A STUDY OF REGIONAL DEVELOPMENT OF DAIRY COOPERATIVES IN INDIA

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Abstract: Dairy sector in India has a great impact on the life of Indian people. Majority of rural population is connected with milk and milk production activity. Dairy cooperatives are the lifeline for the milk producers of the country which fills the gap of requirement of milk between the rural areas and urban areas. Share of agriculture in India's GDP has been increased to 19.9 percent in the year 2020-21 from 17.8 percent in 2019-20. In this paper it is tried to observe the regional development of the dairy cooperatives. It is also discussed and analysed the growth of regional dairy cooperatives with the use of Number of Dairy Cooperative Societies.

Index Terms- **Dairy sector, Cooperative society, Milk production, Region**

I. INTRODUCTION

India is basically an agricultural country which mainly depends upon the weather. Due to this, India faces many uncertainties in the field of agriculture. Agriculture is the main occupation of rural area. The growth of agriculture still holds the key for economic and social upliftment of the rural people. More than 50% population of the country is dependent on agricultural sector and majority of them having the cattle in their houses. Share of agriculture in India's GDP has been increased to 19.9 percent in the year 2020-21 from 17.8 percent in 2019-20. Thus, the Dairy industry is one of the major sectors in Indian Economy. Dairy industry occupies an important place in animal husbandry. Dairy co-operative has been recognized as an effective instrument for bringing major socio-economic changes in the country. The industry where the milk and milk-products are handled is known as Dairy industry. It includes firm dealing with processing of milk, manufacturing of milk products, its marketing and sale in large scale.

Development of organized dairy sector is started from the year 1965 after the foundation of National Dairy Development Board (NDDB). Dairy sector in India is majorly operating on the cooperative basis and NDDB is the apex body of it. To make country self-reliable in the field of dairy product a major initiative named "Operation Flood" has been implemented in year 1969-70 which aimed to modernising and developing the dairy sector. As a positive result of this initiative, it is reported the record break dairy production. India stood at first position in the world in terms of Milk production having 210.19 million tonnes with its contribution of 23% in global milk production in the year 2020-21.

In this paper It has been selected all four regions of the country viz. North region, East region, West region & South region to know the progress of dairying in India. By selecting every region, it is indirectly covered all the states of the country in our study. It is also tried to observe the regional development of the dairy cooperatives in this paper. It is also tried to analyse the growth of regional dairy cooperatives with the use of Number of Dairy Cooperative Societies, Number of Milk Producer Members, Quantity of Milk Procurement and Quantity of Liquid Milk Marketing.

II. LITERATURE REVIEW

Chandramohan & Periyasami (2009) evaluated operational effectiveness and investigated the evolution of dairying activities in India, with a particular focus on Thanjavur District Cooperative Milk Producers' Union Limited (TDCMPU) of Tamil Nadu State. They obtained the results on the basis of Trend percentage, Index number and Coefficient of Variation. From analysis they concluded that TDCMPU has not utilised its plant capacity to the fullest extent. Even it was found that TDCMPU has not made any efforts to increase sales and as a result the sale of milk fluctuated during the study period. They suggested that the union should make some proactive measures to acquire all surplus milk as TDCMPU procured more milk from the societies than what was required.

Prasad & Satsangi (2013) tried to understand the relation between the organizational structure and operational efficiency with the help of case study of Amul dairy model. The aspects covered under this study was to examine the co-operative form of organization with corporate form of organization. It was found that the structure of Amul co-operative is very different from the corporate form but there is need of federation form of organization to receive better success. They have pointed out that better organizational structure is helpful for increasing working conditions and vice a versa the improper organizational structure would sunk the organization. They also found that organizational objectives can be achieved in better structure without making more strain on its members. The technological structure is important to accept the change in technology for better returns. They further found that the federal form of structure is more effective for the better returns. It is populated that the co-operative organization are failure but, in this study, it is found that Amul Co-operative has got a grand success in this area. The researcher has pointed out that the Amul has used men, machine and materials in such a manner that they receive better profit by its structure. Researcher has assessed the several factors for establishing connection between organizational structure and its operational efficiency. Researcher also concluded that the factors examined have a positive role for organizational success.

