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SWOT Analysis of Dairy Marketing Chain of JMF using Analytical Hierarchy Process

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ABSTRACT

Background: Jharkhand State Cooperative Milk Producers' Federation (JMF) plays a vital role in the processing of raw milk purchased from Jharkhand State member-producers and contributes to the development of the dairy sector. The current study explores the essential components in JMF's dairy supply chain, focusing on the marketing unit, and provides a preliminary framework for making decisions regarding its ramifications.

Methods: To compile a SWOT analysis of the milk marketing system in JMF, data were collected from dairy producer members, including dairy farmers, marketing unit executives, and key informants. This includes establishing the objectives of the dairy sector and the internal and external critical factors (CFs). Because SWOT analysis does not give an investigative basis for evaluating the priorities of CFs, the analytic hierarchy approach is utilised to determine the priorities of detected CFs. The CFs have also been ranked according to their importance.

Result: This study's findings indicate that the SWOT-based methodology gives crucial sensitivity when evaluating marketing chain strategy for dairy cooperatives like JMF. The findings of this study show that wide range of quality dairy products,absence of strong sales and marketing experience, emerging new markets offering greater marketing potential, seasonal slump are the major strength, weakness, opportunity and threat of JMF, respectively.

Key words: Analytic Hierarchy Process, Critical factors, JMF, Marketing, SWOT.

INTRODUCTION

India is the largest producer of milk in the world, accounting for 22.00 per cent of global production (FAO, 2019). India produced 187.7 MT of milk with a per capita availability of 394 g per day, according to the NDDB Report, 2018-19 (NDDB, 2019). The dairy sector produces 27.00 per cent of agriculture's GDP and 67.00 per cent of the livestock sector's overall production, supplying 70 million households with a means of subsistence (GoI, 2018). Approximately 80.00 per cent of milk sold continues to be distributed through traditional routes of raw milk and conventionally processed products (Kumar and Staal, 2010; Staal *et al.*, 2006). According to reports, the producer's share in consumer's price of milk varies from 50.00 per cent to 98.00 per cent across the country (CALPI, 2006; Kumar *et al.*, 2010). The cooperative framework of dairy development initiatives contributed significantly to the achievement of India's "White Revolution". Despite India's self-sufficiency in milk production, milk production is not consistently spread among its states; as a result, there is a significant demand-supply imbalance for milk and milk products in a few Eastern Indian states. Due to enhanced infrastructure facilities for milk production, the DCSs in the western and southern areas are performing better in terms of milk procurement and marketing compared to their counterparts in the northern and eastern regions (Rajendran and Mohanty, 2004). In terms of dairy cooperatives and milk production, Jharkhand is the least developed state in the nation. Jharkhand is now ranked seventeenth in terms of both milk production and milk productivity (GoI, 2019). In order to promote dairying as a source of income in the rural areas of the state, the Jharkhand State Cooperative Milk Producers' Federation (JMF) was founded in 2014 with the objective of providing the milk producers of

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Jharkhand with their own marketing and distribution network to give them access to the most vital link in the system: The customer. The farmers realised that marketing was the key to the success of the JMF Pattern and to their own success when they were in charge of the marketing system. Multiple studies have demonstrated that farmers have benefited from co-op integration, which has also worked as a catalyst for linking Indian dairy smallholders to domestic and international markets (Birthal *et al.*, 2007, 2009; Candler and Kumar, 1998; Cunningham, 2009; Kumar, 2010). Marketing is the most essential aspect of any business endeavour. It is what attracts customers and generates revenue, leads a business's future trajectory, and decides its success or failure. Consequently, food producers and processors must employ effective marketing tactics to reach the rural market (Mor *et al.*, 2016; Mor *et al.*, 2017; Mor *et al.*, 2018a). Modern milk supply chain scalability will depend on the expansion of milk collecting and transportation facilities, as well as incentive pricing for high-quality products (Kumar *et al.*, 2011). Consequently, any element that could reduce or increase expenses poses a threat to the economic performance of the business (Bailey, 2001).

