) also studied about the IoT aided smart supply chain for improving the operational performance of the organisation. Ishtiaque et al. (2020) discussed about the supply chain coordination for attain better response from customer to supplier facing. Modgil et al. (2020) also discussed about the managing and coordinating of the supply chain for sustains the effective business activities.

The AFSCQ is exceedingly convoluted due to the lesser shelf life, higher amount of uncertainty during demand in addition to the cost (Van der Vorst and Beulens, 2002; Siddh et al. 2018b). Mangla et al. (2018) also concerned the concepts of sustainability in terms of food quality as well as safety. Lemaire and Limbourg (2019) reviewed literature on sustainable development relates to food loss and waste management. Kumar et al. (2022) discussed about the enhancement of sustainability in food supply chain. It is also noticed that food security in addition to environmental sustainability are highly interdependent in processes along with activities of the supply chain. Therefore, there is a vast necessity of advancing the field of AFSCQ (Manzini et al., 2014).

2.1 Research gaps

AFSCQ practices have a considerable influence on the OS that covering upstream side management (USM), logistic management (LM) or process management (PM), and downstream side management (DSM) of the supply chain. Though, it has not been taking in the literature effectively, selected research concentrated only on the USM of the agri-fresh food supply chain (Grundvag Ottesen, 2006; Shokri et al., 2010; Siddh et al., 2020). As well, various studies concentrated only on DSM of the supply chain (Chrysochou et al., 2009). Additionally, some studies assessed influence of LM on the OS (Rajaguru and Jekanyika Matanda, 2009). Han et al. (2013) studied about supply chain coordination and organisational performance. Hamister (2012) stated that practices of supply chain are ever more link up to the performance of supplier as well as retail platforms. All the previous studies are having different perceptions about AFSCQ practices and OS. A number of studies suggested that information flow play a substantial role in the effective supply chain coordination among supply chain partners (Beulens et al., 2005; Sigala, 2007). Moreover, Nakandala et al. (2017) discoursed that information flow is necessary among various entities of food supply chain for well coordination. Besides, previous studies are largely paid consideration to the direct associations, and so, there is an inadequacy of assessing association concerning AFSCQ and OS. For the time being, previous models or frameworks do assess the relation between the practices of supply chain quality and the financial performance. Martindale (2014) explained food sustainability by using the customer's survey. Sustainability is also explored in the production of agri-food (Van Asselt et al., 2014). As well Soussana (2014) explored LCA and sustainability of the agri-food systems. Nunes et al. (2014) examined environmental sustainability in the agricultural production. Lockie et al. (2015) discussed environmental and social liability expressed in private criterions and real attempts. Schoenherr et al.

(2015) studied about the assured food protection from the perception of SOS. Bisogno (2016) explored about the food supply chains and corporate social responsibility (CSR).

The subsequent openings have been recognised by previous studies on AFSCQ.

- The lack of a model that cover USM, LM and DSM of supply chain to make better in OS.
- The coordination among supply chain stakeholders is not completely counted.
- Numerous outlooks of OS are not considered at the same time.

This paper shows the conceptual framework and structural model of AFSCQ to attain OS. The framework of AFSCQ displays expanded the view of AFSCQ practices and OS.

2.2 AFSCQ practices and OS

In the beginning, AFSCQ practices and OS dimensions were recognised by an inclusive review. It includes the collection of research papers followed by categorisation by the contents of AFSCQ like AFSCQ practices and numerous OS dimensions. The collection of data for review is started from the year 1994 because of the term supply chain related to food sector firstly appeared in the year of 1994. The year 2020 (March) is considered as the finishing year of data collection for the reason that it is accomplishing previous years of the evaluation. Consequently, the period from the year 1994 to 2020 (March) is taken for data collection from reputed publishers i.e., Emerald, Taylor & Francis, Science direct, Inderscience and Wiley online library for the reason that almost all well-reputed journals are accessible in these databanks. Then research papers are collected from these well-reputed journals of industrial and management engineering by utilisation of numerous keywords like food supply chain, supply chain of vegetable and fruit etc. After that, the duplication of papers was removed from all collected papers.

