Journal of the Asian Academy of Applied Business
Vol. 9 (December, 2024), 1-28
ISSN 1675-9869

Strategic analysis using SWOT-AHP: A case study on Dairy Industry in India

By

Carl Chan Teck Hong, Faerozh Madli, Dean Nelson Mojolou and Shaierah Gulabdin
Faculty of Business, Economics & Accountancy
Universiti Malaysia Sabah (UMS), Malaysia

**Corresponding Author: faerozhmadli@ums.edu.my*

Received date: 20 July 2024 | Revised date: 15 August 2024 | Accepted date: 03 September 2024

ABSTRACT

In India, the dairy industry represents an element of agriculture, particularly dairy cooperatives contributing a major role in agricultural growth. This study analyzes key factors in the dairy manufacturing process and proposes a decision framework that addresses its implications Data was obtained from dairy producers, including farmers, executives, and key informants from processing units, in order to identify strengths, weaknesses, opportunities, and threats. This includes establishing the dairy industry's objectives and crucial factors (CFs), both internally and externally. SWOT exploration does not provide a basis for analyzing CF priorities. Therefore, the analytic hierarchy technique is used to determine these priorities. The CFs have also been ranked according to their respective relevance. The outcomes of this study show that the SWOT-based methodology provides critical sensitivity when examining supply chain strategies for the dairy sector.

Keywords: dairy industry, dairy supply chain (DSC), agri-food sector, SWOT analysis, analytic hierarchy process (AHP), SWOT-AHP, critical factors (CF)

INTRODUCTION

An important part of the agricultural economy and food sector of India is the dairy industry. India is the world's biggest producer of milk, which has a substantial impact on both domestic livelihoods and international trade. India also contributes to global dairy production. It contributes to the socioeconomic development of rural communities while also offering vital nutrients for good health. In order for India's milk supply chain to function more effectively, safely, and competitively, a number of issues need to be carefully considered.

Following supplier management, inventory control, and technical developments, quality management is an important component of DSC (Mor, et. al, 2018). To increase food safety and product quality, the dairy sector must operate at peak efficiency (Bhardwaj, et.al, 2016) (Mor, et. al, 2018). To reach the rural market, both food producers and processors must focus on effective marketing strategies (Mor, et. al, 2018).
In order to strategically analyze the dairy industry, all relevant external and internal factors that affect the industry's performance must be examined. Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis and the Analytic Hierarchy Process (AHP) are two effective techniques to use when conducting this kind of analysis. The SWOT analysis is a useful technique for determining and categorizing the critical and significant factors impacting a given industry. However, these factors are ranked in order of relative significance by the analytic hierarchy process (AHP).

SWOT AND AHP MODEL

SWOT Analysis

To evaluate a project or company activity, a strategic planning approach known as the SWOT analysis is initially used. Strength, Weakness, Opportunities, and Threats is an acronym represented by four quadrants on a two-by-two grid, each representing positive and negative internal and external issues. Opportunities and dangers represent external elements impacting the firm, whereas strengths and weaknesses reflect internal advantages and negatives. While the latter discusses future trends in the field under consideration, as well as the state of the economy, funding resources, demographics, physical environment, legislation, and local, national, or internal events, the former focuses on the strengths and weaknesses of human resources, physical resources, financial resources, activities and processes, and experiences (Vu and Trinh, 2021). Figure 1 shows the SWOT analysis framework for industries to use and analyse internal and external environments.