Desmukh (2014) examined the growth and development of Dairy sector in India using data of dairy development published by Government of India (GOI) & various government authorities related to dairy sector. He has observed total milk production in the world with special reference to production of India, per capita availability of milk in the country, state wise milk production, state wise number of dairy plant & its milk processing capacity. In his study he has revealed that there is sustained growth in the availability of milk for the burgeoning population of the country. The per capita availability of milk has also increased. In spite of decline in the share of agriculture sector in Total GDP of the country, the share of livestock sector has been increased. Milk production rate of India is compounding during the study period. He concluded that growth in dairy sector has observed over the year by implementing various progressive plans still it is needed progressive measures to implement for the upliftment of dairy sector.

Anand & Aggarwal (2019) have examined significant difference in the efficiency ratios of three selected dairy companies by comparing data of 8 years to find out the relationship between selected milk producing firms. It has also been observed that there is a significant difference in relationship between Inventory turnover ratios of all selected units. Working capital turnover ratio and fixed assets turnover ratio shows no significant difference in relationship between selected units. Total Assets Turnover Ratio shows that Amul has significant relation with Mother Dairy but has no significant relationship with Kwality Ltd.

III. RESEARCH METHOD

Goal of the present research work is to study regional development of dairy cooperative sector in India and to analyse the growth of dairy cooperative sector of India through regional comparison. The descriptive & analytical research work is carried by collecting region wise data of last 11 years i.e., from the year 2010-11 to 2020-21 from the Annual reports of National Dairy Development Board (NDDB). To compare region wise statistically significant difference, first normality assumption is verified. If assumption of normality is satisfied then parametric test (One way ANOVA) and if assumption of normality is violated then non-parametric test (Kruskal- Wallis test) is used.

IV. DATA ANALYSIS AND INTERPRETATION

4.1.1 Analysis of Number of dairy Cooperative Societies:

The table- 4.1.1 and graph- 4.1.1 represent the number of dairy cooperative societies operated in different region of the country. Number of dairy cooperative societies are increasing for majority years in all the regions. But in year 2014-15 number of dairy cooperatives in North region is decreased and then after it has increasing trend. As like North region same pattern is observed in West region as well as South region as in West region number of dairy cooperatives are decreased in the year 2016-17 and in South region in the year 2015-16 & 2019-20 it has been decreased.

Table- 4.1.1 No of Dairy Cooperative Societies (in numbers)

Region	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
North	52911	54692	54802	55777	55302	57309	61997	66446	66795	67783	68508
East	16328	18176	21834	24963	27548	29792	30878	33015	34133	35327	36432
West	42697	43978	44970	47561	48588	49627	49215	50218	51083	51683	51917
South	31190	32119	34028	34299	34397	34334	35224	35735	38616	38402	39257
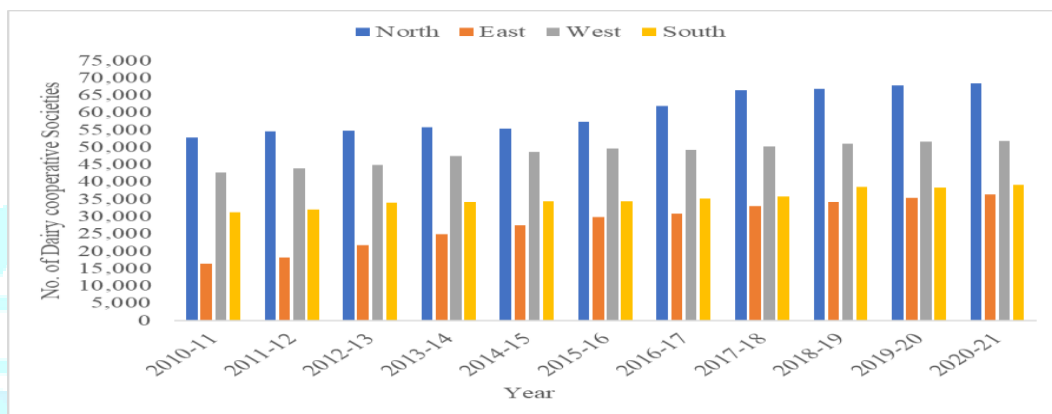
Graph- 4.1.1 Number of Dairy Cooperative Society

Descriptive Statistics of the number of Dairy Cooperative Societies are presented in the table- 4.1.2 from which it can be seen that the highest average number of dairy Cooperatives as 60941 units are operated in the North region followed by West region, South region and at last East region which has lowest average number of 29210. High variability in the number of dairy cooperatives is observed in East region on the other hand, lowest variation is observed in South region.

