Mysore J. Agric. Sci., 59 (2) : 254-264 (2025)

An Analysis of the Extent of Utilization Pattern of Warehouses in Karnataka

S. S. Pramod Nayak[1], Siddayya[2], C. T. Ramachandra[3] and M. S. Ganapathy[4]
[1,2&4]Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru - 560 065
[3]Dept. of Processing and Food Engineering, College of Agricultural Engineering, UAS, GKVK, Bengaluru - 560 065
e-Mail : nayakpss767@gmail.com

Authors Contribution

S. S. Pramod Nayak :
Conceptualization, data collection and analysis, interpretation and Preparation of manuscript;

Siddayya :
Supervision and review of manuscript;

C. T. Ramachandra & M. S. Ganapathy :
Conceptualization of research work and critical review of manuscript

Corresponding Author :

S. S. Pramod Nayak

Received : October 2024
Accepted : December 2024

Abstract

The study investigates the utilization patterns of warehouses operated by the Karnataka State Warehousing Corporation (KSWC) from 2006 to 2024, focusing on the storage capacities and commodities managed by various stakeholders. The data was collected through purposive sampling from seven regional offices, encompassing 150 warehouses across Karnataka. Analytical methods employed include descriptive statistics, Coefficient of Variation (CV), Compound Annual Growth Rate (CAGR) and the Cuddy-Della Valle Instability Index (CDVI) to evaluate trends in storage capacity and utilization. The results revealed that, the KSWC total storage capacity for 2023-24 was 14,13,473 MTs, with significant regional disparities in capacity utilization. The total average storage capacity of owned and hired warehouses was 18,892,378.70 MTs across all regions from 2014 to 2023, with a significantly increasing growth of 4.33 per cent per annum and a more stable CDVI of 4.82. In terms of commodity utilization, food grains consistently occupied the highest percentage of storage space, while other commodities showed more variation over time. Agencies were identified as the primary users of KSWC facilities, accounting for 78.52 per cent of stored commodities, followed by the Food Corporation of India (FCI), farmers and traders. KSWC warehouses reported a total godown damage capacity of 41,876 MTs, indicating a need for repairs. The study suggested that KSWC may build a new warehouse and repair the existing ones to provide better services to stakeholders.

Keywords : Capacity, Storage, Stakeholders, Utilisation pattern, Warehouse

India's agricultural sector is a critical part of its economy, employing nearly half the workforce and contributing 17.5 per cent to the GDP (Ashwini, 2005). In the agricultural year 2023-24, the total foodgrain production is estimated at 3,288.52 lakh tonnes, with key crops like rice (1,367.00 lakh tonnes) and wheat (1,129.25 lakh tonnes) leading the output Central Warehousing Corporation (CWC) and State Warehousing Corporations (SWC) support the sector with extensive storage facilities. CWC operates 422 warehouses across India, offering 10.45 million tonnes of storage capacity and logistics services.

In 2007, Parliament enacted the 2007 Warehousing Act, which came into force on 25 October 2010. This established a key regulator for Negotiable Warehouse Receipts (NWR), the Warehousing Development and Regulatory Authority (WDRA). The WDR Act provides for the growth and regulation of warehouses, the negotiability of receipts from warehouses, the establishment of a Warehousing Development and Regulatory Authority and matters related to or incidental to it. A warehouse supplier must first register its warehouses with WDRA to begin issuing NWRs. It was expected that several stakeholders such as banks, financial institutions, insurance companies, trade, commodities exchanges and customers would benefit from the WDRA-regaled NWRs. A total of 76 stores with WDRA were recorded in four years (Bajantri, 2004).

The Karnataka State Warehousing Corporation (KSWC) is integral in supporting this sector by providing essential storage facilities, thereby minimizing post-harvest losses and stabilizing market prices. KSWC operates across seven divisions in Karnataka, providing a total storage capacity of 14,13,473 MTs. This vast storage network helps minimize post-harvest losses and ensures a steady supply of agricultural commodities to markets. By providing storage facilities, KSWC helps stabilize the prices of agricultural commodities. This is particularly important given the government's target to increase agriculture's contribution to the GSDP from 16 per cent to 30 per cent by 2025. Price stabilization ensures farmers receive remunerative prices for their produce (Kirangowda, 2023).