An analytic hierarchy process (AHP) approach allows the top management to measure the level of uniformity in finding the decision problems (Saaty, 1980). Madaan and Mangla (2015) suggested focusing on CFs in food sector using AHP. Dweiri *et al.* (2016) found that usage of AHP for supplier selection improves the consistency and robustness throughout the process. Mor *et al.* (2018b) and Mor *et al.* (2015) addressed a review of the principles, bottlenecks, and strategies of supply chain practices of Indian agri-food sector and recommended to nurture the system effectiveness over policy direction. Ayodele *et al.* (2014) recognized the challenges existing in unloading and knowledge optimization schemes into the food chain. Ansari *et al.* (2019) recognized the key performance outcomes for the adoption of supply chain remanufacturing and prioritized the factors through hybrid fuzzy AHP and fuzzy TOPSIS approach.

MATERIALS AND METHODS

The present research was conducted at ICAR-National Dairy Research Institute, Karnal, Haryana from 2021 to 2022. A pre-tested schedule has been employed to accumulate the data from dairy producer members including dairy farmers, experts and key informants of milk marketing units to summarize the factors and sub-factors related to strengths, weaknesses, opportunities, threats (SWOT) of the milk marketing system in JMF. A total of 26 issues, called as SWOT factors here, have been derived on the basis of comprehensive literature assessment, focussed group discussion and a pilot study, conducted in the study area. These 26 factors comprised of seven (7) strength factors, six (6) weakness factors, seven (7) opportunity factors and six (6) threat factors. Further, these factors were considered for AHP analysis in consultation with the marketing professionals of the dairy industry, JMF staffs, workers and academicians. The factors are selected based on their applicability and importance to the marketing unit of dairy cooperative (JMF). Following critical factors as shown in the hierarchy model for SWOT factors (Table 3) have been carried forward for AHP analysis. The model represents various SWOT factors as criteria along with their sub-criteria. During the application of AHP, various pairwise assessment matrix has been finalized in the below Table 4 to 7 for SWOT factors (s) analysis. The nine-point scale developed by Saaty (1980) has been adopted for assessing the interaction among the SWOT factors identified for the study. Five experts from marketing unit of JMF during FGD added their understanding to construct the SWOT factors. Then, the pairwise comparisons of SWOT groups using a Saaty's nine-point comparison scale were carried out in consultation with the expert's group. And finally, the SWOT factors were compared in view of every SWOT group.

In this study, AHP method is recommended as a result of its extensive applicability and simplicity of usage (Ho, 2008). AHP is used to support multi-criteria decisions where the problem is divided into different components, *i.e.*, analytical and hierarchy (Saaty, 1980). AHP method provides very satisfactory results and it has been used in various fields, such as process planning, selection of alternatives, optimization, and allocation of resources, *etc*. It combines both qualitative and quantitative aspects of ranking the alternatives (Harputlugil *et al.*, 2011; Yang, 2010). So, the authors applied AHP to evaluate the CFs of marketing unit of JMF in the current study. Initially, a relation between the elements of the given problem is determined and then, the hierarchy model is built and finally, the consistency is checked whether the solution is feasible or not.

The AHP steps are described below:

1. Preparation of the goal: Assessing the CFs to find their related priority.
2. Forming a pairwise assessment matrix: Pairwise assessment matrixes are formed from expert's feedback. The pairwise assessment matrix between the factors is accomplished by Saaty's scale (Table 1).
3. Determination of the Eigenvalues and Eigenvectors and comparative weights: The outlined pairwise comparison matrices are worked to establish the Eigenvalues and Eigenvectors and to compute the relative position of CFs.
4. Assessment of the consistency ratio (CR): It is calculated to confirm the reliability of pairwise comparisons, as follows.

$$CR=CI/RI \quad ...(1)$$

Where,

Consistency index (CI)= $(\lambda_{max}-n)/(n-1)$, (λ_{max} is the max. average value) and random consistency index (RI) relies upon value of (n). CR must be ≤ 0.10 to have an improved level of consistency (Kumar *et al.*, 2011). Table 2 presents the corresponding values of a random index (Saaty, 1980).

