



Research Article

ANALYSIS OF DIRECTION OF CHANGE IN PRODUCT MIX-A STUDY WITH REFERENCE TO DIFFERENT MILK PROCESSING UNITS IN KARNATAKA

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Abstract: Karnataka ranks 11th in the list of top milk producing states in India. It has 14 milk processing units across the state, which procures on an average 72.00 lakh kgs of milk per day with production of about 65 different value added milk products. Performance of Indian dairy industry over the past decades has been extremely impressive in the Karnataka state, due to high margin value added dairy products and good product portfolio of various milk processing units. Hence, present study was conducted to know the direction of change in product mix followed in selected milk processing units and the secondary data were collected for the period of five years, i.e. from 2012-13 to 2016-17 and analyzed by using Markov chain model. The study concluded that curd and Skimmed milk powder were the most loyal products in the product mix across all the processing units of Karnataka state.

Keywords: Milk, Processing, Product mix, Markov chain, Retention

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Introduction

India is the largest milk producing country in the world. Milk production in the country has increased during 2017-18 from 165.4 Million tonnes during 2016-17 which is comparatively higher and persistent [1]. Karnataka ranks 11th in the list of top milk producing states in India. It has 14 milk processing units across the state, which procures on an average 72.00 lakh kg. of milk per day with production of about 65 various milk products [2]. Performance of Indian dairy industry over the past decades has been extremely impressive [3,] which is because of high margin value added dairy products and good product portfolio of various milk processing units. Indian dairy industry will grow rapidly at 20.00 percent per annum; doubling into Rs 2.50 lakh crores market by 2020, led by increasing consumption of value-added products [4]. Keeping this context, a study was undertaken with the

Objective

To analyze the direction of change in product mix followed in the milk processing units.

Materials and methods

Method 1

The present study mainly relied on secondary source of data. Season-wise i.e. flush season (September to February) and lean season (March to August) secondary data on different milk products produced by the randomly selected ten dairy processing units. viz., Bangalore, Mysore, Mandya, Tumkur, Dharwad, Hassan, Belgavi, Vijayapura, Bellary and Kalaburgi out of 14 processing units in the state were collected for the period of five years, i.e. from 2012-13 to 2016-17. The data were mainly obtained from the records of processing departments and annual reports of dairy processing units and were utilized for the analysis of direction of change in product mix for selected dairy processing units. To analyze the direction of change in product mix Markov chain analysis was employed, as done [5-8].

Statistics 1

Markov Chain Model

The changes in product mix of dairy processing units were analyzed by using the first order Markov chain approach. Central to Markov chain analysis is the estimation of transitional probability matrix 'P', whose element p_{ij} indicate the probability of production switching from product 'i' to product 'j' over time. The diagonal elements P_{ij} where $i=j$, measures the probability of a product retaining its share in production or in other words, the loyalty of processing units towards the production of particular product. Annual data on different milk products produced by the dairy processing units for the period 2012-13 to 2016-17 were used to analyze the direction of change in product mix of dairy processing units of Karnataka. The average production of particular product was considered to be a random variable which depends only on the past production of that particular product, which can be denoted algebraically as,

$$E_{jt} = \sum_{i=1}^n [E_{i,t-1}]P_{ij} + e_{jt}$$

Where,

E_{jt} = production of jth milk product by the processing unit of Karnataka in the year t

$E_{i,t-1}$ = production of ith milk product during the year t-1

P_{ij} = the probability that production will shift from ith product to jth product

e_{jt} = the error term which is statistically independent of $E_{i,t-1}$

n = the number of products produced by the dairy processing units

The transitional probabilities P_{ij} , which can be arranged in a (c x n) matrix, have the following properties.

$$\sum_{i=1}^n P_{ij} = 1$$

And

$$0 \leq P_{ij} \leq 1$$

Thus, the expected production share of each product during period 't' is obtained by multiplying the production of these products to the products produced in the previous period (t-1) with transitional probability matrix. The probability matrix was estimated for the period 2012-13 to 2016-17. Thus, transitional probability matrix (T) is estimated using linear programming (LP) framework by method referred to as minimization of mean absolute deviation (MAD)

Min, $OP^* + I e$

Subject to

$XP^* + V = Y$

$GP^* = 1$

$P^* \geq 0$

Where,

P^* is a vector of the probabilities P_{ij}

O is the vector of zeros

I is an appropriately dimensional vectors of areas

e is the vector of absolute errors

Y is the proportion of production to each product.