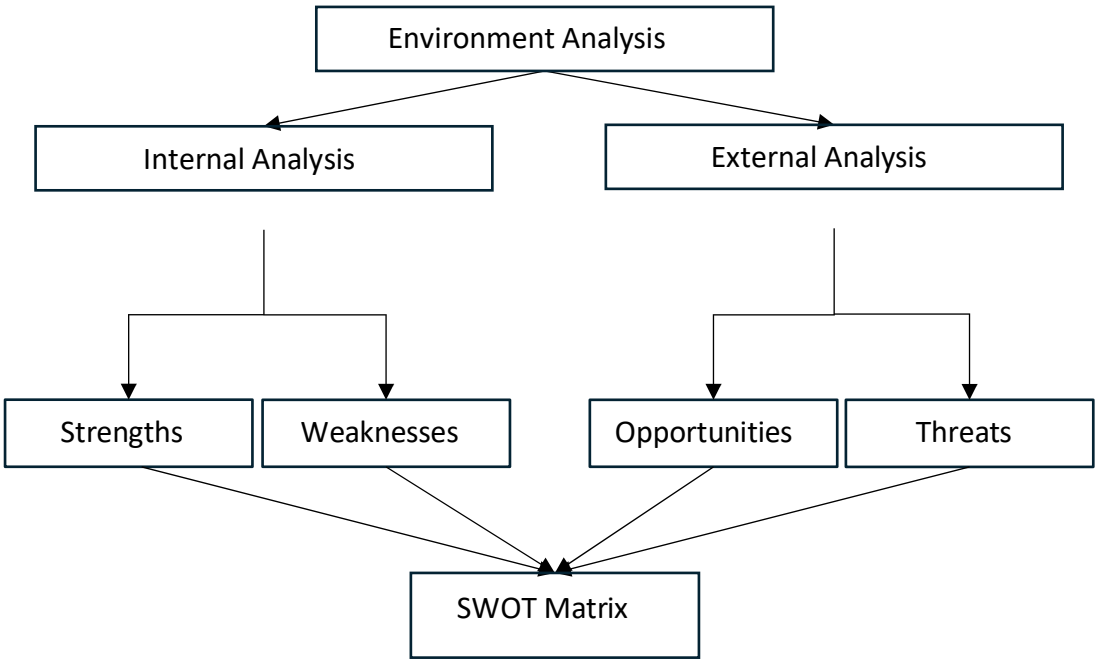

Figure 1. SWOT analysis framework

Analytic Hierarchy Process

The well-known AHP approach, invented by Thomas Saaty, allows for the examination and segmentation of a complex problem requiring decision-making into several separate structures. AHP may also be used by decision-makers to identify the relative weights of criterion and subcriteria through pairwise comparisons (Saaty, 2008; Sherekar & Tatikonda, 2016. The steps in AHP are as follows:

1. Prioritizing and evaluating CFs is a step in goal preparation.
2. Using the input from experts, create a paired assessment matrix. A pairwise assessment matrix between the factors is produced by Saaty's scale (refer Table 1).
3. Finding Eigenvalues, Eigenvectors, and Comparative Weights: Eigenvalues, Eigenvectors, and the relative location of CFs are found using pairwise comparison matrices.
4. When confirming the reliability of pairwise comparisons, the consistency ratio (CR) is employed.

$$CR = CI / RI$$

The random consistency index (RI) is based on the value of n, while the consistency index (CI) is computed as $(\lambda max - n)/ (n - 1)$, where λmax is the maximum average value. $CR \leq 0.10$ is necessary for improved consistency (Kumar, et. al, 2011). The suitable values for a random index are displayed in Table 2 (Saaty, 1980).

Table 1. Pairwise comparison scale

Score	Score Definition
1	Both factors are equally important
3	One factor has slightly more importance than the other
5	One factor is significantly more important than the other
7	One factor is much more important than the other
9	One factor is vastly more important than the other
2, 4, 6, 8	A value that falls between two nearby assessments

Table 2. Random Index (R.I.) (adapted from Mor, et. al, 2019)

n	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
R.I.	**0**	**0**	**0.58**	**0.98**	**1.12**	**1.24**	**1.32**	**1.41**

Methodology and Application

To summarize the factors and sub-factors related to the strengths, weaknesses, opportunities, and threats (SWOT) of India's milk processing system, a pre-tested schedule was used to collect data from dairy producer members, including dairy farmers, shop floor executives, and key informants of milk processing units. This entails establishing the dairy industry's aim as well as the internal and external critical factors (CFs) through pairwise comparisons of the most essential SWOT concerns and evaluations using the eigenvalue method. The process includes three steps: factorization, innerdependency matrix computation, and factor weight calculation. The first step is to identify the CFs and subfactors. Several more techniques, including ELECTRE, TOPSIS, ISM, DEA, and Extended PROMETHEE, have been developed to deal with comparable circumstances (Ho, 2008). However, AHP is frequently suggested due to its broad application and user-friendliness. AHP is used to help with multi-criteria judgments by dividing the problem into discrete analytical and hierarchical components. This approach produces extremely satisfying results and has been applied in a variety of domains, including process planning, alternative selection, optimization, and resource allocation. AHP successfully incorporates both qualitative and quantitative aspects when rating available choices (Yang, 2010; Harputlugil et. al, 2011). As a result, in the current study, the researchers used AHP to examine the key aspects of DSC processes. Figure 2 shows a flowchart illustrating the process.