RESULTS AND DISCUSSION

The current study summarized and proposed a framework for the identification and assessment of the critical SWOT factors in the dairy marketing supply chain of JMF, using the Analytical Hierarchy Process (AHP) approach. The marketing unit is the heart and soul of JMF where the milk after procurement from Bulk Milk Coolers (BMCs) and Milk Pooling Points (MPPs) are brought to the state of art dairy processing plants located at four districts *viz.* Ranchi, Latehar, Koderma and Deoghar by milk tankers where milk after quality testing is further processed into fluid milk and milk products. Finally, the milk is marketed and distributed through chain of retail outlets and milk booths.

Table 1: Scales in pairwise comparisons.

Score	Definition
1	Equal importance of both factors
3	Limited importance of one factor over another
5	Strong importance of one factor over another
7	Very strong importance of one factor over another
9	Extreme importance of one factor over another
2,4,6,8	Intermediate value between two close judgements

Strength analysis

The strength factors have been analysed for priority matrix, weight matrix and the calculations of strength as shown in Table 4. An analysis of strengths revealed that JMF products largely dominated in the markets due to wide array of quality products available for the customers. Also, due to presence of strong and intelligent marketing team with vast experience in marketing, JMF was able to execute strategic marketing plan with long term growth. Another, major strength of marketing unit was it strong distribution channels; this was attributed to the fact that JMF was having sufficient number of milk booths with franchise shops spread across the state. Based on the outcome of AHP for strength factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4). Also, consistency among the strength factors was confirmed since CR value (0.06) was less than (0.10).

Table 2: Random Index (R.I.).

N	1	2	3	4	5	6	7	8	9	10
R.I.	0	0	0.58	0.98	1.12	1.24	1.32	1.41	1.45	1.49

Table 3: AHP model for SWOT in dairy marketing supply chain of JMF.

Criteria	Sub criteria	Critical factors (CFs)
Strength	S1	Wide range of quality product
	S2	Intelligent marketing team executing strategic marketing plan
	S3	Sufficient number of milk booths and franchise shops
	S4	Attractive and quality packaging
	S5	Strong supply chain and distribution network
	S6	Large customer base
	S7	Strong brand image/ brand equity
Weakness	W1	Absence of strong sales/marketing experience
	W2	Lack of awareness among prospective customers
	W3	Low exports in comparison to production
	W4	Focus may be too narrow
	W5	High selling price
	W6	Declining profit margin
Opportunity	O1	New markets offer greater potential
	O2	Investment from external sources
	O3	Wise advertisement and promotion for better brand image
	O4	Partnership
	O5	Online marketing
	O6	Product diversification/ value addition of products
	O7	Increasing demand for healthy drinks
Threat	T1	Seasonal sales slump
	T2	Heavy competition from national and local players
	T3	Price fluctuation due to existing competitors
	T4	Legal and regulatory restrictions
	T5	Problem of taxation
	T6	Economic slowdown

Table 4: Priority calculations for strength factors.

