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A STRUCTURED-LITERATURE-REVIEW OF THE SUPPLY CHAIN PRACTICES IN DAIRY INDUSTRY

ABSTRACT

Dairy industry plays a vital role in enriching the socio-economic status of rural India, particularly in women empowerment. In general, either a structure or subcomponents of dairy supply chain is discussed in the literature, but the rational (why, what, how) is missing. Further, the structured-literature-review (SLR) of dairy supply chain management (DSCM) practices is scarce. This paper presents an SLR of articles published in the context of DSCM practices. The paper further assesses the extent to which the SLR approach can be applied to DSCM so as to produce a consistent knowledge stock by evolving a context-sensitive study. The key challenges discussed in reviewed articles are highlighted. Authors selected the articles published in peer-reviewed journals and categorized the articles published in recent eleven years into three main subjects of supply chain i.e. distribution management (DM), risk management (RM), and decision-making strategies (DMS). The findings of this study show that the food safety, product quality, and associated economic benefits in dairy industry can be achieved through technological innovation, eradication of uncertainties, and introducing the global SCM practices into lean and green initiatives.

KEYWORDS | Supply chain management, structured-literature-review, dairy industry, strategic management, decision-making.

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INTRODUCTION

In the current global market, industries cannot ignore the success factors such as economic trends, competitive position, technology advancement, and operations and SCM activities. SCM is a generic term related to a set actions to manage various entities such as supplier, procurement process, production, product delivery, the flow of information, customer demand etc. in an organization. SCM is viewed as a system of interaction among various stakeholders (Christopher, 1992; Lambert, 2008). The improved product quality, elimination of uncertainties and high brand value leads to better SCM and offer the decreased costs (Cooper, Lambert, & Pagh, 1997; Wisner, 2003). Effective SCM and logistic activities include managing the customer need, on-time product delivery, and flow of information across the supply chain (SC) network (Srivastava, 2006). SCM address various methods for achieving consumer focus through process effectiveness (Zokaei & Hines, 2007). Cooper et al. (1997) stated that SCM is more extensive than coordination management as it includes the linking of key business activities over the interconnection. Mentzer et al. (2001) and Wisner (2003) emphasized on the significance of firm and cross-firm coordination. The framework for logistical activities involves the execution of basic activities, value-added activities, planning and control, and strategic decision measures (Hsiao, Van der Vorst, Kemp, & Omta, 2010). Competitiveness in the supply chain has been a key issue for organizations and 'mapping the competitiveness of an organization help to form the sound basis for business strategy development. Each stakeholder in SC must intend to turn out in a dynamic and competitive way for sustainable business operations (Mor, Bhardwaj & Singh, 2018a; 2018b; 2018c).

The fundamental difference between food supply chain (FSC) and other is the continuous and significant variation in product quality over time. SCM activities like service, delivery, and information flow are still key challenges in the food sector. Strategically, rather than competing within the low-cost market segment, many food producers are working on different marketing strategies to target the rural market. This has led the industries to implement a range of sustainable practices like local sourcing, reuse, recycling, and green purchasing (Mor, Singh, & Bhardwaj, 2016; 2017). The role of logistics, packaging and on-time delivery are some worries in food processing sector like dairy (Jahre & Hatteland, 2004). Further, due to the highly perishable in nature of dairy products, they entail special treatment, cooling mechanism, handling and quick actions starting from milk procurement to distribution or retailing. DSC entails four main elements as raw milk supplier/farmer, milk processing plant, retailer, and the end consumer. The dairy industry has observed vast changes in their business structure like globalization, technological development, the enhanced shelf life of products, and seasonal demand fluctuation. It needs significant development in their competitiveness status so as to meet high product quality, consistency, and safety standards of the export market (Bhardwaj, Mor, Singh, & Dev, 2016). Diverse characteristics make it more challenging to manage the supply chain activities in dairy industry. Quality management appears to be the most important factor in dairy industry followed by inventory management, supplier management and technological innovations (Mor, Bhardwaj, & Singh, 2017).