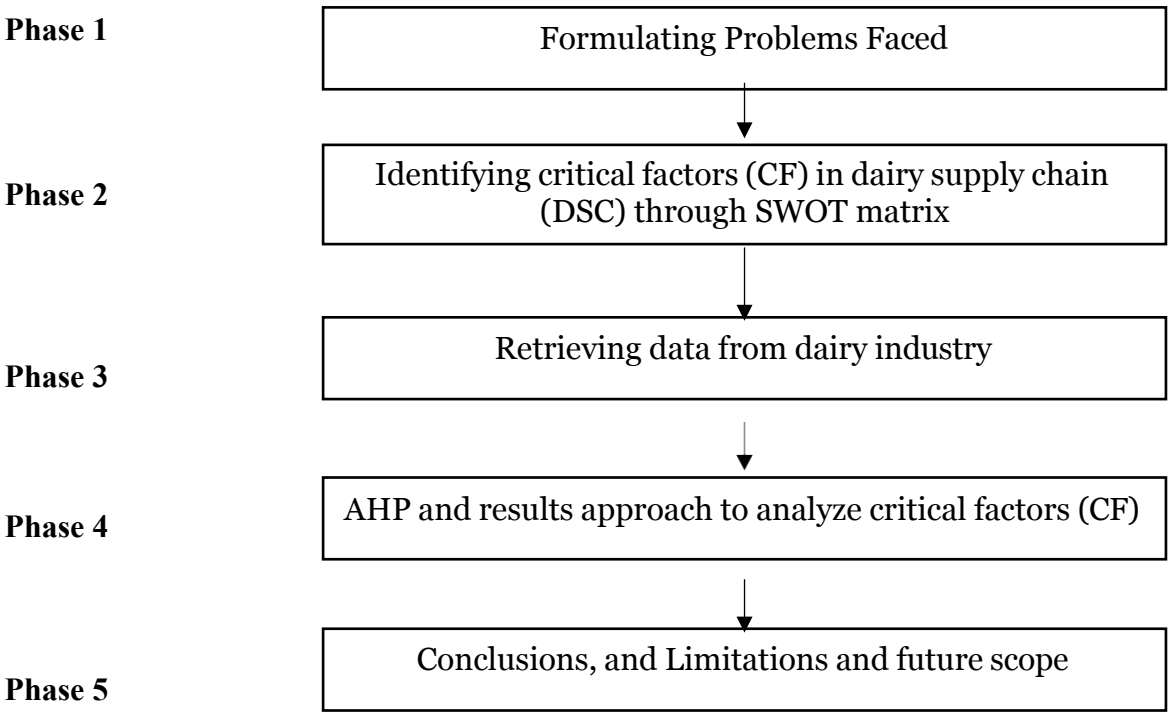

Figure 2. Phases of proposed methodology

Application of AHP

After a pilot study and a review of the literature (see Section 4), all 17 CFs are being considered for AHP. The data is gathered from milk processing companies in northern India, and the gathered information is analyzed to rank the SWOT factors. The SWOT factor hierarchy model (Figure 3) is shown below, and it displays several SWOT factors along with their respective sub-criteria.