The KSWC is carrying out disinfestation/extension services to eradicate insects, pests and rodent fumigation of stocks is being done to maintain the stocks scientifically and hygienically. Prophylactic to eradicate termites before the construction of new buildings is also done (Fathima *et al.,* 2019). Disinfestation/extension services are also extended to the rice mills, cinema theatres, libraries and other food processing units, public places throughout Bangalore. The Corporation is operating with 150 Warehouse Centres spread across the state with a storage capacity of 17.50 Lakh MTs as of March 2020. The Corporation provides scientific storage facilities for food grains, pulses, oil seeds, spices, sugar, fertilizers, manures and other notified commodities. The corporation delivers handling and transportation of stocks to and from the warehouse centres to its major bulk depositors like the Food Corporation of India and fertilizer companies. To provide pest control and disinfestation services to farmers, Govt. offices, public libraries, hotels, theatres, public buildings, private establishments, residences, etc. Specialized services include rodent control, insect control and cockroach control augmentation of storage capacity every year for storage of stocks of farmers and other depositors.

The different stakeholders are utilizing the warehouses services of KSWC such as Farmers, Traders, Merchants, Food Corporation of India (FCI) and agencies. Where agencies include, Karnataka Food & Civil Supplies Corporation. National Agricultural Cooperative Marketing Federation of India (NAFED), Karnataka State Cooperative Marketing Federation (KSCMF) Ltd., Karnataka Oil Federation (KOF), Fertilizer Companies. Sugar Factories, Karnataka State Beverages Corporation Ltd., Mysore Sales International Ltd., ITC Ltd, Food Division. Karnataka Milk Federation Ltd., Other Govt. Organisations (Mallikarjungouda, 2007).

METHODOLOGY

The study was conducted on the Karnataka State Warehousing Corporation (KSWC) to analyse the extent of utilization patterns of KSWC and major commodities stored by the different stakeholders. The purposive sampling method was used for the collection of data during the year 2023-24 and the secondary data was collected from 2006 to 2024 by interviewing the seven regional offices of KSWC *i.e.,* Davangere, Hubli, Mysore, Raichur, Shivamogga, Bengaluru and Gulburga across total 150 warehouses of Karnataka state. The data pertains to storage capacity, utilization of warehouses by stakeholders, region-wise storage, idle capacity and commodity-wise storage by the stakeholders.

The source of secondary data was collected from different department and source were Karnataka State Warehousing Corporation (KSWC), *Krishi Maratha Vahani* website, Directorate of Economic and Statistics, Department of Agriculture and Farmers Welfare, Karnataka Agricultural Price Commission (KAPC), Commission for Agricultural Cost and Prices (CACP), Karnataka State Agricultural Marketing Board (KSAMB), Ministry of Consumer Affairs, Food and Public Distribution.

Analytical tools used to achieve the results of the study were descriptive statistics, Coefficient of Variance (CV), Compound Annual Growth Rate (CAGR) and Cuddy Della Valle instability Index (CDVI). It is a measure used to determine the annual growth rate over a specified period of time, assuming that growth happens at a steady rate compound

annually. It provides a smoothed annual rate of growth that can be easily compared across different time periods. The growth rate in the storage capacity of different regions of KSWC were analyzed using the exponential function of the form:

$$Y_t = a\ b^t e^u \ldots\ldots (1)$$

Where,

Y_t = Dependent variable for which growth rate is to be estimated (storage capacity) a = intercept b = trend co-efficient

e = Napierian base

t = time trend

u = Disturbance or error term

The CAGR is obtained from the linearly transformed estimating form of the above equation (1), as stated below

$$\ln Y_t = \ln a + \ln b + u \ldots\ldots (2)$$

CAGR per cent can be expressed as:

$$CAGR\ (\%) = (Antilog\ b - 1) \times 100$$

Coefficient of Variance (CV)

The coefficient of variance used to check is varies with storage capacity over periods between 2015 to 2023 across seven regions of KSWC.

$$CV = \frac{\text{standard deviation}}{\text{mean}} \times 100$$

Cuddy Della Valle Index (CDVI)

The Cuddy Della Valle Index de-trends show the exact direction of the instability. Therefore, it is a better measure to capture instability in storage capacity. A low value of this index indicates low instability in storage capacity of KSWC in different regions. The Cuddy Della Valle Index corrects the CV as:

Cuddy - Della Valle Instability Index (%) = $CV\sqrt{(1-R^2)}$

Where, C.V. is the Coefficient of Variation in per cent, and R^2 is the coefficient of determination from a time trend regression adjusted for its degrees of freedom. The ranges of CDVI are given as follows

- Low instability = 0 to 15
- Medium instability = 15 to 30
- High instability = 30 and above