Literature review is a research approach and content analysis of the relevant literature (Krippendorff, 2004). Content analysis is a systematic way of briefing many words of text into a smaller set of contents (Weber, 1990). Structured literature review (SLR) aims to address the issues in a particular research area through *identifying*, *evaluating* and *integrating* the outcome of the relevant available studies leading to various research questions. An SLR study must address the following (Baumeister & Leary, 1997; Bem, 1995; Baumeister & Leary, 1997):

- Establish to what extent the prevailing research has been developed in a particular area.
- Find out the relations, conflict and research gaps in literature, and formulate the conceptualization of a problem (Sternberg, 1991).
- Define the future research directions, and extend or develop a new theory.

Structured reviews vary from traditional reviews by assuming a detailed technology aimed at reducing the bias through exhaustive literature examinations. An SLR offers various research questions that form the basis of a research problem (Massaro, Dumay, & Guthrie, 2016) and research questions. The first step in performing an SLR is to create a list of structured questions or groups. The second step is to execute an in-depth search of the relevant available literature. Thus, SLR is a way for reviewing the scholarly literature to develop insights, critical reflections, future research area (Massaro et al., 2016).

Thus, current paper is an attempt to review the relevant available literature concerning SCM practices in the dairy industry. The rest of the paper is organized as follows. Section 2 covers the methodology part, and section 3 includes the analysis of articles. The discussion is given in section 4, while, section 5 is the conclusion, and limitation and future scope in continuation to this study.

METHODOLOGY

In this paper, the target population is the articles published recently in various databases. The articles were searched on various scientific databases like Google Scholar, Open access Journal, Web of Science, Scopus etc. by using the title, abstract field and keyword. These databases offered numerous articles which were reduced by applying the limiting criteria in selecting and evaluating the body of literature on DSCM, for example, year of publication, research area i.e. dairy industry, supply chain management, operations management, food processing etc.; type of journal and document etc. (Mor et al., 2016). A sample size of more than 100 articles of recent eleven years (2008 to 2018) concerning supply chain management practices was considered. The selected articles concern three main research areas i.e. DM, RM, and DMS in the context of dairy supply chain management (DSCM). The reviewed articles were classified on the basis number of year of publication, journal name/type, subject and area of research.

Validity and Reliability

Validity is the degree to which a measuring process signifies the quality of obtained results leading to as realistic. External validity is related to whether the sample of study agree to the population or not (Neuendorf, 2002; Krippendorff, 2004). In this paper, all the articles are related to SCM practices and hence, the external validity is assured. Subsequently, face validity is confirmed that whether the developed instrument measure exactly what it is intended to measure or not and approve the outcome if reasonable (Neuendorf, 2002; Krippendorff, 2004). The articles reviewed in this paper have been tested by the subject experts and academicians whether it is sufficient to assess the proposed results, and content validity is measured. An instrument is supposed to support the content validity if it covers all aspects of the research area which it is proposed to measure, and hence the content validity has been checked by the authors. Weber (1990) confirms that the article selection must be reliable to develop valid implications from the expression, and the reliability issue occurs due to the uncertainty of word definitions. In the current paper, the percent agreement technique is used to assess the reliability by simply adding up the selected cases by the three experts, and dividing by the total number (Mor et al., 2016). Finally, the reliability gained in the current paper comes out to be 76%, and thus deemed as reliable.

ANALYSIS

Khadar and Sandesha (2016) highlighted the effectiveness of SC practices w.r.t dairy products in Dakshina Kannada dairy and observed a clear focus on milk quality, brand loyalty, customer demand and brand image. De Steur, Wesana, Dora, Pearce, and Gellynck (2016) presented SLR to show that the potential of value stream mapping to identify and reduce food waste. Authors concluded that a multi-stakeholder collaboration in FSC is vital for successful execution of lean. Sharma, Chandana, & Bhardwaj (2015) investigated various performance indicators along with sub-factors in green inventory network management. Gautam, Virmani, and Singh (2016) found the effect of marketing activities on Amul's success in Indian dairy industry and found the marketing strategies as critical for firm's success. Parenreng, Pujawan, Karningsih, and Engelseth (2016) investigated the RM issues due to food traceability and innovation through a contextual study of Sulawesi in Indonesia. Deshpande et al. (2016) explored the dairy product's market in India and found that about 50% of dairy products in India are retained for self-consumption, 40% is procured and distributed by unorganized milkmen, and 10% form the organized sector. Further, the international companies and local cooperative organizations consume 55% and 45% of milk produce respectively. Mor et al. (2017) developed a framework for the evaluation of procurement performance in dairy supply chain practices in the context of Indian dairy industry. Exhibit 1 depicts the list of key journals referred for sampling of articles published in this context.