Table- 4.1.2 Descriptive Statistics of Number of Dairy Cooperative Societies

Region	N	Mean	SD	Minimum	Maximum
North	11	60211	6138	52911	68508
East	11	28039	6923	16328	36432
West	11	48322	3168	42697	51917
South	11	35236	2604	31190	39257

Assumption of normality for Number of Dairy Cooperative Societies:

H_0: The Number of Dairy Cooperative Societies follow normal distribution.

H_1: The Number of Dairy Cooperative Societies do not follow normal distribution.

Table 4.1.3 Shapiro-Wilk test for Number of Dairy Cooperative Societies

Region	statistic	p -value	statistic	p -value
North	0.842	0.034		
East	0.93	0.41	0.981	0.66
West	0.909	0.24		
South	0.927	0.381		

It can be depicted from the table-4.1.3 that p value of Shapiro-Wilk test statistics for Number of Dairy Cooperative Societies is greater than 0.05. So, it can be said that the Number of Dairy Cooperative Societies located in each region follow normal distribution. So, to check the significant difference for Number of Dairy Cooperative Societies amongst different region, one way ANOVA is applied. To decide whether to apply Fisher's ANOVA or Welch's ANOVA, assumption of homogeneity of variance is checked.

H_0: There is homogeneity of variance among Number of Dairy Cooperative Societies

H_1: There is no homogeneity of variance among Number of Dairy Cooperative Societies

Table- 4.1.4 Leven's Homogeneity of Variances Test for No. of Dairy Cooperative Societies				
	Statistic	**df**	**df2**	**p**
No. of Dairy Cooperative Societies	7.78	3	40	$< .001$

It can be observed from the Table- 4.1.4 that p value of Levene's test statistic is less than 0.05. So, it can be said that there is no homogeneity of variance amongst different regions for Number of Dairy Cooperative Societies. So, to test the significant difference for Number of Dairy Cooperative Societies amongst different regions, Welch's ANOVA is applied.

H_0: There is no significant difference for number of Dairy Cooperative Societies amongst different regions.

H_1: There is significant difference for number of Dairy Cooperative Societies amongst different regions.

Table- 4.1.5 One-Way ANOVA (Welch's)				
	F	**df1**	**df2**	**p -value**
No. of Dairy Cooperative Societies	81.0	3	21.0	$< .001$

It can be observed from the Table- 4.1.5 that the p value of test statistic for Number of Dairy Cooperative Societies is less than 0.05. So, it can be inferred that at 5% level of significance, there is significant difference for Number of Dairy Cooperative Societies amongst different regions. Further, pairwise comparison is carried out to know which pair has significant difference for Number of Dairy Cooperative Societies using Games- Howell Post-Hoc test.

Table:4.1.6 Pairwise comparisons - Games- Howell Post-Hoc test for No. of Dairy Cooperative Societies							
		t-value	**p-value**			**t-value**	**p-value**
North	East	11.5	$< .001$	East	West	-8.84	$< .001$
North	West	5.71	$< .001$	East	South	-3.23	0.03
North	South	12.42	$< .001$	West	South	10.58	$< .001$

It can be observed from the table number 4.1.6 that the p value is less than 0.05 for all the pair of different regions of the country.

4.2.1 Analysis of Number Milk Producer Members:

From the below Table- 4.2.1 and Graph- 4.2.1 it can be visualised that the number of milk producer members in every region have increased continuously except in the South region as in South region it has observed that in the initial year from year 2010-11 to year 2013-14 milk producer members have increasing trend but a sudden downfall in the year 2014-15 and then again increasing trend but again downfall in the year 2020-21.