Results and Discussion

Extent of Utilisation Patterns of the Warehouses in Different Regions of KSWC

The KSWC employed various utilization patterns, including storage capacity, turnover, deposit, release, actual stock, occupancy rates and ideal capacity. The results indicated that, the total storage capacity of KSWC in 2023-24 is 1,413,437 MTs, with an owned capacity of 1,361,422 MTs and a hired capacity of 52,015 MTs. The KSWC operates across seven regional warehouses: Bangalore, Mysuru, Davanagere, Shivamogga, Hubli, Raichur and Gulburga. Among these regions, Hubli accounted for the highest storage capacity at 20.85 per cent of the total capacity, with 293,264 MTs of owned capacity and 1,408 MTs of hired capacity, followed by Mysuru (20.61%), Raichur (20.19%) and Bangalore (13.82%). The lowest storage capacity was accounted for by Gulburga at 4.96 per cent of the total capacity, with 67,534 MTs of owned capacity and 2,504 MTs of hired capacity, followed by Shivamogga (6.39%) and Davanagere (13.19%). The storage capacity in different regions is given in Table 1.

While Hubli, Mysuru, Raichur and Bangalore have the highest storage capacities due to a greater number of warehouses established in these regions, which are major production and distribution hubs including major fertilizer, beverages and seed companies, in the case of Gulburga, Raichur and Davanagere, there are godown damages of 1,600 MTs. Shivamogga has a low number of warehouses built. KSWC has a total godown damage of 41,876 MTs of capacity, with Raichur region accounting for the highest hired capacity at 42.70 per cent, followed by Mysuru (20.13%) and Shivamogga (17.29%) with a godown damage of 1,000 MTs.

Table 1

Storage Capacity of Karnataka State Warehousing Corporation in different regions (KSWC) (2023-24)

Regions	Storage Capacity (in Metric tonnes)		
	Own	Hired	Total
Bangalore	193943.00 (14.25)	1382.00 (2.66)	195325.00 (13.82)
Mysore	276524.00 (20.13)	14781.00 (28.40)	291305.00 (20.61)
Davangere	185679.00 (13.64)	752.00 (1.44)	186431.00 (13.19)
Shivamogga	81368.00 (5.98)	8999.00 (17.29)	90367.00 (6.39)
Hubli	293264.00 (21.54)	1408.00 (2.71)	294672.00 (20.85)
Raichur	263110.00 (19.33)	22225.00 (42.70)	285335.00 (20.19)
Gulburga	67534.00 (4.96)	2504.00 (4.81)	70038.00 (4.96)
Total	1361422 (100.00)	52051 (100.00)	1413473 (100.00)

Note : The figures shown in parenthesis indicates per cent (%)

Table 2, shows the storage turnover to the total storage capacity of KSWC from 2015 to 2023, indicated the optimal utilization of both owned and hired capacities. Davanagere region accounted for the highest capacity utilization at 29.30 per cent for owned capacity and 42.00 per cent for hired capacity with 29.40 per cent of the total capacity followed by Shivamogga (25.57%), Mysore (25.28%) and Bengaluru (23.45%). The Shivamogga region is relied on hired capacity, with a utilization of 37.20 per cent compared to 23.74 per cent of owned capacity. This due to a lesser number of godown (10) are built in the Shivamogga regions. The lowest utilization of storage capacity was accounted in the Raichur region at 10.36 per cent of total capacity followed by Hubli (18.50%) and Gulburga (19.56%) these three regions showed under-utilized of storage capacity over the years due to godown damages, despite having the highest number of established warehouses.

Table 2

Percentage of turnover capacity across storage capacity of KSWC in different regions (2015 to 2023)

Regions	Owned (%)	Hired (%)	Total (%)
Mysore	24.85	29.06	25.28
Bangalore	23.49	21.08	23.45
Davanagere	29.30	42.00	29.40
Shivamogga	23.74	37.20	25.57
Hubli	18.50	30.81	18.50
Gulburga	18.69	20.34	19.56
Raichur	10.18	12.36	10.36

The results indicated that, the four KSWC regions like Davangere, Shivamogga, Mysore and Bengaluru have showed better utilization of storage capacity and space with a lesser number of warehouses compared to other regions, while Raichur, Gulburga and Hubli showed under-utilization of storage capacity and space during the period from 2015 to 2023.

Percentage of Storage Utilization of KSWC in Different Regions and Stakeholders

The primary stakeholders of KSWC are farmers, traders, agencies and the Food Corporation of India (FCI). Additionally, several entities utilized warehouse facilities *i.e.,* Karnataka Food & Civil Supplies Corporation, NAFED, KSCMF Ltd., KOF, fertilizer companies, sugar factories, Karnataka State Beverages Corporation Ltd., Mysore Sales International Ltd., ITC Ltd. (Food Division), Karnataka Milk Federation Ltd. and other government organizations. The KSWC was primarily storing agricultural produce, seeds, manures, fertilizers, agricultural implements and other notified commodities. Table 3 shows the percentage share of various stakeholders utilizing KSWC.