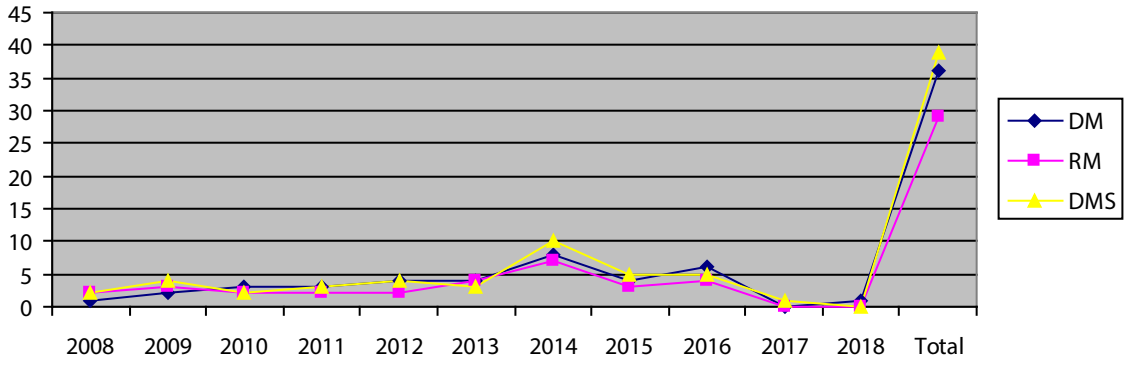
Exhibit 1. List of key Journals referred for Sampling

Sr. No.	Name of Journal(s)
1	Annals of Operations Research
2	International Journal of Production Economics
3	Journal of Management Sciences and Technology
4	International Journal of Services Technology and Management
5	Production Planning and Control
6	Journal of Industrial and Production Engineering
7	International Journal of Production Research
8	Review of Agricultural Economics
9	International Journal of Production Management and Engineering
10	International Journal of Physical Distribution and Logistics Management
11	Journal of Dairy Science
12	Agricultural Economics Research Review
13	International Journal of Logistics and Supply Chain Management Perspectives
14	International Journal of Supply and Operations Management
15	International Food and Agribusiness Management Review
16	International Journal of Scientific and Engineering Research
17	Journal of Manufacturing Technology Management
18	Industrial and Engineering Chemistry Research
19	International Dairy Journal
20	IOSR Journal of Business and Management
21	Proceedings of the International Conference on Industrial Engineering and Operations Management

Subburaj, Babu, and Subramonian (2015) focused on improving the operational efficiency of DSC in Tamilnadu through SWOT analysis, and identified five areas of focus namely, the creation of the special dairy zone, implementing dynamic milk procurement process, reinforcing the cooperative societies, creation of feed bank and increasing fodder productivity, integrated animal health plan and information technology. Banasik et al. (2016) developed a scientific model of waste handling and expressed the exergy loss as an environmental indicator in FSC. Sharma et al. (2017) ranked the key performance indicators responsible for implementation of GSCM in Indian dairy sector through extensive literature review and personal interviews. Handayati, Simatupang, and Perdana (2015) surveyed the FSC practices to identify key coordination issues. Chen, Zhang, and Delaurentis (2014) developed a model to study the 'quality measures' in FSC via a case study and concluded that the decentralized SC lead to distortion in food quality. Behzadi, O'Sullivan, Olsen, Scrimgeour, and Zhang (2017) investigated the effectiveness of robust and resilient strategies along with the profit gain through optimal RM and SC planning decisions. Mangla, Sharma, and Patil (2016) proposed that it is expected to focus on basic success factors to enhance the execution of FSCM practices. Zubair and Mufti (2015) assessed the DSC risks and found key risks of competition, quality of raw materials, and natural disasters etc. Nicholas et al. (2014) indicated that the preference of low-input and organic DSC members in Belgium, Finland, Italy, and the UK lies in developing the innovations to improve animal welfare and forage quality. Boland et al. (2015) found that