	Priority matrix (a)							Weight Matrix (W)							Criteria	Wt. Sum	Rank	C=WS/
	S1	S2	S3	S4	S5	S6	S7	S1	S2	S3	S4	S5	S6	S7	Wt. (CW)	(WS)a*W		CW
S1	1	2.09	2.02	2.2	2.25	3.2	2.1	0.28	0.44	0.26	0.22	0.19	0.19	0.15	0.25	1.97	1	7.69
S2	0.46	1	3.08	3.2	3.42	4.05	2.42	0.13	0.21	0.39	0.33	0.29	0.25	0.17	0.25	1.91	2	7.82
S3	0.49	0.32	1	2.14	2.21	2.25	2.04	0.14	0.07	0.13	0.22	0.19	0.14	0.15	0.15	1.11	3	7.61
S4	0.42	0.33	0.40	1	2.03	3.24	2.05	0.12	0.07	0.05	0.10	0.17	0.20	0.15	0.12	0.92	4	7.53
S5	0.40	0.31	0.47	0.47	1	2.26	2.11	0.11	0.07	0.06	0.05	0.08	0.14	0.15	0.09	0.70	5	7.45
S6	0.33	0.24	0.45	0.29	0.48	1	2.31	0.09	0.05	0.06	0.03	0.04	0.06	0.16	0.07	0.52	6	7.33
S7	0.45	0.42	0.50	0.48	0.45	0.47	1	0.13	0.09	0.06	0.05	0.04	0.03	0.07	0.07	0.49	7	7.40
∑	3.54	4.70	7.92	9.78	11.84	16.47	14.03											
																	λ_{max}	7.54
																	CI	0.09
																	RI	1.32
																	CR= CI/RI	0.06

Table 5: Priority calculations for weakness factors.

	Priority matrix (a)						Weight matrix (W)						Criteria	Wt.sum	Rank	C=WS/
	S1	S2	S3	S4	S5	S6	S1	S2	S3	S4	S5	S6	Wt.(CW)	(WS)a*W		CW
S1	1	2.14	2.05	2.02	2.01	3.25	0.31	0.47	0.28	0.22	0.17	0.21	0.28	1.84	1	6.66
S2	0.47	1	3.05	3.12	4.02	2.05	0.14	0.22	0.42	0.34	0.34	0.13	0.27	1.81	2	6.79
S3	0.49	0.33	1	2.14	2.22	4.12	0.15	0.07	0.14	0.24	0.19	0.26	0.17	1.12	3	6.42
S4	0.50	0.32	0.47	1	2.15	3.14	0.15	0.07	0.06	0.11	0.18	0.20	0.13	0.82	4	6.29
S5	0.50	0.25	0.45	0.47	1	2.06	0.15	0.06	0.06	0.05	0.08	0.13	0.09	0.56	5	6.22
S6	0.31	0.49	0.24	0.32	0.49	1	0.09	0.11	0.03	0.04	0.04	0.06	0.06	0.40	6	6.45
∑	3.26	4.52	7.26	9.06	11.89	15.62										
															λ_{max}	6.47
															CI	0.09
															RI	1.24
															CR= CI/RI	0.07

Table 6: Priority calculations for opportunity factors of marketing unit of JMF.

	Priority matrix (a)							Weight Matrix (W)							Criteria	Wt. Sum	Rank	C=WS/
	S1	S2	S3	S4	S5	S6	S7	S1	S2	S3	S4	S5	S6	S7	Wt. (CW)	(WS)a*W		CW
S1	1	2.15	2.31	2.01	2.05	3.02	2.2	0.27	0.44	0.29	0.21	0.18	0.19	0.14	0.25	1.93	1	7.78
S2	0.47	1	3.04	3.02	3.24	4.04	2.04	0.13	0.21	0.38	0.32	0.28	0.25	0.13	0.24	1.92	2	8.00
S3	0.43	0.33	1	2.08	2.12	2.15	4.12	0.12	0.07	0.12	0.22	0.18	0.14	0.26	0.17	1.21	3	7.21
S4	0.50	0.33	0.48	1	2.22	3.04	2.11	0.14	0.07	0.06	0.11	0.19	0.19	0.13	0.12	0.95	4	7.80
S5	0.49	0.31	0.47	0.45	1	2.16	2.08	0.13	0.06	0.06	0.05	0.09	0.14	0.13	0.09	0.70	5	7.71
S6	0.33	0.25	0.47	0.33	0.46	1	2.21	0.09	0.05	0.06	0.04	0.04	0.06	0.14	0.07	0.50	6	7.53
S7	0.45	0.49	0.24	0.47	0.48	0.45	1	0.12	0.10	0.03	0.05	0.04	0.03	0.06	0.07	0.47	7	7.15
Σ	3.67	4.86	8.01	9.36	11.57	15.86	15.76											
																	λ_{max}	7.60
																	CI	0.09
																	RI	1.32
																	CR= CI/RI	0.06