Table- 4.2.1 No. of Milk Producer Members (in thousand)											
Region	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
North	2376	2409	2414	2422	2443	2541	2782	2971	2998	3021	3057
East	946	1044	1243	1364	1469	1578	1663	1697	1788	1843	1899
West	5109	5145	5175	5373	5497	5641	5671	5691	5787	5835	5865
South	6033	6124	6283	6293	5990	6076	6171	6176	6270	6533	6442
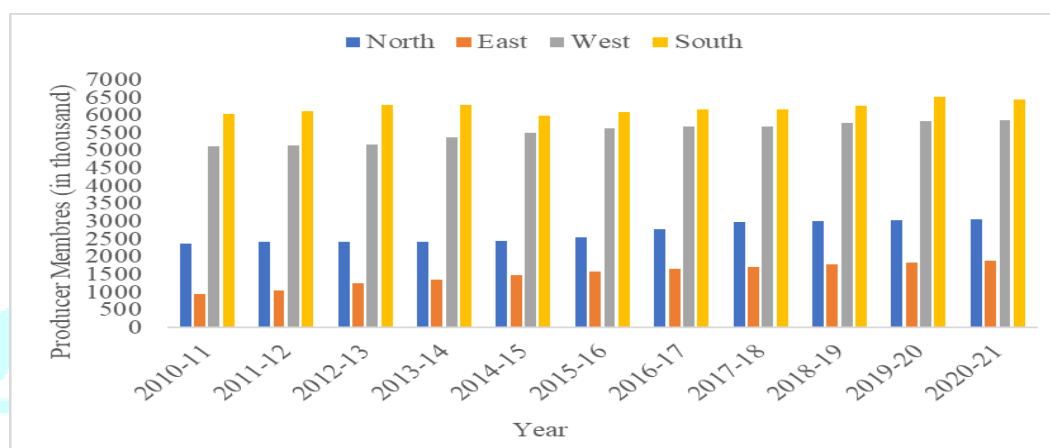
Graph- 4.2.1 Number of Milk Producer Members

Table- 4.2.2 shows the Descriptive statistics of the Number of Milk Producer Members resides in the different region. It can also be depicted from the table that the average number of milk producer members are highest in the South region with its mean value of 6217 followed by West region, North region and lastly lowest average milk producer members are found in East region with average value of 1503. High variation in the number of milk producer members is seen in the East region whereas low variation is seen in South region.

Table- 4.2.2 Descriptive Statistics of No. of Milk Producer Members					
Region	N	Mean	SD	Minimum	Maximum
North	11	2676	289	2376	3057
East	11	1503	321	946	1899
West	11	5526	284	5109	5865
South	11	6217	168	5990	6533

Assumption of normality for Number of Milk Producer Members:

H_0: The Number of Milk Producer Members follow normal distribution.

H_1: The Number of Milk Producer Members do not follow normal distribution.

Table 4.2.3 Shapiro-Wilk test for No. of Milk Producer Members				
Region	statistic	p -value	statistic	p -value
North	0.804	0.011	0.954	0.08
East	0.937	0.483		
West	0.892	0.147		
South	0.956	0.72		

It can be interpreted from the table- 4.2.3 that p value of Shapiro-Wilk test statistics for Number of Milk Producer Members is greater than 0.05. So, it can be concluded that the Number of Milk Producer Members located in the different regions follow normal distribution. So, to check the significant difference for Number of Milk Producer Members amongst different region, one way ANOVA is applied. To decide whether to apply Fisher's ANOVA or Welch's ANOVA, assumption of homogeneity of variance is checked.

H_0: There is homogeneity of variance among Number of Milk Producer Members

H_1: There is no homogeneity of variance among Number of Milk Producer Members

Table- 4.2.4 Leven's Homogeneity of Variances Test for No. of Milk Producer Members				
	Statistic	df	df2	p
No. of Milk Producer Members	2.93	3	40	0.045

It can be depicted from the Table- 4.2.4 that the p value of Leven's test statistic is less than 0.05. So, it can be said that there is no homogeneity of variance amongst selected regions for Number of Milk Producer Members. So, to test the significant difference for Number of Milk Producer Members amongst different regions, Welch's ANOVA is applied.