The results indicated the percentage share of stakeholder-stored commodities in KSWC from 2014 to 2023. Agencies led in storage by managing a total of 125 commodities with a capacity of 1,109,878 MTs, representing the highest share at 78.52 per cent. This

TABLE 3

Percentage share of various stakeholders utilizing KSWC (2014 to 2023)

Stake holders	Number of commodities stored	Per cent of commodity stored (%)	Capacity (MTs)
Farmers	45.00	5.46	77121.80
FCI	8.00	14.79	209080.00
Traders	55.00	5.28	74617.50
Agencies	125.00	78.52	1109878.00

was followed by FCI (14.79%), farmers (5.46%) and traders (5.28%). Although FCI stored only 8 commodities with capacity of 2,09,080 MTs, which was significantly higher than that of traders (74,617.50 MTs) and farmers (77,121.80 MTs), as shown in Table 3. Agencies primarily stored a diverse range of commodities, including fertilizers, beverages, seeds, manures and agricultural implements. While FCI stored wheat and rice for the Public Distribution System (PDS). Farmers and traders predominantly stored agricultural and horticultural commodities.

Table 4 indicates the region-wise storage utilization pattern of different stakeholders who deposited commodities in the KSWC from 2014 to 2023. The main stakeholders include farmers, the Food Corporation of India (FCI), traders and agencies. In total, agencies contributed the highest deposition of different types of commodities, with 1,109,877.89 MTs, followed by FCI (209,079.91 MTs), farmers (77,121.78 MTs) and traders (74,617.53 MTs).

Farmers utilized around 28.29 per cent of storage in the Raichur region, followed by Gulbarga (26.29%) and Hubli (24.78%) and Other regions, such as Shivamogga (1.92%), Mysore (4.03%), Davangere (6.18%) and Bengaluru (8.39%), showed comparatively lower utilization. While, FCI utilized around 26.14 per cent of storage in the Gulbarga region, depositing 54,645.46 MTs of storage. This was followed by Davangere (24.20%), Hubli (19.73%) and Mysore (18.38%). Regions like Bengaluru (7.21%) and Shivamogga (4.33%) had comparatively lower utilization as well. But, there was no utilization by FCI in the Raichur region because FCI has its own godowns and distributes major commodities for the Public Distribution System (PDS) in this area.

Traders had the highest utilization in the Hubli region at 25.96 per cent, storing 19,373.42 MTs of commodities, followed by Gulbarga (25.81%), Raichur (21.29%) and Mysore (16.36%). Other regions such as Shivamogga (0.86%), Bengaluru (7.21%) and Davangere (7.00%) exhibited comparatively lower utilization. Agencies accounted for around 46.10 per cent of storage in the Mysore

TABLE 4

Region-wise storage utilization by various stakeholders (2014 to 2023)

Region	Farmer (MTs)	FCI (MTs)	Trader (MTs)	Agency (MTs)
Davangere	4764.86 (6.18)	50597.54 (24.20)	5222.88 (7.00)	49442.51 (4.45)
Bengaluru	6475.65 (8.39)	15080.51 (7.21)	2023.18 (2.71)	234528.80 (21.13)
Hubli	19109.16 (24.78)	41254.06 (19.73)	19373.42 (25.96)	36761.21 (3.31)
Gulburga	20358.34 (26.39)	54645.46 (26.14)	19259.51 (25.81)	34559.08 (3.11)
Mysore	3107.35 (4.03)	38436.23 (18.38)	12210.76 (16.36)	511695.16 (46.10)
Raichur	21825.10 (28.29)	0.00	15889.48 (21.29)	193266.70 (17.41)
Shivamogga	1481.32 (1.92)	9066.11 (4.33)	638.30 (0.86)	49624.52 (4.47)
Total	77121.78 (100.00)	209079.91 (100.00)	74617.53 (100.00)	1109877.98 (100.00)

Note : The figures shown in parenthesis indicates per cent (%)

region with a total of 193,266.70 MTs storage, followed by Bengaluru (21.13%) and Raichur (17.41%). Other regions had significantly lower utilization, particularly Gulbarga (3.11%), Hubli (3.31%), Davangere (4.45%) and Shivamogga (4.47%). Similar findings were reported by Suresh. B (2005), who studied the utilization pattern and performance of KSWC and found that agencies and other entities are dominated in utilization of storage space.