Afterward identified the two academicians are having the doctorate in the perishable food segment and three food supply chain experts were invited for truncation process of collected research papers. During the truncation process, the research papers which relates to AFSCQ are separated. In specific, AFSCQ practices are recognised in both supply chain of agri-fresh food and quality associated research studies. After recognised AFSCQ practices are grouped as USM, LM, DSM and supportive practices like top management leadership (TML), and supply chain coordination using IT (SCCIT).

By tradition, OS was generally evaluated by financial measures like return on invested capital, etc. (Aramyan et al., 2007). The financial measures of organisation did not completely depicted the OS because of OS completely attained by some additional objectives as social and environmental sustainability (Siddh et al., 2017).

Later on, structured interviews with academicians and field expert had been organised. The discussions with academicians and field expert were recorded in addition to analysed before accomplishing some development in the models or frameworks. Then Q-sort technique is utilised to assess the consistency of the models. During the assess model conformity or consistency, selected senior-level managers are invited to study the models to develop an all-inclusive quality. By feedback from field professional, the concepts of research are revised and developed the final models.

As per conversed, an all-inclusive accomplishment of AFSCQ necessitates to covering three major dimensions, comprising: USM, LM and DSM. Besides, supportive practices like TML and SCCIT, etc. takes part a significant function in the effective

supply chain execution or OS. Considering the comprehensive literature review, the considerable AFSCQ practices are recognised.

The main categorisation of AFSCQ practices are

- USM
- DSM
- LM
- supporting practices like TML and SCCIT.

The innovative processes, products, or organisational approaches to a surviving organisation are needed to increase sustainable effectiveness (Hansen et al., 2009; Schaltegger and Wagner, 2011; Horn and Brem, 2013). Sustainability can be expressed as the establishing of novel processes, products, or organisational methods that have a complete optimistic impact on the capital stock of the organisation, by the focus on economic, social and environmental objectives (Hansen et al., 2009).

3 Structural model of AFSCQ and related hypotheses

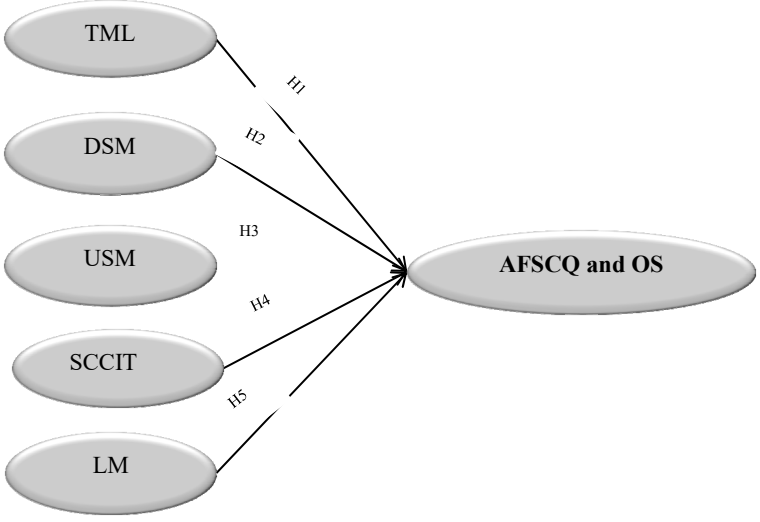
The study promotes a conceptual framework for AFSCQ and OS regarding the learning phase and suggests a structural model that comprises the relationship between AFSCQ practices and OS. This section discussed the structural model of AFSCQ and related hypotheses in the subsequent stages. Figure 1 shows the conceptual framework for governing all the suggested factors or construct of AFSCQ that influence the USM, LM and DSM of agri-fresh food supply chain that suffered inadequate focus in earlier literature. Zeng et al. (2013) stated that upstream quality mainly relates to supplier quality; logistic quality links to processing quality or process control while downstream quality mainly relates to customer focus. TML is illustrated as base or foundation of the framework. It indicates that TML examine; human resources management that sustains USM, LM, DSM and supportive practices like SCCIT. On the basis of above discussion OS is expressed as economic, social and environmental sustainability that shows at the top of concerned framework. Then, direct, and indirect relationships of concerned concepts or practices with several extents of OS are established, as indicated in Figure 2. The proposed structural model of AFSCQ to achieve OS is shown in Figure 2. In the subsequent stages, hypotheses are developed that shows relationship among AFSCQ practices and OS. Structural equation modelling (SEM) approach is selected to empirically test the proposed model.