H_0: There is no significant difference for Number of Milk Producer Members

H_1: There is significant difference for Number of Milk Producer Members

Table- 4.2.5 One-Way ANOVA (Welch's) for No. of Milk Producer Members				
	F	df1	df2	p -value
No. of Milk Producer Members	820	3	21.4	< .001

It can be derived from the Table- 4.2.5 that the p value of test statistic for Number of Milk Producer Members is less than 0.05. So, it can be inferred that at 5% level of significance, there is significant difference for Number of Milk Producer Members amongst different regions. Further, pairwise comparison is carried out to find which pair has significant difference for Number of Milk Producer Members using Games- Howell Post-Hoc test.

| Table: 4.2.6 Pairwise comparisons - Games- Howell Post-Hoc for No. of Milk Producer Members							
		t-value	p-value			t-value	p-value
North	East	9.01	< .001	East	West	-31.1	< .001
North	West	-23.3	< .001	East	South	-43.16	< .001
North	South	-35.19	< .001	West	South	-6.95	< .001

It can be observed from the table - 4.2.6 that the p value is less than 0.05 for all the pair of Milk Producer Members of different regions of the country.

4.3.1 Analysis of Quantity of Milk Procurement:

From Table- 4.3.1 and Graph- 4.3.1 it can be visualised that the Milk procurement quantity in different region has fluctuating trend. East regions have reported more fluctuations among all the regions. It also can be observed that in all regions there was a decline for quantity of milk procurement in the year 2019-20.

Table- 4.3.1 Quantity of Milk Procurement (in thousand kilograms per day)											
Region	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
North	3741	3951	4100	4228	4862	5009	5114	5823	5499	5341	5616
East	1666	1610	1814	2089	2350	2547	2398	2513	2873	2667	2225
West	12862	14372	16642	17570	19758	22296	22660	25909	28122	25926	29133

| **South** | 7933 | 8773 | 10269 | 10275 | 10983 | 12705 | 12696 | 13286 | 14254 | 14067 | 14849 |
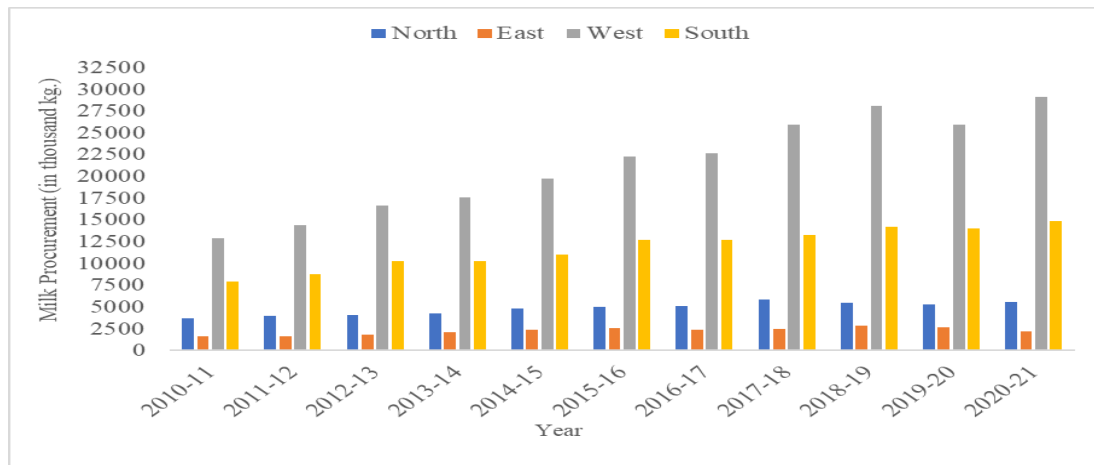
Graph- 4.3.1 Quantity of Milk Procurement

Table- 4.3.2 shows the Descriptive Statistics of Quantity of Milk Procurement. It can be seen from the table 4.3.2 that the highest average quantity of milk procurement as 21386 thousand kg. was observed in the West region followed by South region, North region and East region with lowest average milk procurement of 225 thousand kg. Lowest variation in the quantity of milk procurement is observed in the East region while highest variation in the quantity of milk procurement is observed in West region.

Table- 4.3.2 Descriptive Statistics of Quantity of Milk Procurement					
Region	**N**	**Mean**	**SD**	**Minimum**	**Maximum**
North	11	4844	726	3741	5823
East	11	2250	415	1610	2873
West	11	21386	5572	12862	29133
South	11	11826	2318	7933	14849

Assumption of normality for Quantity of Milk Procurement:

H_0: The Quantity of Milk Procurement follows normal distribution.