Composition of Stakeholders Utilizing the KSWC Warehouses

Different types of stakeholders stored different kinds of commodities in KSWC from 2006 to 2024. Mainly the Food Corporation of Indian (FCI), agencies, farmers & traders, agencies include organizations such as the Karnataka Food & Civil Supplies Corporation, NAFED, KSCMF Ltd., KOF, Fertilizer Companies, Sugar Factories, Karnataka State Beverages Corporation Ltd., Mysore Sales International Ltd., ITC Ltd., Food Division, Karnataka Milk Federation Ltd., along with other government organizations like RCF, KRIBCO and IFFCO. Meanwhile, farmers and traders utilized between 23 to 26 per cent of the storage space in KSWC. The important stakeholder of fertilizer were agencies and traders. The FCI majorly stored wheat and rice whereas farmers and trader majorly store food grains, horticulture commodities, spices, pluses and other commodities.

The Table 5 Shows about composition of stakeholders utilizing the KSWC warehouses showed that from 2006 to 2009, utilization was minimal across all stakeholders, with no commodities stored. Farmers began utilizing the warehouses in 2010, recorded a significant growth in storage space, which reached 49.63 per cent by 2024. This increase indicated a growing dependence on KSWC by farmers in recent

Table 5

Composition of stakeholders utilizing the KSWC warehouses

Year	Farmer (MTs)	%	FCI (MTs)	%	Trader (MTs)	%	Agency (MTs)	%	Total (MTs)	%
2006	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.20	0.00
2007	0.00	0.00	0.00	0.00	0.00	0.00	18.31	0.00	18.31	0.00
2008	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00
2009	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2010	52.68	0.07	0.00	0.00	0.00	0.00	0.00	0.00	52.68	0.00
2011	22.11	0.03	0.00	0.00	0.00	0.00	0.00	0.00	22.11	0.00
2012	2.62	0.00	0.00	0.00	0.00	0.00	0.55	0.00	3.17	0.00
2013	68.80	0.09	0.00	0.00	28.80	0.04	0.00	0.00	97.60	0.01
2014	965.34	1.25	0.00	0.00	218.20	0.29	0.00	0.00	1183.54	0.08
2015	797.22	1.03	0.00	0.00	0.00	0.00	0.00	0.00	797.22	0.05
2016	1196.55	1.55	0.00	0.00	6.13	0.01	32.94	0.00	1235.62	0.08
2017	5039.05	6.53	0.00	0.00	542.20	0.73	0.00	0.00	5581.25	0.38
2018	5762.05	7.47	0.00	0.00	223.33	0.30	0.00	0.00	5985.38	0.41
2019	3084.51	4.00	0.00	0.00	0.35	0.00	0.00	0.00	3084.86	0.21
2020	139.40	0.18	0.00	0.00	280.17	0.38	5466.95	0.49	5886.52	0.40
2021	857.63	1.11	0.00	0.00	114.81	0.15	17746.96	1.60	18719.39	1.27
2022	3837.86	4.98	0.00	0.00	3147.65	4.22	507101.04	45.69	514086.56	34.96
2023	17018.86	22.07	23201.84	11.10	31402.51	42.08	451558.32	40.69	523181.52	35.57
2024	38276.40	49.63	185878.06	88.90	38652.96	51.80	127952.71	11.53	390760.13	26.57
Total	77121.78	100.00	209079.90	100.00	74617.09	100.00	1109877.98	100.00	1470696.75	100.00

years. Farmers became more aware of the state warehouse services, rebate charges and subsidies provided by KSWC.

The FCI stored majorly wheat and rice for the usage of the Public Distribution System (PDS). From the period of 2006 to 2022, commodities were distributed to the public under the PDS scheme, whereas FCI also had its own godowns and KSWC immediately distributed (*Nyaya Bele Angadi*) after storing the commodities in warehouses; thus, such records were not maintained.

In the years 2023 and 2024, FCI utilized 11.10 per cent and 88.90 per cent of storage space across the seven regions. As per report of index number of wheat and rice production in India from 2010 to 2024, production was increased 45.5 per cent from the base fiscal year 2008.

Traders utilization of storage space followed a fluctuating trend. In the year of 2023, 42.08 per cent of total warehouse utilized, but this increased to 51.80 per cent in 2024. Similar findings were reported by Suresh (2005), who studied the utilization pattern and performance of KSWC, traders utilized 23 per cent of storage space in 1994-95 bit after that a declining trend was observed over the year, due to impact of procurement under Minimum Support Price (MSP) scheme and also according GOI 25 per cent of production will be used for the storage after meeting marketable surplus.