firms must balance the need of multiple areas like the general public, employees, cooperative members, external funding organizations etc. Daud, Putro, and Basri (2015) concluded that extensive RM practices are crucial for milk supply chain like biological, natural, operational and institutional risks. Dora, Kumar, and Gellynck (2016) identified the product perishability, retailer's behavior, traditional production process and layout as significant factors in the food sector for lean implementation. The subject-wise classification of articles is shown in Figure 1.

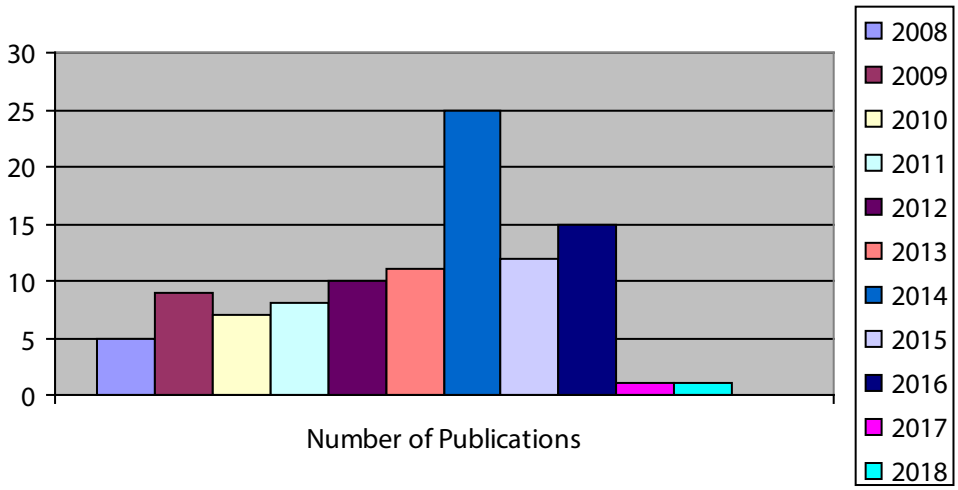
Figure 1. Subject-wise Classification



Minarelli, Raggi, and Viaggi (2015) identified the determinants of innovation and revealed that an association exists between product, process and market innovation due to the technological factors in the food sector. Bamgboje-Ayodele, Ellis, and Turner (2014) recognized a research gap in perishable food chains for knowledge optimization concepts, the influence of firm-level absorptive capacity and ecological uncertainties. Bharti (2014) dealt with the potential and difficulties in the frozen food products in India. García-Arca, González-Portela, and Prado-Prado (2014) directed that there is a significant probability of improving cost efficiency (about 26%) in smallholder dairy. Ghosh, Sindhu, Panghal, and Bhayana (2014) analyzed various risk enablers in the dairy sector with interpretive structural modeling (ISM) approach. Khan and Prashari (2014) analyzed the growth and development of Indian dairy sector in the context of the role of government agencies and policymakers. Kumar (2014) evaluated the performance of inventory management in dairy industry and proposed a theoretical model for a coordinated production network. Lemma and Gatew (2014) presented the modeling and optimization approaches discussed in literature focusing the perishability of products, wastages and loss assessment in DSC. Okano, Vendrametto, and Santos (2014) demonstrated that it is possible to organize DSC by using indicators to rank them and modeling best practices to improve productivity and become a sustainable productive chain. Patel, Modha, Patel, and Patel (2014) discussed that India ranks 1st in milk production as well as consumption and stands distinct with the lowest cost of milk production. Patushi and Kume (2014) suggested the cluster development to increase business competitiveness through policy guidance, and proposed a model for enhanced productivity, lowered costs and better product quality. Banaszewska, Cruijssen, Claassen, and van der Vorst (2014) performed contextual analysis in dairy industry and focused on the benefits obtained from whey treatment. Verma and Seth (2014) highlighted the poor road infrastructure and absence of cold chain infrastructure in Indian dairy industry. Khoi and Dung (2014) provided a close look at value chain and its application in the dairy industry in Vietnam. Mahajan, Garg, and Sharma (2014) concluded that India ought to play a crucial role in adhering to food safety norms for its domestic market as well as for global processed food business. Muhammad, Akhter, and Ullah (2014) introduced the significance of dairy production practices in Pakistan and found that SC disruption as a critical issue that is based on informal channel. Kumar (2014) revealed the connection between DSCM, operational performance, inventory management and lean SC practices. Glover, Champion, Daniels, and Dainty (2014) applied institutional theory to explore the role of supermarkets in developing the sustainable practices across DSC. Luxton, Sankaran, and Carroll (1999) analyzed the interactions of SC coordination in New Zealand dairy industry with special emphasis on operation research