Table 7: Priority calculations for threat factors of marketing unit of JMF.

	Priority matrix (a)						Weight matrix (W)						Criteria	Wt.sum	Rank	C=WS/
	S1	S2	S3	S4	S5	S6	S1	S2	S3	S4	S5	S6	Wt. (CW)	(WS) a*W		CW
S1	1	2.15	2.3	2.12	2.02	2.3	0.31	0.48	0.29	0.24	0.18	0.17	0.28	1.85	1	6.60
S2	0.47	1	3.4	3.02	3.2	2.5	0.15	0.22	0.44	0.34	0.29	0.18	0.27	1.80	2	6.66
S3	0.43	0.29	1	2.04	2.22	2.16	0.14	0.07	0.13	0.23	0.20	0.16	0.15	0.99	3	6.44
S4	0.47	0.33	0.42	1	2.04	3.4	0.15	0.07	0.05	0.11	0.19	0.25	0.14	0.84	4	6.16
S5	0.40	0.31	0.45	0.49	1	2.2	0.12	0.07	0.06	0.05	0.09	0.16	0.09	0.58	5	6.17
S6	0.43	0.40	0.24	0.29	0.45	1	0.14	0.09	0.03	0.03	0.04	0.07	0.07	0.42	6	6.21
Σ	3.20	4.48	7.81	8.96	10.93	13.56										
															λ_{max}	6.37
															CI	0.07
															RI	1.24
															CR= CI/RI	0.05

Weakness analysis

The weakness factors have been analysed for priority matrix, weight matrix and the calculations of weaknesses as shown in Table 5. Even though JMF had strong marketing team but they lacked experience in the domain of marketing and sales which was the major weakness of marketing unit. Also, it was observed that many prospective customers were unaware about Medha dairy products in the markets especially in rural pockets of the state. Therefore, JMF should focus on brand promotion and advertisement for attracting more number of customers. Another, major weakness expressed by majority was that due to low export potential, JMF remained only as a domestic player unlike other national brands like Amul, Mother Dairy *etc*. Based on the outcome of AHP for weakness factors, all the CI, RI and CR scores are valid for AHP criteria (Table 5). Also, consistency among the weakness factors was confirmed since CR value (0.07) was less than (0.10).

Opportunity analysis

The opportunity factors have been analysed for priority matrix, weight matrix and the calculations of opportunities as shown in Table 6. Among opportunities it was observed that due to wide market penetration, JMF had potential to capture new markets in both rural and urban areas and expand its market presence throughout the state. Further, it was perceived that more investment from external sources apart from government sources should be encouraged for better brand positioning in the market. Besides this, JMF should also focus more on advertisement and promotional activities in order to appeal large customers. Based on the outcome of AHP for threat factors, all the CI, RI and CR scores are valid for AHP criteria (Table 6). Also, consistency among the threat factors was confirmed since CR value (0.06) was less than (0.10).

Threat analysis

The threat factors have been analysed for priority matrix, weight matrix and the calculations of threats as shown in Table 7. It was observed that during lean season or during the time of festival there was shortage in the supply of fluid milk in the markets which was perceived as major threat to the marketing department. The second threat was heavy competition from national and local players. JMF faced stiff market competition from other reputed milk brands like Amul, Mother Dairy, Ossam dairy etc. apart from unorganized milk vendors. Further, due to this reason there was frequent fluctuations in the price of the milk and milk products, thus severely affecting the cooperative business. Based on the outcome of AHP for threat factors, all the CI, RI and CR scores are valid for AHP criteria (Table 7). Also, consistency among the threat factors was confirmed since CR value (0.05) was less than (0.10).