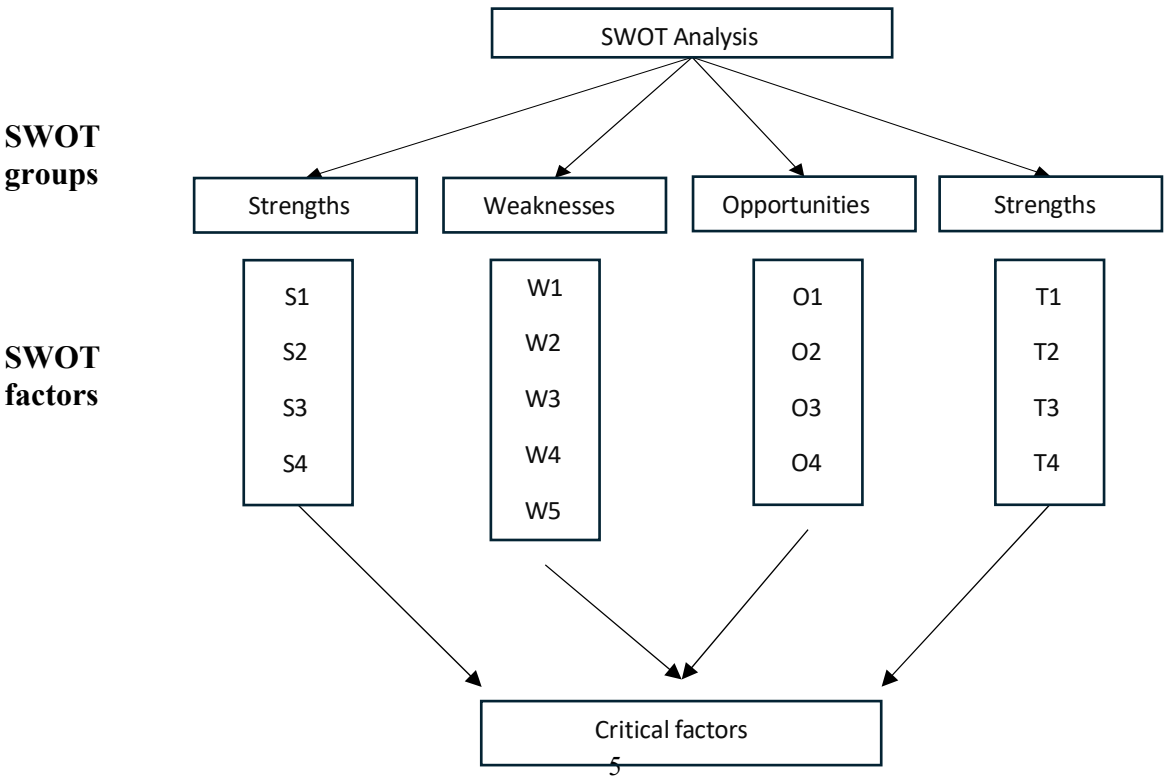

Figure 3. Hierarchical structure of the SWOT matrix

Pairwise Assessment Matrix

The tables below include a variety of pairwise assessment matrices for the examination of SWOT factor(s). In this study, the Critical Factors (CFs) of Distribution and Supply Chain Management (DSCM) practices were evaluated using Saaty's (1980) nine-point scale. Five academic specialists and five dairy executives gave their thoughts to the SWOT analysis. The SWOT groups were then compared pairwise using Saaty's nine- point comparison scale in consultation with the expert panel. Each SWOT category was extensively evaluated in comparison to the others. The professionals shared their knowledge in constructing comparison matrices and specifying the dependencies necessary to perform pairwise comparisons.

Table 3. Pairwise comparisons of SWOT factors (adapted from Mor et. al, 2019)

SWOT Groups	S	W	O	T	Importance Degrees of SWOT Groups
Strengths (S)	1	2.00	5.00	9.00	0.530
Weaknesses (W)	0.50	1	3.00	7.00	0.308
Opportunities (O)	0.20	0.33	1	3.00	0.115
Threats (T)	0.11	0.14	0.33	1	0.047
CR= 1.3					

Table 4. Comparison Matrix of Strengths Group (adapted from Mor et. al, 2019)

Strengths (S)	**S1**	**S2**	**S3**	**S4**	**Importance Degrees**
S1. Well trained and skilled workforce offered at all stages to assist R&D and industry processes (RD).	1	2.00	4.00	6.00	0.510
S2. Offers job opportunities to the rural population, particularly benefiting women. (WE).	0.50	1	2.00	4.00	0.271
S3. Ensures a consistent income source for farmers. (FI).	0.25	0.50	1	53.00	0.152
S4. The implementation of a two-axis payment system (based on Fat and SNF) ensures farmers receive a fair price for their milk production.	0.17	0.25	0.33	1	0.067
CR= 0.017					