3.1 Top management leadership

TML performs a central position in a well and commercial implementation of AFSCQ practices (Siddh et al., 2018a). It is very necessary for top management as well as employees to be well acquainted with needs of OS. The required resources are being made available by top management to assess customer's feedback, in addition, to make up attempt to sustain them. Also, the involvement of customers in organisational activities is very vital for the success of the overall supply chain.

Figure 1 Conceptual model of AFSCQ and OS

Figure 2 Structural model of AFSCQ and OS



In modern view, supplier quality is observed as TML that mainly emphases on the quality of supplier. Supplier quality denotes raw food quality and attaining environmental sustainability (Rimmington et al., 2006). TML is important to confirm this implementation is fruitful (Singh, 2008; Mokhtar et al., 2019). The TML counts the quality of supplier is the major part by endorsing developed strengths of coordination and keeping a relationship with the best suppliers that cause superior cooperation and collaboration among partners of the supply chain. Also, an effective lead of supply chain coordination, information should be shared with stakeholders of the supply chain. Consequently, leadership of top management has a considerable position, to confirm that communicating of information is employed positively amongst stakeholders of the supply chain. As well, quality of information like accuracy, credibility, and timeliness, etc. is also governed by top management for coordination of supply chain (Zeng et al., 2013).

The top management also plays a vital part in the employees' development and enthusiasm. The top management also conducts training programs to improve skills and

knowledge related to the quality of employees (Singh, 2008; Kretschmer et al., 2014; Ghode et al., 2021). Besides logistic management is counted in favor of AFSCQ then also focused by means of top management (Siddh et al., 2017). From now, propose the following hypotheses.

H1 TML supportively influences the AFSCQ and OS.

3.2 Downstream side management

The DSM is taking into account as a key part of an organisation by top management (Siddh et al., 2015). It is concerned with the needs of consumers or provides the better produce to the consumer. Ali et al. (2010) stated that buyers are generally showing their concern for freshness/purity of food produces followed by quality, cost, packing, and availability of non-seasonal food produce, etc. Lamprinopoulou and Tregear (2011) cover up the linkage to the performance of marketing by examining the contents and structure of network relationship. All of the department should convey vision as well as mission among member of staff that associated to DSM (Aghazadeh, 2004; Nabhani and Shokri, 2009). Moreover, to boost the customer's welfares, organisations develop the values of work by understanding quality constraints of food products.

It is too effective to enhance the quality of process in addition to LM, etc. (Taylor, 1994; Ahmed et al., 2005; Louw et al., 2007; Tuominen et al., 2009; McCarthy et al., 2013). Thus, DSM impacts the AFSCQ. From now on, propose the following hypotheses.

H2 The DSM supportively influences the AFSCQ and OS.

3.3 Upstream side management

USM practices show that a certain quality raw food material sustains the standards of final outcome (Bourlakis et al., 2012). The defined characteristic of process as well as final outcome would support the companies by delivering standard raw foodstuff on the preferred schedule along with essential amount. It is also noticed that efficient USM could cut inventory losses in addition to sustain ecological targets (Rimmington et al., 2006). As a consequence, the USM impacts the AFSCQ. From now, proposed the following hypothesis.

H3 The USM positively influences the AFSCQ and OS.

3.4 Supply chain coordination using IT

The coordination among supply chain stakeholders employing IT services (like blockchain) boosts the efficacy of logistic quality. It is noticed that to accomplish standards of food product, procedure, in addition to facility, coordination between suppliers and consumers with the organisation is needed (Ulwick, 2005). SC processes and data sharing among the participants of the SC network can be enhanced by blockchain technology (Ghode et al., 2020).

The sharing of data among supply chain partners, with a real target of lessening spoil then make realistic OS. The paper concentrated on the flow of information and material, especially on communing necessity and information of shelf-life (Kaipia et al., 2013). Supply chain stakeholders that communicate information commonly are efficient of

functioning as a distinct or single entity, jointly or cooperatively, they can make out the necessities of the consumer perfectly and henceforth, can react to market variant more rapidly. From now, proposed the following hypothesis.