applications. Kumar and Prabhakar (2013) recognized the different issues in Indian dairy industry to enhance the productivity of DSC. The year-wise classification of articles is shown in Figure 2.

Figure 2. Year-wise Classification

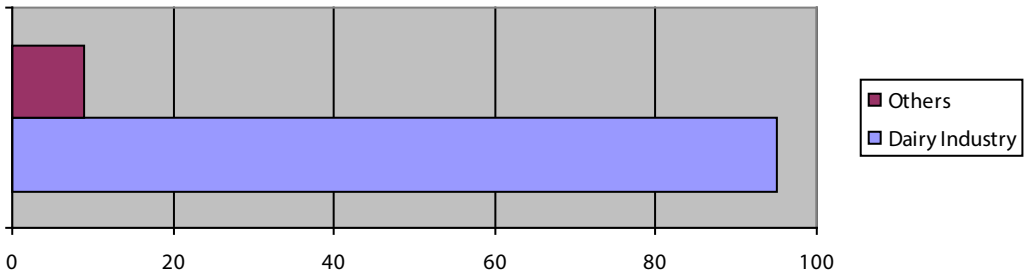


Prakash and Pant (2013) suggested that the importance of balance scorecard approach in India is different from the developed countries due to infrastructural issues, variable milk production, poor breed of cattle, poor sourcing, unavailability of cold infrastructure and poor information systems. Prasad and Satsangi (2013) concluded that it is a popular belief that Indian cooperative system is a failure, but Amul with cooperative structure is an example of grand success in this context. Sharma (2013) emphasized on various aspects of lean management, complex production system and cold chain infrastructure in DSC. Bilgen and Celebi (2013) explored the issues in Yogurt production in a dairy plant through mixed programming model. Augustin, Udabage, Juliano, and Clarke (2013) introduced the drivers for an aggressive dairy industry and the associated issues of producing dairy products. Gold, Udabage, Juliano, and Clarke (2017) studied the factors affecting the supply chain performance in global agri-food business. Vlontzos and Theodoridis (2013) evaluated the efficiency change in 29 Greek dairy firms by non-parametric approaches and data envelopment analysis models. Rao, Raju, Reddy, and Hussain (2013) concluded that significant changes are needed in milk procurement and processing phases in Indian dairy sector to compete globally. Gupta and Roy (2012) conducted some case studies to measure the associated benefits gained with vertical integration in Indian dairy industry. Kumar et al. (2012) probed into the conceptualization of geographic information system (GIS) in the dairy industry and offered the execution of RM tools. Kajananthan and Achchuthan (2013) recognized that the dairy sector needs to design the marketing and DM plans at large scale. Ashok and Sriwastwa (2012) examined the strategy and purpose of the low input DSC and the role of information system in DSCM. Samuel et al. (2012) presumed that agri-food production system is completely in a developed stage in the USA, UK, Australia and New Zealand, however, it is advancing itself in the developing nations like China and India. El-Osta and Morehart (2000) analyzed the effect of technological innovation and demonstrated that innovation would significantly increase the profitability of the dairy industry. Barbe, Gonzalez, Triay, and Hughes (2011) revealed some insight into the vertical integration to enhance the efficiency of British dairy farmers through the effective production systems. Kumar, Staal, and Singh (2011) concluded that the progressive DSC has a comprehensive structure, and the traceability and food security issues are the barriers in a dairy production system. Mishra and Shekhar (2011) contended that perishable nature of dairy products leads to high wastage and it reduces the product value. Pinior, Belaya, Petersen, and Selhorst (2011) realized the arrangement of hierarchical interaction in German dairy industry by exploring the inter-departmental relationship in supply chain network. Rathod, Nikam, Landge, and Hatey (2011) investigated the Gokul dairy cooperative for the benefits of dairy farmers through a pretested questionnaire survey in 150 dairy industries in Maharashtra. Singh and Javadekar (2011) focused on