Table 5. Comparison Matrix of Weaknesses Group (adapted from Mor et. al, 2019)

Weaknesses (W)	W1	W2	W3	W4	W5	Importance Degrees
W1. Dairy industry is grappling with the issue of water wastage. (WW).	1	2.00	4.00	3.00	7.00	0.397
W2. Indian dairy market comprises both unorganized and organized sectors, with only 20% being organized. (OU).	0.50	1	4.00	5.00	7.00	0.340
W3. The distribution sector requires enhancements and investments in logistics and transportation (TF).	0.25	0.25	1	1.00	5.00	0.110
W4. Absence of water treatment facilities for processed water. (WT).	0.33	0.20	1.00	1	6.00	0.119
W5. Use of plastic films poses significant environmental and health risks (PF).	0.14	0.14	0.20	0.17	1	0.034
CR= 0.071						

Table 6. Comparison Matrix of Opportunities Group (adapted from Mor et. al, 2019)

Opportunities (O)	O1	O2	O3	O4	Importance Degrees
O1. Due to low production costs, there is a high potential for export (EP).	1	1.00	2.00	7.00	0.381
O2. Through implementing a dynamic payment system, farmers' profits will increase and their relationship with the organization will be strengthened (DPS).	1.00	1	2.00	6.00	0.367
O3. Improving the information flow throughout the dairy supply chain can be achieved by implementing effective information systems (IT).	0.50	0.50	1	4.00	0.197
O4. Utilising robotic milk collection processes (AMC).	0.14	0.17	0.25	1	0.055
CR=0.030					

Table 7. Comparison Matrix of Threats Group

Threats (T)	T1	T2	T3	T4	**Importance Degrees**
T1. If the dynamic payment system is not integrated into the dairy industry's milk procurement policy, there are problems with trust and low supplier satisfaction (SS).	1	4.00	6.00	4.00	0.591
T2. Due to dairy products' high price sensitivity, consumers are unwilling to pay more for higher-quality goods (HP).	0.25	1	2.00	3.00	0.209
T3. As more firms enter the market, competition is progressively growing (MC).	0.17	0.50	1	1.00	0.098
T4. To create novel and inventive products, a substantial investment is needed in the R&D sector (RDI).	0.25	0.33	1.00	1	0.102
CR=0.038					

Table 8. SWOT matrix (adapted from Mor et. al, 2019)

Strengths (S)	**Weaknesses (W)**
S1. Well trained and skilled workforce offered at all stages to assist R&D and industry processes (RD). S2. Offers job opportunities to the rural population, particularly benefiting women. (WE). S3. Ensures a consistent income source for farmers. (FI). S4. The implementation of a two-axis payment system (based on Fat and SNF) ensures farmers receive a fair price for their milk production.	W1. Dairy industry is grappling with the issue of water wastage. (WW). W2. Indian dairy market comprises both unorganized and organized sectors, with only 20% being organized. (OU). W3. The distribution sector requires enhancements and investments in logistics and transportation (TF). W4. Absence of water treatment facilities for processed water. (WT). W5. Use of plastic films poses significant environmental and health risks (PF).
Opportunities (O)	**Threats (T)**
O1. Due to low production costs, there is a high potential for export (EP). O2. Through implementing a dynamic payment system, farmers' profits will increase and their relationship with the organization will be strengthened (DPS). O3. Improving the information flow throughout the dairy supply chain can be achieved by implementing effective information systems (IT). O4. Utilising robotic milk collection processes (AMC).	T1. If the dynamic payment system is not integrated into the dairy industry's milk procurement policy, there are problems with trust and low supplier satisfaction. (SS) T2. Due to dairy products' high price sensitivity, consumers are unwilling to pay more for higher-quality goods (HP). T3. As more firms enter the market, competition is progressively growing (MC). T4. To create novel and inventive products, a substantial investment is needed in the R&D sector (RDI).

