EVALUATING OF PERFORMANCE PARAMETERS OF SUPPLY CHAIN MANAGEMENT IN MILK INDUSTRY

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ABSTRACT: *The aim of this article is to examine the performance assessment model in more depth. Due to the fact that the milk industry is one of the most significant sectors in the nation, proper planning at both the macro and micro levels is required. It is necessary to address the supply chain management in this sector since it is one of the most essential aspects of the business. The significance of the supply chain in the dairy industry is explored in this research study. To rate the distinct alternatives, the suggested research identifies numerous parameters and employs a variety of criteria. The study then uses the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) to rank the various alternatives. The findings of this research show that the model presented in this article is capable of estimating the impact of major variables on supply chain components in the dairy sector.*

Keywords: *Supplu chain Management, Milk Sector, TOPSIS*

1. INTRODUCTION

Supply Chain Management (SCM) is a rapidly growing field that is essential to academics as well as corporate executives on the board of directors. In order to get a grasp of how and why SCM courses of action increase, as well as the consequences of these plans for the industry's proficiency and intensity [1,] elements of showcasing, financial considerations, coordinations, and authoritative conduct are very important. The exchange of information between colleagues within a distribution network becomes more important as time goes on. Different Extranet developments may bring about different aspects of data sharing, such as the exchange of request, stock, and request data—among different companies and departments. In particular, the effect of these distinct aspects of data exchange on the SCM is of particular interest[2]. Data sharing and forecasting by people from the inventory network were accomplished via the use of requests directed to the group directly above them, referred to as their first "echelon." This creates a slew of problems across the Supply Chain. The following were examples: excessive stock holding and inadequacies, extended lead times, and reduced administration levels[3, 4]. Stock Management also plays an important role in the overall operation of the Supply Chain Management system. The performance of the supply chain is highly dependent on three stock arranging parameters: (i) the forecast inaccuracy, (ii) the method of communication across echelons, and (iii) the recurrence of stock arranging. It is also essential in Supply Chain Management to plan for the flow of materials. the method through which product needs are planned and communicated at the distribution centers is referred to as flow planning. Specifically, we are thinking about two widely used methods, which we will refer to as the distribution resource planning (DRP) technique and the reorder point (ROP) approach respectively.

The DRP approach refers to a situation in which the manufacturing level has information on the period-by-period item requirements of the DCs, allowing it to have a better perception of product requirements in the future. [4] The manufacturing level forecasts the period-by-period item requirements at the DCs in the ROP framework while the ROP is being implemented. Many businesses have seen a substantial increase in the number of items they provide in recent decades. According to the Bundled Goods Industry Association, the number of new products introduced more than doubled from 12,000 to 24,000 between 1986 and 1996. The number of goods available in large shops has increased from 1000 items available on request in the 1950s to 30,000 items available in a modern supermarket in the present day. Comparative improvements may be seen in a wide range of industries, including automobiles, computer equipment, programming, and media transmission businesses, to name a few. High product diversity is expected to have a negative impact on supply chain performance in terms of renewal lead time and cost[5]. Material development is impossible to achieve without transportation. Natural disasters, labor disputes, terrorist activity, and infrastructure failures are just a few of the reasons why transportation may be disrupted. Other factors include strikes, labor disputes, and terrorist actions. A transportation disturbance occurs when the flow of material between two echelons in the supply chain is obstructed, resulting in the cessation of the movement of these goods without regard for the source of the disruption[6]. A few studies have identified deterrents and barriers to supply chain performance management that must be addressed (PM). Enterprise resource planning (ERP) frameworks, for example, have been seen as a significant impediment. An ERP framework can be thought of as a modularized collection of business programming applications that are perfectly integrated to provide computerized connections and a common source of information for a company[7].

2. METHODOLOGY AND DATA ANALYSIS

2.1 Steps of the Process

1. Critical success criteria and performance indicators were established as a result of a survey of the literature.
2. A Likert 5 point scale has been used in the surveys in order to ensure that all input data is uniformly distributed.
3. All components are given equal weighting, and the TOPSIS MODEL is applied to the data received from various Dairy Industries using the questionnaire that was previously developed.
4. TOPSIS MODEL was used to determine the ranking of SCM performance metrics, which was then implemented in MATLAB.