the usage of IT by the unorganized sector for SCM of perishable food products in Pune and found enormous wastage of food products due to non-usage of IT. Vandeplas (2011) revealed that effective information systems can improve the system efficiency, productivity, and traceability of dairy industry. Bowonder, Raghu Prasad, and Kotla (2005) discussed the application of information and communication technology (ICT) in the dairy industry and revealed ICT can help in improving the overall productivity of dairy industry. Kumar (2010) explored the issues related to the decision-making process in dairy industry and demonstrated that it leads to better SCM in the dairy industry.

Popovic and Radovanov (2010) recognized the vertical integration as a key driver in SCM practices in Serbian dairy industry. Wamba and Wicks (2010) characterized the role of inventory management, RFID, and transportation system in dairy industry's growth. Kumar et al. (2010) observed the expenses and return in the conventional dairy system to assess its marketing process and the capability to handle demand fluctuations. Berkum (2009) examined the structure of dairy production system by pointing out that the dairy sector is yet in developing state in many nations. Punjabi (2009) studied the factors affecting the performance of dairy industry through Porter's five elements i.e. ability towards the entry of new players, bargaining power of supplier and buyer, the threat of substitutes, and challenges among the existing players. Saravanakumar and Jain (2009) proposed the value-added chain management for the dairy sector through variables like information costs, and non-value factors like innovation. Tordecilla-Madera, Polo, Muñoz, and Rodríguez (2017) designed a robust logistics system for the milk storage and refrigeration system for optimizing the usage of the cooling tank for procurement and distribution. Schlecht and Spiller (2009) considered the business connection between the dairy industry and dairy farmers in north-western Germany, especially regarding arranging the conditions of the DSC network. Jansik (2009) inspected the research gaps at different levels of DSC including milk production, procurement, and processing. Figure 3 represents a comparison of articles on the basis of sector.

Figure 3. Sector-wise Classification



Pieniadz, Hanf, Voicilas, Wegener, and Götz (2009) found that effectiveness of DSC can be attained through better coordination between different interfaces of a supply chain. Rangasamy and Dhaka (2008) explored the effect of advertising on the productivity of the private dairy plants in Tamil Nadu in 20 dairy industries along with the logistics and transportation management agencies. Schotzko and Hinson (2000) proposed a solution to the issues that hamper the dairy industries to be more sustainable and competitive. Bremmers, Poppe, Wijnands, and Meulen (2008) concluded that the impacts of regulatory overheads are intervened by creativeness, organizational culture, food safety standards etc. in the food sector. Szajner and Szczególska (2007) argued that the policymakers in Polish dairy industry should promptly stimulate the sustainable SC activities and brand value. Srikanth (2007) discovered the effect of operations management on dairy products in four dairy cooperative industries in Karnataka. Spicka (2013) concluded that the vertical business relationship in DSC is a key weakness of Czech dairy industry. Amorim, Alem, and Lobo (2013) suggested that it is possible to reduce the percentage of expired products that reach the end of their shelf-lives by using the risk-averse models. Taylor (2011) proposed the cluster development to raise the business competitiveness in the dairy industry through policy guidance. Lapar, Garcia, Aditto, and Suriya (2005) evaluated the cost of employing effective information system in 130 smallholder dairy farms along with its benefits. Calker, Antink, Beldman, and Mauser (2005) introduced a contextual