Agencies, including cooperatives and other entities, consistently maintained a significant share of the storage capacity. In 2022, agencies utilized 45.69 per cent of the total storage space. However, their utilization declined to 40.69 per cent in 2023 and further to 11.53 per cent in 2024. This sharp decline was due to adverse weather conditions, such as reduced rainfall, which affected crop production. Consequently, the use of fertilizers, manure and seeds also declined. The study findings reported by Kumar *et al.,* (2024) reduced in rainfall has directly affected crop yields, leads to decrease in demand for storage capacity.

Overall, the total utilization of storage capacity was minimal in the early 2000s. Over the years, it increased substantially, reaching 1,470,696.75 metric tonnes (MTs) by 2024. This significant growth can be attributed to the facility of advance storage space reservation (up to three months before usage) and the large volume of goods stored by both government and private agencies-particularly the Food Corporation of India (FCI) and other related bodies-which dominated the storage space. At the same time, warehouse usage by farmers and traders also increased notably during this period.

Commodity-wise Utilization in the State Warehouses in Karnataka

Karnataka is the 8th largest state in India in geographical area. It has a wide and varied topography, climate, etc. and produce various types of food grains, oilseeds, pluses, fertilizer, spices, fruits and vegetables. Large quantity of fertilizer, seeds, feed etc., was produced and procured from neighboring state.

Table 6, shows commodity -wise utilization in the state warehouses in Karnataka from 2006 to 2024. The commodities stored were food grains, pluses, oilseeds, species, fertilizer and other agricultural produce and inputs. Further, some non-agricultural products were also being stored in warehouses.

It can be seen from the table that food grains dominated the storage space, constantly occupying more than 50 per cent of the storage space in most years. In 2022, a substantial amount of 463,513.70 MTs of food grains accounted for 45.22 per cent of the total storage space, while in 2023, this decreased slightly to 39.57 per cent with 405,588.80 MTs stored. The highest recorded storage was in 2021, with 17,547.07 MTs, accounting for 1.71 per cent of the total storage. The storage of food grains is increasing over the years.

Fertilizers occupied the second-highest position in the utilization of warehouse space. However, their utilization showed a mixed trend over the years. In 2022, fertilizers occupied 53.02 per cent of the total

TABLE 6

Commodity-wise utilization in the state warehouses of Karnataka

(Metric tonnes)

Year	Food Grains		Pulses		Oilseeds		Spices		Fertilizer		Others	
	Quantity (MTs)	%	Quantity (MTs)	%	Quantity (MTs)	%	Quantity (MTs)	%	Quantity (MTs)	%	Quantity (MTs)	%
2006	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2007	18.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2008	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2009	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2010	52.68	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2011	0.00	0.00	0.00	0.00	0.00	0.00	22.11	1.21	0.00	0.00	0.00	0.00
2012	0.25	0.00	0.00	0.00	0.00	0.00	2.37	0.13	0.00	0.00	0.55	0.00
2013	97.60	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2014	1135.04	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.50	0.01
2015	705.22	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	92.00	0.03
2016	1084.68	0.11	104.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	46.94	0.01
2017	3508.40	0.34	308.00	0.56	0.00	0.00	66.15	3.62	0.00	0.00	1697.93	0.49
2018	4171.44	0.41	1265.02	2.31	0.00	0.00	12.30	0.67	0.00	0.00	536.63	0.15
2019	2983.80	0.29	21.00	0.04	0.00	0.00	75.34	4.12	0.00	0.00	0.00	0.00
2020	153.10	0.01	3.95	0.01	0.00	0.00	20.02	1.09	0.00	0.00	5709.45	1.64
2021	17547.07	1.71	4.52	0.01	67.77	0.22	5.63	0.31	0.00	0.00	1094.40	0.31
2022	463513.70	45.22	10283.44	18.75	2849.46	9.10	95.97	5.24	2693.38	53.02	34462.16	9.88
2023	405588.80	39.57	3166.07	5.77	24861.62	79.39	707.15	38.65	1487.38	29.28	85054.90	24.39
2024	124480.85	12.14	39676.64	72.36	3537.33	11.30	822.78	44.97	898.89	17.70	219960.25	63.08
Total	1025041.82	100.00	54832.63	100.00	31316.18	100.00	1829.82	100.00	5079.65	100.00	348703.70	100.00

warehouse space with 2,693.38 MTs. By 2023, this dropped to 29.28 per cent with 1,487.38 MTs.

Pulses also utilized a significant portion of warehouse space. In 2022, 10,283.44 MTs of pulses were stored, accounting for 18.75 per cent of the total warehouse space. However, by 2023, their storage had reduced to 3,166.07 MTs, accounting for only 5.77 per cent. Despite fluctuations, pulses saw their peak in 2024, where they took up 72.36 per cent of the space with 39,676.64 MTs stored.