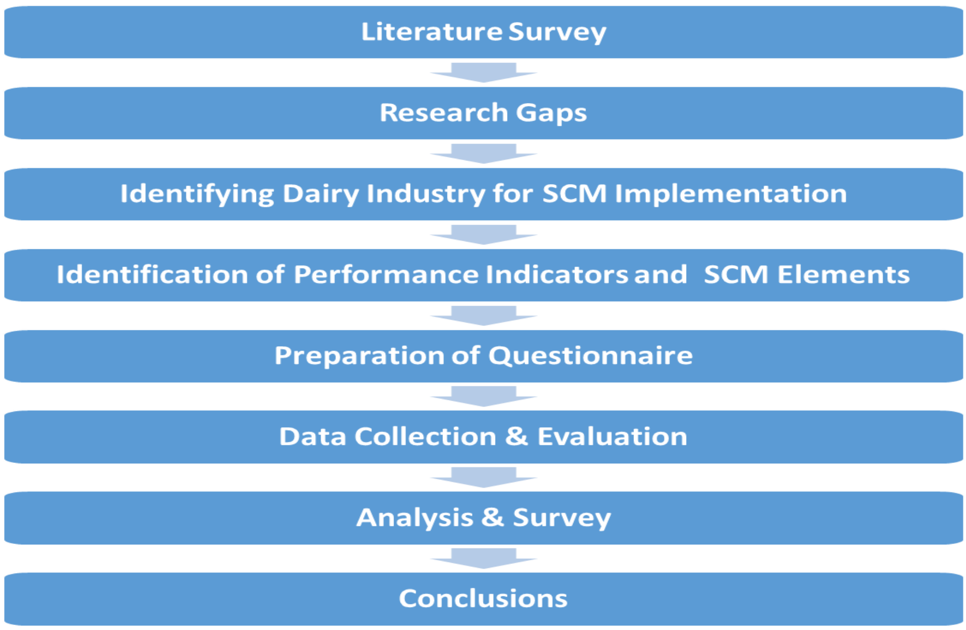

Figure 1. Methodology

Table 1. Performance Indicators and SCM Elements

PERFORMANCE INDICATORS (PI)	Abbreviation	JIT ELEMENTS (JE)	Abbreviation	JIT ELEMENTS (JE)	Abbreviatio n
Inventory Management	IM	Demand Forecasting	DF	Product Variety	PV
On time Delivery	OTD	JIT Purchasing	JP	Kanban Implementation	KI
Profit Maximization	PM	Information Sharing	IS	ERP Implementation	EI
Quality Improvement	QI	Good Supplier Network	GSN	Total Preventive Maintenance	TPM
Flow Time	FTE	Flexible Manufacturing	FMS	Logistic	LM

Efficiency		System		Management	
Production Service Level	PSL	Mode of transportation	MOT		

The TOPSIS technique is used to evaluate the ranking of the six Performance indicators based on twelve SCM elements. On the basis of the questionnaire prepared, the data are collected and simplified as shown in Table 2.

Table 2. Average Data Matrix

PERFORMANCE INDICATORS	DF	JP	IS	GSN	FMS	PV	TQM	KI	EI	TPM	LM	MOT
IM	3.272	3.363	2.909	3.181	2.818	2.818	2.181	2.818	2.818	2.272	3.545	3.181
OTD	2.636	3.909	3.454	3.090	3.181	3.090	2.363	2.909	3.181	3	3.818	4
PM	3	3	3.545	2.818	3.181	3.090	3.727	2.909	3.181	3.090	3	2.545
QI	2.181	3.181	3.181	2.272	3.090	3.363	4.272	3.181	3.181	3.181	2.363	2.090
FTE	2.454	3.363	3.545	2.909	4	3.272	3.181	2.909	3	3.363	2.545	2.090
PSL	3.090	3.545	3.272	2.818	3.090	3.272	3	2.727	3	3.181	2.454	1.909

3. RESULTS AND DISCUSSIONS

Yoon and Hwang were the first to propose the TOPSIS method, which was then evaluated by a variety of surveyors and administrators [8]. In this approach, options are evaluated in light of their capacity to be compared in a perfect arrangement. When an option becomes more similar to a flawless arrangement, it receives a higher evaluation [9]. Perfect arrangement is a solution that is the best from any point of view, but it does not exist for all intents and purposes, therefore we try to approach it as much as we can with our current knowledge. Fundamentally, while evaluating the comparability of a design to a perfect dimension and a non-perfect dimension, we consider the distance between the design and the ideal and non-perfect arrangement. The TOPSIS method is broken down into six phases, which are detailed below[10].

STEP-1)

$$\begin{matrix} X_1 & X_2 & \cdots & X_n \end{matrix}$$

$$\begin{matrix} x_{11} & x_{12} \cdots & x_{1n} \\ x_{21} & x_{22} \cdots & x_{2n} \\ \vdots & \vdots & \vdots \\ x_{31} & x_{32} \ldots & x_{3n} \end{matrix} \quad (1)$$

Where Ai denotes the alternatives i, i = 1, . . . ,m; Xj represents jth attribute , j = 1, . . . , n, related to ith alternative; xij is a crisp value showing the performance rating of each lternative Ai with respect to each criterion Fj

STEP-2)

Now we calculate Normalized Decision Matrix $F[f_{12}]$

Normalized value $f_{ij} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^{n} x_{ij}^2}}$ i=1,….n; j=1,….m