CONCLUSION

JMF plays a crucial role in reducing rural poverty by increasing rural milk production and marketing. Various marketing agents interact at different stages of the milk supply chain, from producers to consumers. The producer's share in consumer rupee is an assessment of the relative bargaining power in the market. It also demonstrates the producers' market access and integration. Using the AHP methodology, the identification of the CFs in the JMF dairy marketing chain indicated some of the most significant strengths, weaknesses, opportunities and threats. The Indian dairy business must simultaneously address the challenges of quality, product development, infrastructure-support development and international marketing. Equally critical is the need for technical collaboration and marketing partnerships with some of the leading dairy firms in the world through strategic alliances. However, the participation of middlemen, the producers' lack of bargaining power and the absence of infrastructure facilities for collection, storage, transportation and processing are the most significant factors affecting the milk prices received by producers. India's milk marketing faces future challenges in the areas of milk quality, product development, infrastructure support development and global marketing. The SWOT analysis will assist policymakers and marketing executives in minimising JMF's weaknesses and threats, while capitalising on its strengths and opportunities for improved performance.

Conflict of interest

All authors declare that they have no conflict of interest.

REFERENCES

Ansari, Z.N., Kant, R. and Shankar, R. (2019). Prioritizing the performance outcomes due to adoption of critical success factors of supply chain remanufacturing. Journal of Cleaner Production. 212: 779-799.

Ayodele, A.B., Ellis, L. and Turner, P. (2014). Identifying Key Research Challenges in Investigating Knowledge Optimization Strategies in Perishable Food Chains. In Proceedings of the 11th International Conference on Intellectual Capital, Knowledge Management and Organizational Learning, University of Sydney, Sydney, Australia, 6-7 November.

Bailey, K. (2001). The Fundamentals of Forward Contracting, Hedging and Options for Dairy Producers in the North East. Staff Paper #338, June 5. College of Agricultural Sciences, The Pennsylvannia State University, U.S.A.

Birthal, P.S., Jha, A.K., Tiongco, M.M. and Narrod, C. (2009). Farm-level impacts of vertical coordination of the food supply chain: Evidence from contract farming of milk in India. Indian Journal of Agricultural Economics. 64(3): 481-496.

Birthal, P.S., Joshi, P.K. and Gulati, A. (2007). Vertical Coordination in High-Value Food Commodities: Implications for Smallholders, In: Agricultural Diversification and Smallholders in South Asia, [Joshi, P.K., Gulati, A. and Ralph Cummings Jr. (Eds.)]. Academic Foundation, New Delhi. pp: 405-440.

CALPI (2006). Toward Accelerated Growth in Dairy: An Action Research to Improve the Traditional Milk Sector", Summary Report. Capitalization of Livestock Programme Experience India, Series II, Institute and Place.

Candler, W. and Kumar, N. (1998). India: The Dairy Revolution: Impact of Dairy Development in India and the World Bank's Contribution, The World Bank Operation Evaluation Department (OED), The World Bank, Washington, D.C., U.S.A.

Cunningham, K. (2009). Rural and Urban Linkages: Operation Flood's Role in India's Dairy Development, Discussion Paper 924, International Food Policy Research Institute, Washington D.C., U.S.A..

Dweiri, F., Kumar, S., Khan, S.A. and Jain, V. (2016). Designing an integrated AHP based decision support system for supplier selection in automotive industry. Expert Systems with Applications. 62: 273-283.

FAO (2019). OECD-FAO Agricultural Outlook, OECD Agriculture statistics (database). doi: dx.doi.org/10.1787/agr-outl-data-en.