H_1: The Quantity of Milk Procurement does not follow normal distribution.

Table 4.3.3 Shapiro-Wilk test for Quantity of Milk Procurement				
Region	statistic	p -value	statistic	p -value
North	0.926	0.375	0.919	0.004
East	0.95	0.642		
West	0.949	0.632		
South	0.938	0.499		

It can be seen from the Table- 4.3.3 that the p value of Shapiro- Wilk test statistics for Quantity of Milk Procurement is less than 0.05. It can be seen from the test statistics that the region wise Quantity of Milk Procurement is not normally distributed. In other word it can be said that the assumption of normality is violated for Quantity of Milk Procurement in different regions. So, to test the significant difference for Quantity of Milk Procurement amongst different regions, Kruskal Wallis test is applied.

H_0: There is no significant difference for Quantity of Milk Procurement amongst different regions.

H_1: There is significant difference for Quantity of Milk Procurement amongst different regions.

Table: 4.3.4 Kruskal-Walli's test for Quantity of Milk Procurement			
	Chi-square	**df**	**p -value**
Milk Procurement	39.7	3	< .001

From the Table no. 4.3.4 that the p value of test statistic for Quantity of Milk Procurement is less than 0.05. So, it can be inferred that at 5% level of significance, there is significant difference for Quantity of Milk

Procurement amongst different regions. Further, pairwise comparison is carried out to know which pair has significant difference for Quantity of Milk Procurement using Dwass- Steel- Critchlow- Flinger test.

Table- 4.3.5 Pairwise comparisons- Dwass-Steel-Critchlow-Fligner pairwise comparisons for Quantity of Milk Procurement							
		t-value	p-value			t-value	p-value
North	East	-5.62	< .001	East	West	5.62	< .001
North	West	5.62	< .001	East	South	5.62	< .001
North	South	5.62	< .001	West	South	-5.15	0.002

It can be depicted from the table no. 4.3.5 that the p value is less than 0.05 for all pair of Quantity of Milk Procurement of different regions of the country.

4.4.1 Analysis of Quantity of Liquid Milk Marketing:

It can be seen from table- 4.4.1 that south region has increasing trend in terms of Quantity of Liquid Milk Marketing. It is also observed that the Quantity of Liquid Milk Marketing has increasing trend in west region except the year 2020-21 and in east region except the year 2018-19. Quantity of Liquid Milk Marketing in North region have reported decrease in the year 2012-13 & 2020-21.

Table- 4.4.1 Quantity of Liquid Milk Marketing (in thousand litres per day)										
Region	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
North	6122	6278	6242	9315	9955	10288	10587	11040	11589	12149	11775
East	1739	1826	2008	2755	2899	2916	3147	3211	3175	3301	3408
West	6699	7032	7529	9249	9838	10229	10629	11087	11216	11443	10720
South	7425	7808	8007	8125	8549	8695	8718	9616	9829	10233	10243
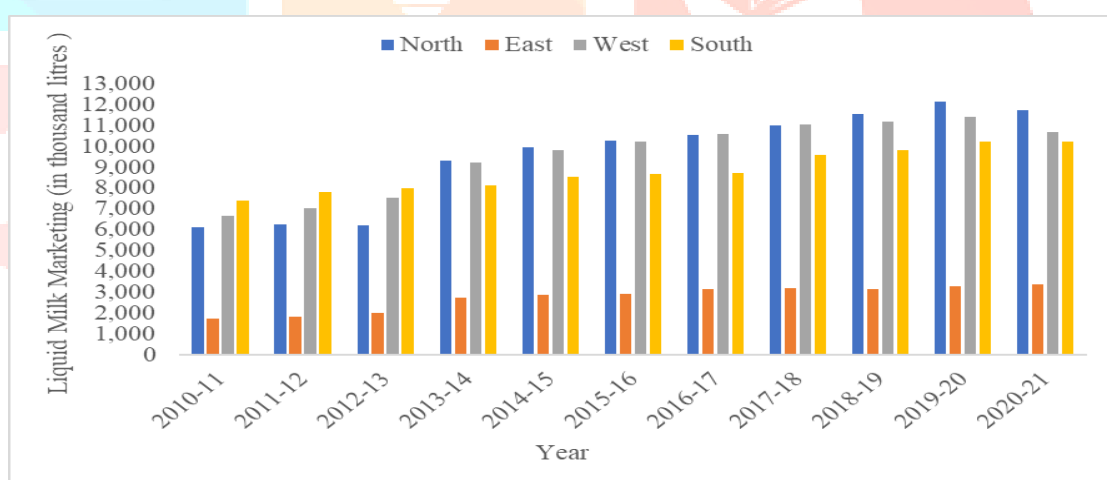
Graph- 4.4.1 Quantity of Liquid Milk Marketing