Oilseeds showed varying utilization levels throughout the years. In 2022, oilseeds occupied 9.10 per cent of the warehouse space with 2,849.46 MTs stored and by 2023, this jumped significantly to 79.39 per cent with 24,861.62 MTs. However, their storage reduced in 2024 to 11.30 per cent with 3,537.33 MTs.

The storage of spices has remained marginal over the years. In 2022, spices utilized 5.24 per cent of the space, storing 95.97 MTs, which INCREASED to 38.65 per cent in 2023 with 707.15 MTs. By 2024, spices accounted for 44.97 per cent of the storage space with 822.78 MTs.

Other commodities showed a more stable trend, though their share fluctuated over the years. In 2022, they occupied 9.88 per cent of the warehouse space, but by 2023, they saw a significant rise, utilizing 24.39 per cent of the space with 85,054.90 MTs. The highest utilization for other commodities occurred in 2024, where 63.08 per cent of the warehouse space was allocated, amounting to 219,960.25 MTs.

The inter-commodity comparison of utilization shows that food grains have consistently utilized the highest percentage of storage space, while other commodities have shown more volatility in their utilization over time. The studies reported by Suresh (2005), Patil., (2007) and Dinesh., (1987) that food grains occupied around more than 50 per cent followed by fertilizer, pluses, oilseeds and spices slight increase over the period from 1997 to 2024.

Growth and Instability in Storage Capacity, Turnover, Deposit, Releases, Actual Stock and Occupancy Across the Region of KSWC

The Karnataka State Warehousing Corporation (KSWC) has systematically maintained records detailing the utilization patterns of various types of warehouses across different regions. The data collected pertaining to several critical metrics, including storage capacity, turnover, deposits, release, actual stock against the reservation and occupancy by weight and by bags. The data was analyzed to assess growth and instability trends across the seven regions of KSWC from 2015 to 2023.

The Karnataka had reduced the storage capacity by 10 per cent where state need more storage capacity for food grains, pluses, oilseeds and other agriculture commodities. So, growth and instability analysis were used to check the performance, growth and stable of Karnataka state warehouses to help different stakeholders like, farmers, traders, FCI and agencies.

Growth and Instability of Storage Capacity Across the Seven Regions of KSWC

Data presented in Table 7 shows the growth and instability of storage capacity of owned and hired warehouses across the seven regions of KSWC from 2015 to 2023. The total average storage capacity of owned warehouses across the seven regions was 18,102,342.70 MTs. The overall storage capacity of owned warehouses was significantly increasing at 6.89 per cent annually and which is highly stable (CDVI: 3.58). Among the seven regional warehouses, storage capacity of Gulbarga region was highest and significantly increasing at 9.11 per cent per annum with more stable in performance (CDVI: 5.79) whereas growth of Bengaluru region was increasing at 12.96 per cent annually but which is statistically non-significant with more CDVI of 4.62 indicating more stable in the performance. The total average storage capacity of hired warehouses in Karnataka was1,937,098.22 MTs, where the growth was significantly declining annually at 20.89 per cent and CDVI of 39.89 indicating heavily instability in storage capacity.

TABLE 7

Growth and instability in storage capacity across the seven regions of KSWC (2015 to 2023)

Type of Warehouses	Region	Average (MTs)	CV	CDVI	CAGR
Owned	Mysore	3048685.90	11.24	3.34	4.36 **
	Bangalore	1921140.10	30.61	4.62	12.69 NS
	Davanagere	2291341.98	16.81	5.5	6.40 **
	Shivamogga	934426.99	8.31	5.76	2.51 *
	Hubli	3053390.90	18.2	9.31	6.86 **
	Gulbarga	3396513.00	21.67	5.79	9.11 **
	Raichur	3171173.50	17.7	3.28	7.24 **
	Total	18102342.70	16.81	3.58	6.89 **
Hired	Mysore	217009.35	24.71	23.59	2.26 NS
	Bangalore	47301.17	86.78	29.34	-32.78 NS
	Davanagere	86440.30	231.16	189.84	-34.37 **
	Shivamogga	264013.94	115.64	74.57	-27.85 **
	Hubli	80422.34	116.43	89.46	-29.45 **
	Gulbarga	897253.20	58.63	39.13	-26.50 **
	Raichur	193364.04	61.81	46.03	-27.14 **
	Total	1937098.22	61.28	39.87	-20.89 **
Total	Mysore	3135566.10	11.01	3.27	4.20 **
	Bangalore	1919213.70	27.9	5.37	11.20 NS
	Davanagere	2276748.28	11.97	6.93	3.71 **
	Shivamogga	1148967.88	20.83	14.12	-5.15 **
	Hubli	3017707.90	17.02	10.35	5.89 **
	Gulbarga	4115963.30	14.13	12.12	3.21 *
	Raichur	3225203.80	14.93	5.51	5.78 **
	Total	18892378.70	11.63	4.82	4.33 **

Note : Significant level based on *P- value* at 1 per cent (**) and 5 per cent (*) and N. S. (Non-significant)

All the seven regions considered hired warehouses shows significantly declining growth and instable in storage capacity because KSWC hired warehouses includes rice mills, cinema halls, processing units, old libraries etc., which are lack in disinfestation, extension services, maintenance and advance technologies as compared to owned warehouses.