GoI (2018). National Action Plan for Dairy Development (NAPDD), Vision-2022. Department of Animal Husbandry and Dairying and Fisheries. Ministry of Agriculture and Farmers Welfare, GOI.

GoI (2019). Bimonthly Report, September. State Dairy Profiles, Dairy Development Schemes. Department of Animal Husbandry and Dairying. Ministry of Fisheries, Animal Husbandry and Dairying, Govt. of India.

Harputlugil, T., Prins, M., Tanju, G.A. and Ilker, T.Y. (2011). Conceptual framework for potential implementations of multi criteria decision making (MCDM) methods for design quality assessment. In Proceedings of the CIB International Conference, Delft University of Technology, Amsterdam, The Netherlands, 20-23 June.

Ho, W. (2008). Integrated analytic hierarchy process and its applications-A literature review. European Journal of Operational Research. 186: 211-228.

Kumar, A. (2010). Milk Marketing Chains in Bihar: Implications for Dairy Farmers and Traders, Agricultural Economics Research Review. Conference Issue. pp: 469-477.

Kumar, A., Staal, S.J. and Singh, D.K. (2011). Smallholder dairy farmers' access to modern milk marketing chains in India. Agricultural Economics Research Review. 24: 243-253.

Kumar, Anjani and Staal, Steven J. (2010). Is traditional milk marketing and processing viable and efficient? An empirical evidence from Assam, India. Quarterly Journal of International Agriculture. 49(3): 213-225.

Kumar, A., Staal, S., Baltenweck, I. and Lapar, L. (2010). Traditional milk market in Assam: Potential for income and employment generation. Indian Journal of Agricultural Economics. 65(4): 747-759.

Madaan, J. and Mangla, S. (2015). Decision Modeling Approach for Eco-driven Flexible Green Supply Chain. In Systemic Flexibility and Business Agility, Springer, New Delhi. pp: 343-364.

Mor, R.S., Bhardwaj, A., Singh, S. and Kharub, M. (2018a). Framework for measuring the performance of procurementpractices in dairy industry. In Sustainable Procurement in Supply Chain Operations; CRC Press-Taylor and Francis Group: Boca Raton, FL, USA.

Mor, R.S., Jaiswal, S.K., Singh, S. and Bhardwaj, A. (2018b). Demand Forecasting of Short-Lifecycle Dairy Products. In Understanding the Role of Business Analytics; Springer Nature Singapore: Singapore.

Mor, R.S., Singh, S. and Bhardwaj, A. (2016). Learning on lean production: A review of opinion and research with in environmental constraints. Operations and Supply Chain Management: An International Journal. 9: 61-72.

Mor, R.S., Singh, S., Bhardwaj, A. and Bharti, S. (2017). Exploring the causes of low-productivity in Dairy industry using AHP. Jurnal TeknikIndustri. 19: 83-92.

Mor, R.S., Singh, S., Bhardwaj, A. and Singh, L.P. (2015). Technological implications of supply chain practices in agri-food sector-A review. International Journal of Supply and Operations Management. 2: 720-747.

NDDB (2019). Annual Report 2019-20. National Dairy Development Board, India.

Rajendran, K. and Mohanty, S. (2004). Dairy co-operatives and milk marketing in India: Constraints and opportunities. Journal of Food Distribution Research. 35(2): 35-41.

Saaty, T.L. (1980). The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation; McGraw: New York, USA.

Staal, S.J., Baltenweck, I., Njoroge, L., Patil, B.R., Ibrahim, M.N.M. and Kariuki, E. (2006). Smallholder Dairy Farmers Access to Alternative Milk Market Channels in Gujarat. IAAE Conference, Brisbane, Australia.

Yang, Y. (2010). SWOT-TOPSIS Integration Method for Strategic Decision. In Proceedings of the International Conference on E-Business and E-Government, Guangzhou, China, 7-9 May. pp: 1575-1578.