Table 9. Overall Priority Scores of SWOT factors (adapted from Mor, et. al, 2019)

SWOT Group	Group Priority	SWOT Factors	Factors Priority within the Group	Overall Priority of Factor
Strengths	0.530	S1. Well trained and skilled workforce offered at all stages to assist R&D and industry processes (RD).	0.510	0.270
		S2. Offers job opportunities to the rural population, particularly benefiting women. (WE).	0.271	0.144
		S3. Ensures a consistent income source for farmers. (FI).	0.152	0.081
		S4. The implementation of a two-axis payment system (based on Fat and SNF) ensures farmers receive a fair price for their milk production.	0.067	0.036
Weaknesses	0.308	W1. Dairy industry is grappling with the issue of water wastage. (WW).	0.397	0.122
		W2. Indian dairy market comprises both unorganized and organized sectors, with only 20% being organized. (OU).	0.340	0.105
		W3. The distribution sector requires enhancements and investments in logistics and transportation (TF).	0.110	0.034
		W4. Absence of water treatment facilities for processed water. (WT).	0.119	0.037
		W5. Use of plastic films poses significant environmental and health risks (PF).	0.034	0.011
Opportunities	0.115	O1. Due to low production costs, there is a high potential for export (EP).	0.381	0.044
		O2. Through implementing a dynamic payment system, farmers' profits will increase and their relationship with the organization	0.367	0.042

		will be strengthened (DPS).		
		O3. Improving the information flow throughout the dairy supply chain can be achieved by implementing effective information systems (IT).	0.197	0.023
		O4. Utilising robotic milk collection processes (AMC).	0.055	0.006
Threats	0.047	T1. If the dynamic payment system is not integrated into the dairy industry's milk procurement policy, there are problems with trust and low supplier satisfaction. (SS) T2. Due to dairy products' high price sensitivity, consumers are unwilling to pay more for higher-quality goods (HP). T3. As more firms enter the market, competition is progressively growing (MC). T4. To create novel and inventive products, a substantial investment is needed in the R&D sector (RDI).	0.591	0.028
		T1. If the dynamic payment system is not integrated into the dairy industry's milk procurement policy, there are problems with trust and low supplier satisfaction. (SS) T2. Due to dairy products' high price sensitivity, consumers are unwilling to pay more for higher-quality goods (HP). T3. As more firms enter the market, competition is progressively growing (MC). T4. To create novel and inventive products, a substantial investment is needed in the R&D sector (RDI).	0.209	0.010

		T1. If the dynamic payment system is not integrated into the dairy industry's milk procurement policy, there are problems with trust and low supplier satisfaction. (SS) T2. Due to dairy products' high price sensitivity, consumers are unwilling to pay more for higher-quality goods (HP). T3. As more firms enter the market, competition is progressively growing (MC). T4. To create novel and inventive products, a substantial investment is needed in the R&D sector (RDI).	0.098	0.005
		T1. If the dynamic payment system is not integrated into the dairy industry's milk procurement policy, there are problems with trust and low supplier satisfaction. (SS) T2. Due to dairy products' high price sensitivity, consumers are unwilling to pay more for higher-quality goods (HP). T3. As more firms enter the market, competition is progressively growing (MC). T4. To create novel and inventive products, a substantial investment is needed in the R&D sector (RDI).	0.102	0.005

Based on Table 3-9, comparing dairy sector matrices for strengths, weaknesses, opportunities, and threats yielded critical insights. A two-axis payment system (0.067) is a driver, as is the availability of highly qualified technical labor and jobs, with a focus on rural populations, including women (0.271). The key difficulties emphasized in this area are large amounts of fresh water waste (0.397), a chaotic marketing sector for this product (0.340), and the safety of employing plastic sheets (0.034). On the other side, opportunities in this industry are driven by the ability to export due to lower manufacturing costs (0.381) or greater relationships/profits through adaptable payment channels. (0.367) In contrast, automated milk collecting points might have small impacts (0.055).

A dynamic payment system is not maintained at low supplier satisfaction rates of 0.591, high price sensitivity of 0.209, and improved market competitiveness of 0.098, which

is a non-major concern when discussing this broad application. These consistency ratios, on the other hand, demonstrate consistent evaluations, signaling that when dealing with risks and capitalizing on development opportunities, strategic concern should be focused on water resource management, marketing structures, export potential, and payment modes. Lower supplier satisfaction is mostly caused by low danger (0.591) and elasticity of demand (0.209), although more competition provides modest risks (0.098). As a result, the overall consistency ratio of these matrices emphasizes the need for a strategic focus on water resource management, market organization principles, export possibilities, and payment methods for risk reduction and growth opportunity optimization.