analysis of DSC in collaboration with the production system for performance analysis. Chandra and Tirupti (2003) depicted that market changes considerably affects the small dairy farmers and the firms with good product quality probably succeed in the milk processing sector.

DISCUSSION

This paper provides a summary of the studies published recently in the area of DSCM. One of the qualities of this paper is the theoretical framework used. The reviewed articles present a sound hypothesis base for DM, RM, and DSM. The articles discuss various strategies for smoothening the DSC by eliminating the uncertainties, execution of effective information systems, technological innovations etc. in the dairy industry sector to meet the global standards. The conceptual framework established to classify the selected articles show that 32%authors framed SCM as a process, 23% as a system approach, 14% as a management activity, and rest as a business strategy. Out of the reviewed articles, about 93% articles are related to dairy industry and rest 7% are related to another food sector; and about 34% articles discuss DM, 28% discuss RM, and 37% discuss DMS practices in the context of the dairy supply chain. Further, the researchers like Mor et al. (2015; 2016; 2017; 2018a; 2018b; 2018c), Bhardwaj et al. (2016), Sharma et al. (2017) etc. have come up with some explanations to the issues of high wastages and improvement in food processing and dairy sector. The research questions framed in this paper also suggest a significant role of SCM practices in the dairy industry.

The current paper wrap-up with the key supply chain challenges in dairy industry identified through this structured literature review that differentiate the DSCM from another generic supply chains (Exhibit 2).

Exhibit 2. Key challenges in DSC

Sr. No.	Challenges
1	Effectiveness of information systems
2	Perishable nature of dairy products
3	Traceability of quality related issues
4	High risk of milk adulteration/contamination
5	Effectiveness of cold chain
6	High demand fluctuations
7	Logistics, transportation and road infrastructure

Due to the perishable nature of dairy products, it is a challenge to effectively manage the dairy supply chain. Further, these products need quick responding supply chain supported by effective coordination throughout the supply chain network. Thus, the shop-floor executives and top management of industry need to manage their supply chain activities in an effective way by considering the above factors in order to compete globally.

CONCLUSIONS

This paper starts with filling the research gap in literature with an emphasis on supply chain practices in dairy industry. The articles concerning three subjects, i.e. distribution management, risk management and decision-making have been selected for review. The articles were compared on the basis of year of publication as well as the research area. The comprehensive literature review suggests that though SCM is a more generic term related to all sectors, the characteristics like demand fluctuation, perishable nature of product, seasonality, traceability, small-scale production etc. are the major concerns that differentiate the dairy supply chain from other. Dairy industry currently calls for an effective and competitive supply chain strategies along with food safety and security to meet the standards of the export market. In above context, the managers and professionals in the dairy industry need to develop high responsiveness in supply chain directing on the coordination and effective information system. An integrated supply chain approach along with the excellence in decision-making can significantly improve the competence of dairy industry. In conclusion, the strategies discussed in this

paper can assist the dairy industry to achieve higher level of competitiveness and leanness.

Limitations and Future scope

The current paper has some limitations that authors might want to recognize. The principal restriction is the arrangement of selected papers. In any case, it ought to be noticed that the authors' judgment is a factor in choosing and ordering the articles. Authors recognize that there can be numerous different approaches to sort the articles. It must be noticed that the publication year for each article is most significant when reported. In those studies, that included reviews or field surveys, authors did not reveal the time of their information collection specifically. In such cases, authors accepted that the information was accumulated in conjunction with presenting the article. Future research studies can be conducted for other subjects of supply chain such as integration, collaboration, quality management, supplier management, SC trust etc. in order to benchmark the best DSCM practices.

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