H4 SCCIT positively influences AFSCQ and OS.

3.5 Logistic management (LM)

Moreover, the LM also influences the AFSCQ. LM recommends the facility location nearby to suppliers and consumers also govern the order dimensions (Mangla et al., 2019; Jie et al., 2013; Patidar et al., 2021). Paksoy et al. (2012) examined that obstruct in product distribution in addition to decay of produce through transport is lessened by the LM. From now, proposed the following hypothesis.

H5 LM positively influences the AFSCQ and OS.

3.6 AFSCQ and OS

The effective execution of supply chain has the considerable effect on OS like economic, social and environmental sustainability (Panigrahi et al., 2019; Hong et al., 2019; Namagembe et al., 2019; Kumar et al., 2020; Mani et al., 2020; Yadav et al., 2021). Siddh et al. (2017) reviewed AFSCQ and discussed that AFSCQ has the main effect on OS for instance practices of AFSCQ encapsulate the entire supply chain. The OS covers ECS, SOS and ENS of an organisation (Mangla et al., 2018).

4 Data collection, analysis, and results

The proposed model was empirically tested with the help of SEM approach. Data has been collected through the utilisation of survey questionnaire from the Indian industries to examine conceptual model of AFSCQ and OS. The response collected for this study supports the key requirement as the sample size is 163. The responses should be as lowest 150–300 for an empirical investigation (Hutcheson and Sofroniou, 1999). The coding was performed after the collection of data for all the items. The attempt of coding involves the variables numbering. Afterward, data screening was carried out.

The internal consistency among set of items of a construct is measured by Cronbach's alpha. The value of Cronbach's alpha for constructs differed from 0.717 to 0.798, which is acceptable value of reliability. The Cronbach's alpha higher than 0.7 is considered the satisfactory range (Flynn et al., 1990).

Second order confirmatory factor analysis (CFA) was executed by employing AMOS 18.0 software by means of maximum likelihood (ML) estimation method. The second order measurement model supposed a latent construct leading the correlation among TML, DSM, USM, SCCIT and LM. CFA was employed to examine the second order measurement model. All construct in the second order measurement model sustains the key essentials and are subsequently considered. The results for leading construct (AFSCQ and OS) as well sub constructs (TML, DSM, USM, SCCIT and LM) were estimated by CFA.

The Convergent validity of the model can be evaluated by average variance extracted (AVE). The estimate of AVE is 0.517 for construct AFSCQ and OS. The value of AVE

higher than 0.50 is acceptable. The value of composite reliability (CR) for second order latent construct is 0.793. The Value of AVE higher than 0.70 is acceptable. The estimates of numerous model fit indices for model are as follows; (χ^2) / df = 2.296, GFI = 0.894, AGFI = 0.866, RMR = 0.033, NFI = 0.840, CFI = 0.909 and RMSEA = 0.066. RMR should be less than 0.08 as well as RMSEA should be less 0.07 (Hair et al., 2006). The p value of each hypothesis is significantly low (***) and unable to reject the null hypothesis. The entire model fit indices are in satisfactory range. It proves that AFSCQ and OS is takes into significance as a second-order construct along with five sub-dimensions.

5 Discussion

This paper serves the main purpose of determining the gaps surviving in the literature of AFSCQ and OS using revising several selected research papers. As per the time is going by, research papers in the arena of AFSCQ and OS are rising. As expressed earlier, AFSCQ and OS emphasised AFSCQ practices that focus on continuous process improvement to enrich OS. Therefore, OS is a valuable outlook for AFSCQ that enables the successful organisation to show the appropriate stage of variations to be conveyed in the supply chain in addition to appropriate accomplishment that can be considered. Moreover, Siddh et al. (2015) conversed the OS in terms of supply chain quality of perishable food products. One more noticeable outlook is that the measurement of performance aspect is also at a rising phase in AFSCQ and OS literature. Some studies concerned on the enhancing performance of supply chain using examining the waste due to decaying nature of food products (Atilgan and McCullen, 2011). These particulars suggest researchers/practitioners to preferably build up a performance measurement approach for the AFSCQ and OS that will assist evaluation as well as generation of consistently implemented quality practices in the all-inclusive agri-fresh food supply chain.