Table 3. Linear Normalize Average Data Matrix

PI	JE											
	DF	JP	IS	GSN	FMS	PV	TQM	KI	EI	TPM	LM	MOT
IM	0.47507	0.40315	0.35712	0.46907	0.35426	0.36453	0.27789	0.39505	0.37558	0.30564	0.4814	0.47432
OTD	0.38273	0.4686	0.42403	0.45565	0.3999	0.39972	0.30107	0.40781	0.42395	0.40358	0.51848	0.59644
PM	0.43558	0.35963	0.4352	0.41554	0.3999	0.39972	0.47486	0.40781	0.42395	0.41568	0.40739	0.37949
QI	0.31666	0.38133	0.39052	0.33503	0.38846	0.43504	0.5443	0.44594	0.42395	0.42793	0.32089	0.31164
FTE	0.36952	0.40315	0.4352	0.42896	0.50286	0.42326	0.4053	0.40781	0.39983	0.45241	0.3456	0.31164
PSL	0.44864	0.42497	0.40169	0.32161	0.38846	0.42326	0.38224	0.38229	0.39983	0.42793	0.33325	0.28465

STEP-3)

Hereweighted normalized decision matrix is calculated in which normalized decision matrix is multiplied by its associated weights.

The weighted normalized value $r_{ij} = w_{ij}.f_{ij}$ j= 1,……..m; i=1……..n

wj represents the weight of the jth attribute

Table 4. Weighted Linear Normalized Average Data Matrix

PI	DF	JP	IS	GSN	FMS	PV	TQM	KI	EI	TPM	LM	MOT
IM	0.12954	0.088559	0.089281	0.085253	0.075133	0.093868	0.077877	0.12869	0.093894	0.081021	0.13491	0.14012
OTD	0.10436	0.10294	0.10601	0.082814	0.084811	0.10293	0.084376	0.13284	0.10599	0.10698	0.1453	0.1762
PM	0.11877	0.079	0.1088	0.75525	0.084811	0.10293	0.13308	0.13284	0.10599	0.11019	0.11417	0.11211
QI	0.086344	0.083766	0.097629	0.060891	0.082385	0.11202	0.15254	0.14526	0.10599	0.11344	0.089929	0.092064
FTE	0.10075	0.088559	0.1088	0.077963	0.10665	0.10899	0.11358	0.13284	0.099958	0.11993	0.096856	0.092064
PSL	0.12233	0.093351	0.10042	0.058452	0.082385	0.10899	0.10712	0.12453	0.099958	0.11344	0.093393	0.084091

STEP-5)

Separation measures are defined. Separation measure $\boldsymbol{k_i^+}$ of each alternative from PIS is given as:

$$k_i^+ = \sqrt{\sum_{j=1}^{n} r_{ij-} r_j^{+\,2}} \quad \text{i= 1,……, m}$$

DF	JP	IS	GSN	FMS	PV	TQM	KI	EI	TPM	LM	MOT
0.12954	0.10294	0.1088	0.085253	0.10665	0.11202	0.15254	0.14526	0.10599	0.11993	0.1453	0.1762

Similarly separation measure. k_i^- of each alternative from NIS is given as:

$$k_i^- = \sqrt{\sum_{j=1}^{n} r_{ij-} r_j^{-\,2}} \quad \text{i= 1,……., m}$$

DF	JP	IS	GSN	FMS	PV	TQM	KI	EI	TPM	LM	MOT
0.086344	0.079	0.089281	0.058452	0.075133	0.093868	0.077877	0.12453	0.093894	0.0811021	0.089929	0.08409

STEP-6)

Relative nearness to the idea solution is calculated and alternatives in descending order is ranked. The relative nearness of the alternative Ai with respect to PIS r^+can be expressed as:

$$\mathbf{p_i} = \frac{\mathbf{k_i^-} + \mathbf{k_i^+}}{\mathbf{k_i^-}}$$

Performance Indicators	**IM**	**OTD**	**PM**	**QI**	**FTE**	**PSL**
Preference Score	0.45996	0.60451	0.50585	0.42895	0.3967	0.33453
Ranking	4	6	5	3	2	1

Above matrix shows the ranking of Performance Indicators based on several criteria which would be beneficial in developing a decision support system for successful implementation of SCM in Dairy Industry.

4. CONCLUSIONS:

The purpose of this paper is to assist supply chain managers in making choices. First, the main ideas and techniques for measuring the performance of the supply chain, as well as the work done in this area, were discussed in detail. Even while a significant number of studies stressed the significance of the measure and offered techniques and methods, it was observed that there was no universal framework for connecting the strategy to performance metrics that took into consideration the peculiarities of the supply chain. Additionally, the development of a technique for integrating and extracting a performance score linked to the mutual dependency of the factors seems to be of significant significance and should be taken into consideration, among other things. The TOPSIS technique is used in order to collect performance data and find the most significant component.

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