It can be observed from table- 4.4.2 that the highest average Quantity of Liquid Milk Marketing as 9606 thousand litres was observed in the West regions followed by North region, South region and East region with lowest Quantity of Liquid Milk Marketing as 2762 thousand litres. Highest variability in the Quantity of Liquid Milk Marketing is observed in North region whereas lowest variability in the Quantity of Liquid Milk Marketing is observed in East region.

Table- 4.4.2 Descriptive Statistics of Quantity of Liquid Milk Marketing					
Region	N	Mean	SD	Minimum	Maximum
North	11	9576	2309	6122	12149
East	11	2762	613	1739	3408
West	11	9606	1744	6699	11443
South	11	8841	994	7425	10243

Assumption of normality for Quantity of Liquid Milk Marketing:

H_0: The Quantity of Liquid Milk Marketing follow normal distribution.

H_1: The Quantity of Liquid Milk Marketing do not follow normal distribution.

Table 4.4.3 Shapiro-Wilk test for Quantity of Liquid Milk Marketing				
Region	statistic	p -value	statistic	p -value
North	0.842	0.034		
East	0.836	0.028	0.94	0.024
West	0.86	0.058		
South	0.922	0.34		

It can be depicted from the table no. 4.4.3 that p value of Shapiro- Wilk test statistics for Quantity of Liquid Milk Marketing is less than 0.05. It can be seen from the test statistics that the region wise Quantity of Liquid Milk Marketing is not normally distributed. In other words, it can be said that the assumption of normality is violated for Quantity of Liquid Milk Marketing in different regions. So, to test the significant difference for Quantity of Liquid Milk Marketing amongst different regions, Kruskal Wallis test is applied.

Table: 4.4.4 Kruskal-Walli's test Quantity of Liquid Milk Marketing			
	Chi-square	df	p -value
Liquid Milk Marketing	25.7	3	< .001

It can be observed from the table- 4.4.4 that the p value of test statistic for Quantity of Liquid Milk Marketing is less than 0.05. So, it can be inferred that at 5% level of significance, there is significant difference for Quantity of Liquid Milk Marketing amongst different regions. Further, pairwise comparison is carried out to know which pair has significant difference for Quantity of Liquid Milk Marketing using Dwass- Steel- Critchlow- Flinger test.

Table: 4.4.5 Pairwise comparisons- Dwass-Steel-Critchlow-Fligner pairwise comparisons for Quantity of Liquid Milk Marketing							
		t-value	p-value			t-value	p-value
North	East	-5.618	< .001	East	West	5.618	< .001
North	West	-0.139	1	East	South	5.618	< .001
North	South	-1.997	0.492	West	South	-1.904	0.534

It can be depicted from the table no. 4.4.5 that the p value is less than 0.05 for all pair of Quantity of Liquid Milk Marketing of different regions of the country.

V. FINDINGS OF THE STUDY

- Increasing trend is observed in number of dairy cooperative societies every year.
- It has reported a rise in number of dairy cooperative societies around 37% in year 2020-21 compare to year 2010-11.
- It is observed that majority dairy cooperatives are operated in North region but maximum Number of Milk Producer Members are residing in the South region.
- Number of Milk Producers in South region is 252.76% high compare to number of producers in North region.
- As of now India is at first position in milk production as we have witnessed this fact in daily Milk Procurement data.
- Western region stood at the first position in per day milk procurement with 8.75% average growth rate followed by South region at 6.64%, North region at 4.32% and lastly East region at 3.49%.
- Figures of Quantity of Liquid Milk Marketing are very noteworthy in which among all the regions average liquid milk marketing is highest in north region with average grow rate of 7.53% but the continuous positive growth is detected in South region during entire study period. Average growth rate of South region is noted at 3.31%.

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