The bulk of the papers indicated that information management is dynamic for concentrating AFSCQ issues, though sustainability management is one more vital outlook of AFSCQ and OS. It exposes that research towards AFSCQ practices and OS is being focused to an immense extent. It also indicates that agri-fresh food products and concern services quality immersed should be propagated by means of coordination through using well means of communicating or interactive information amid supply chain stakeholders. In addition, the technology and moral principles of industry of agri-fresh products ought to be regulated by overarching standards of sustainability.

From the above discussion on AFSCQ and OS, there is no model or framework available for managing AFSCQ and OS. Researchers also evaluated the studies on AFSCQ then investigated that there is no model or framework existing for governing AFSCQ in the earlier literature (Siddh et al., 2017).

Since above discussion on AFSCQ and OS, a conceptual outline has been developed for managing of AFSCQ and OS that is shown in Figure 1. The conceptual framework for coping all of the suggested constructs of AFSCQ and OS that influences the USM, LM and DSM of agri-fresh food supply chain that suffered insufficient attention in the earlier literature. Zeng et al. (2013) specified that upstream side quality of supply chain mainly relates to supplier quality, logistic quality of supply chain relates to logistics quality even

downstream side quality of the supply chain primarily connects to emphasis on consumer focus. In Figure 1, the TML is shown as a foundation of the AFSCQ and OS framework. It signifies that TML appraise the human resources management that hold up USM, LM, DSM by means of customer satisfaction and supportive practices also, like SCCIT. The OS is expressed as economic, social and environmental sustainability that shows final outcome of the AFSCQ practice at the top of the concerned conceptual framework.

6 Research implications

This paper presents recent chances of advance exploration in arena of the AFSCQ and OS. Findings of this paper expose subsequent implications.

- The agri-food products have a substantial share in the economy of the world and also supplies for a lot of food industries. The price of agri-fresh food has shown a critical rise thru the world. Aggarwal and Srivastava (2016) discussed that agriculture kind of productiveness is the strength of developing countries' economy. Researchers specified that superior economic returns by means of food cultivators also retailers can simply be attained if the enormous post-harvest damages could possibly be lessened by way of better handling and improved supply chain processes (Kalia and Parshad, 2015). Moreover, it is also noticed that bulk of research papers are from the developed countries in the field of AFSCQ while not as lots of consciousness in emerging populations. Researchers examined the studies on AFSCQ and also indicated that study in the direction of AFSCQ is fast rising due to more impendence that AFSCQ is achieving. Consequently, there are numerous research openings in the domain of AFSCQ in developing nations.
- AFSCQ has the substantial effect on OS by means of the AFSCQ practices considering the complete dimensions of the supply chain. The OS comprises of economic, social in addition to environmental sustainability of an organisation. OS measures are distinct from the usual measures of performance as return on investment, etc. Bisogno (2016) indicated that small supply chain can facilitate the concentration on sustainability in term of money along with social and environmental sustainability. Practitioners can utilise that conceptual model like 'road map' in support of employing AFSCQ and OS practices to attain sustainability in term of economic, social and environmental. Researchers may require integrating the sustainability in several facets of AFSCQ.

7 Conclusions

This paper discusses the combination of quality with supply chain which is lacking in concerned literature. It enunciates the all-inclusive framework for advising AFSCQ and OS. As per concerns, managerial implications in the paper, by reviewing the quality issues contained by supply chain of agri-fresh foodstuff, a conceptual framework that offers a complete depiction of essential practices or dimensions of AFSCQ and distinct facts of OS is suggested. This conceptual or theoretical framework of AFSCQ can be utilised as 'a direction' for concept constructing in addition to preparing a measurement instrument. Also, a structural model that identifies the direct, as well as indirect

correlation among practices of AFSCQ and OS dimensions are proposed. Since all the endeavor of any organisation must initiate by the TML. Also, infrastructure supportive practices like SCCIT, TML, etc. are then used to assists the core or central practices like USM, DSM, LM, etc.

As far as future work of this study is concerned, the proposed framework requires testing with other industries from the globe. It is desirable to establish rationality of these models by empirical research in distinctive perspectives. Outcomes as the subsequent empirical analysis will provide evince to support the correlation among AFSCQ practices as well as OS. These commendations imply innovative advice for upcoming research or studies.

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