X is a block diagonal matrix of lagged values of Y

V is the vector of errors

G is a grouping matrix to add the row elements of P arranged in P^* to unity.

Table-1 Transitional probability matrix for different milk products produced by the selected dairy processing units from Karnataka

Products	Curds	Cream	SMP	WMP	Buttermilk	Others
Curds	0.632	0.195	0.109	0.064	0.000	0.000
Cream	0.898	0.000	0.000	0.000	0.057	0.045
SMP	0.000	0.282	0.575	0.033	0.110	0.000
WMP	0.672	0.000	0.000	0.088	0.021	0.219
Buttermilk	1.000	0.000	0.000	0.000	0.000	0.000
Others	0.543	0.036	0.085	0.000	0.027	0.309

SMP=Skimmed Milk Powder; WMP=Whole Milk Powder, Others include Ghee, Pedha, Paneer, Lassi, Khoya, Butter, Flavored milk, Mysore pak, kunda, Ice-cream etc. (20 more products).

Results and Discussion

The major milk products produced in selected dairy processing units were Curds, Cream, Skimmed milk powder, Whole milk powder, Buttermilk and others. Transitional probability matrix displayed in table 1 revealed that curd was the most stable product with highest retention of 63.20 percent of the total production followed by Skimmed milk powder (57.50 %), the category of other products (30.90 %) and whole milk powder (8.90 %). Cream and Buttermilk were the most unstable products produced by the milk processing units (0.00 % retention). Apart of holding 63.20 percent of its production, curds had gained large share (100.00%) of Buttermilk, 89.80 percent of Cream, 67.20 percent of whole milk powder and 54.30 percent of category of others during the study period. At the same time curds lost 19.50 percent of its share in production to cream, 10.90 percent to Skimmed milk powder and 6.40 percent to Whole milk powder. Similarly, skimmed milk powder had gained 10.90 percent share of curds, 8.50 percent the category of other products. At the same time Skimmed milk powder lost 28.20 percent of its share in production to Cream, 11.00 percent to Buttermilk and 3.30 percent to whole milk powder. While taking on account of Whole milk powder we got to know that it had gained 6.40 percent share of Curds, and 3.30 percent to Skimmed milk powder. At the same time Whole milk powder lost 67.20 percent of its share in production to Curds, 21.90 percent to the category of other products, and 2.10 percent to Buttermilk.

Conclusion

Curd production in selected processing units from Karnataka has shown an increasing trend by gaining the shares from Buttermilk, Cream and Whole milk powder. Demand for Skimmed milk powder was consistent irrespective of season. Diversification of production of other products should be restricted only to flush season. Hence, milk processing units from Karnataka should get milk in flush season and convert it into value added products to gain more profit.

Application of research: This study gives an idea about the changing direction of product mix with regards to selected processing units of Karnataka. It will help the

selected processing units in further planning or developing the strategy for diversification of product mix.

Research Category: Agribusiness Management

Abbreviations:

SMP=Skimmed Milk Powder

WMP=Whole Milk Powder

KMF= Karnataka Milk Federation

MAD = Mean absolute deviation, LP= Linear Programming

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Author Contributions: All authors equally contributed

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Study area / Sample Collection: Bangalore, Mysore, Mandya, Tumkur, Dharwad, Hassan, Belgavi, Vijayapura, Bellary and Kalaburgi

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

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