The total average storage capacity of owned and hired warehouses was 18,892,378.70 MTs across all regions, with a significantly increasing growth of 4.33 per cent per annum and more stable (CDVI : 4.82). The owned warehouses of KSWC performing well with a significant growth rate and stability whereashired warehouses reported as non-significant growth and instability in storage capacity. This indicates that owned warehouses contribute positively to the storage capacity, whereas hired warehouse are declining and shows instability in the storage capacity. The results are consistent with studies of Krishnan *et al.,* (2017) and Sari *et al.,* (2017) that storage

capacity had increased at a rate of 6.7 per cent of CAGR during the last decade in India with total agriculture warehousing capacity of 90 million MTs.

These warehouses facilities are mostly utilized by the agencies, Food Corporation of India (FCI) and traders for storage whereas, farmers have utilized only 5.46 per cent of the total storage capacity across the seven regions. So, the study suggested that awareness and better utilization of storage capacity can reduce market distress sales and provide minimum rebates to farmers. The KSWC warehouses has godown damage of 41,876 MTs capacity and needs to be repaired. KSWC plans to construct a greater number of modern warehouses in strategic locations. These new warehouses would accommodate increasing storage demand and ensure better logistical efficiency. KSWC will focus on renovating and repairing older warehouses to meet current standards, improving infrastructure like roofing, flooring, ventilation and pest control. This ensures they are suitable for a wide range of goods and maintain high storage standards.

References

Ashwini, P., 2005, Commodity portfolio management of cold storage units in Hyderabad (A.P). M. B. A. (Agri.) Thesis (*Unpub*.), University of Agricultural Sciences, Bangalore.

Bajantri, V., 2004, Utilization and viability of cold storages in Karnataka - An economic analysis. M. Sc. (Agri.) Thesis (*Unpub*.), University of Agricultural Sciences, Bangalore.

Dinesh, K., 1987, A study on the performance of state warehouses in Karnataka and storage utilization pattern in the central warehouse, Bangalore M.Sc. Thesis (*Unpub.*), University of Agricultural Sciences, Bangalore.

Fathima Banu Sutar., Parashivamurthy, S., Rajendra Prasad, V., Palanimuthu. and Ramanappa, T. M., 2019, Effect of seed treatment and containers on red gram cv. BRG-5 seed quality during storage. *Mysore J. Agric. Sci.,* **53** (2) : 47 - 56.

Kirangowda, H. S. and Krishnamurthy, B., 2023, Value chain analysis of bangalore blue grapes in Chikkaballapur district. *Mysore J. Agric. Sci.,* **57** (2) : 461 - 467.

Krishnan, B., Jain, V. John., Kishore, S., Mahantesh, S. and Prof. Savita, C. H., 2017, Agricultural warehouse management system. *Int. J. Adv. Res.,* **5** (5) : 600 - 603.

Kumar, P., Tanveer, N., Dhiman, S., Rajput, S., Rajput, M., Rajput, Y. and Pandey, N., 2024, A review on seed storage technology: recent trends and advances in sustainable techniques for global food security. *Agro Environmental Sustainability*, **2** (1) : 34 - 50.

Mallikarjungouda Patil., 2007, Performance of warehousing in Karnataka - A comparative analysis, MBA Thesis (*Unpub.*), University of Agricultural Sciences, Dharwad.

Patil, S. V., 2007. Performance of warehousing in Karnataka. *Ind. J. Agril. Eco.*, **62** (3) : 456 - 465.

Sari, T. P., Ridwan, A. Y. and Aurachman, R., 2017, Designing floor tile warehouse layout using heuristic approach method to increase warehouse capacity and reduce travel distance. *Int. J. Innov. Enterp. Sys.* **1** (1) : 44 - 52.

Suresh Banakar., 2005, An economic analysis of utilization pattern and performance of Karnataka State Warehousing Corporation, M.Sc. Thesis (*Unpub.*), University of Agricultural Sciences, Dharwad.

https://desagri.gov.in/https://des.karnataka.gov.in/

https://kswc.karnataka.gov.in/