CONCLUSION

This paper proposes an AHP-based paradigm for identifying and assessing CFs in the dairy supply chain. This study relies on expert opinions and data from many dairy units to inform its results. 17 critical factors (CFs) are carried over for ranking, including four strengths, five weaknesses, four opportunities, and four threats. The authors selected 17 CFs in their respective groups and the overall output of SWOT analysis in a second stage. 17 CFs are considered for inclusion when identifying the most important ones within any given SWOT category. To this end, it is recommended that the SWOT and AHP approach which is therefore applied research in dairy industry. The researcher shows that there is much emphasis placed on PF in relation to other factors. Thus, order of importance is PF, IT, SS, WE. Small dairy farmers have to be included in the forthcoming dairy sector. A greater investment is required in the empowerment of rural development and women through dairy industry. Farmers will gain more if service quality increases and at the same time service delivery costs decrease.

LIMITATIONS

The dairy industry, like other sectors, operates in a dynamic environment whereby factors such as market conditions, consumer preference and regulatory landscapes can affect the SWOT analysis to be relevant and constant over time. Not to mention, the AHP method can face challenges to adapt from these changes because the weights assigned to the factors can be outdated in a short period of time.

REFERENCES

Bhardwaj, A., Mor, R. S., Singh, S., & Dev, M. (2016). An investigation into the dynamics of supply chain practices in dairy industry: A pilot study. In Proceedings of the 2016 International Conference on Industrial Engineering & Operations Management, Detroit, MI, USA (pp. 1360-1365).

Kumar, A., Staal, S. J., & Singh, D. K. (2011). Smallholder dairy farmers' access to modern milk marketing chains in India. Agricultural Economics Research Review, 24, 243-253. https://doi.org/10.1177/0971344120110207

Mor, R. S., Bhardwaj, A., & Singh, S. (2018). A structured literature review of the supply chain practices in dairy industry. Journal of Operations and Supply Chain Management, 11(1), 14-25. https://doi.org/10.12660/joscmv11n1p14-25

Mor, R. S., Bhardwaj, A., & Singh, S. (2018). A structured literature review of the supply chain practices in food processing industry. In Proceedings of the 2018 International Conference on Industrial Engineering & Operations Management, Bandung, Indonesia (pp. 588-599).

Mor, R. S., Bhardwaj, A., & Singh, S. (2018). Benchmarking the interactions among barriers in dairy supply chain: An ISM approach. International Journal for Quality Research, 12(2), 385-404. https://doi.org/10.18421/IJQR12.02-06

Mor, R. S., Bhardwaj, A., & Singh, S. (2018). Benchmarking the interactions among performance indicators in dairy supply chain: An ISM approach. Benchmarking: An International Journal, 25(9), 3858-3881. https://doi.org/10.1108/BIJ-09-2017-0254

Mor, R. S., Bhardwaj, A., & Singh, S. (2019). Integration of SWOT-AHP approach for measuring the critical factors of dairy supply chain. Logistics, 3(1), 9. https://doi.org/10.3390/logistics3010009

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

Ortiz-Barrios, M., Miranda-De la Hoz, C., López-Meza, P., Petrillo, A., & De Felice, F. (2020). A case of food supply chain management with AHP, DEMATEL, and TOPSIS. Journal of Multi-Criteria Decision Analysis, 27(1-2), 104-128. https://doi.org/10.1002/mcda.1693

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

Sherekar, V., & Tatikonda, M. (2016). Impact of factor affecting on labour productivity in construction projects by AHP method. International Journal of Engineering Science and Computing. https://doi.org/10.4010/2016.1619

Vu, T. T., & Trinh, H. H. H. (2021). Blockchain technology for sustainable supply chains of agri-food in Vietnam: A SWOT analysis. Science & Technology Development Journal: Economics, Law and Management, 5(1), 1278-1289. https://doi.org/10.32508/stdjelm.v5i1.737