

# Data Driven Operational Efficiency in Regional Newspaper Production: A Case Study of Newsprint Circulation and Inventory Optimisation

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**Abstract:** *This study proposes analytics practices to help newsprint media organisations optimise their ground-level operations and reduce inventory-related wastage, thereby, saving significant cost which could be reinvested in further business operations. To achieve this objective, the paper analyses three years' worth of data of a local operational branch of a national print media conglomerate in India and generalises the findings across all branches to estimate total potential savings by following the suggested steps. The two major areas of concern are vendor management and inventory demand forecasting, and product redistribution for market capturing. The study utilises analytical tools from pivot charts to choropleths leading to an estimated saving of over INR 10,45,000 per annum for a single production branch or facility. The study identifies some of the most common problems faced by print media production sites and concludes with suggested protocols that every site should follow at the managerial level to overcome such issues by leveraging the power of similar analysis techniques.*

**Keywords:** Inventory Management; Newsprint Circulation; Demand Forecasting; Optimisation; Newsprint Waste Management

## 1. Introduction

The newsprint media industry in India is highly competitive with many brands targeting a limited market space that is quickly shifting towards digital alternatives (Rothmann & Koch, 2014). In such a scenario where newsprint media companies have to spend massive amounts of money on strategic market positioning, inventory optimisation plays a critical and central role (Thomopoulos, 2015). Inventory procurement and production accounts for the greatest expense in print media companies leading to its efficient management even more necessary. As the biggest contributor to newsprint production cost, proper inventory management can lead to significant savings for any print media organisation. While many print media organisations struggle to efficiently manage inventory, most are yet to transition to digital systems making their operational work manual and labour-intensive. The lack of efficient inventory management and data-based insight leads to significant cost leakage.

This study analyses a regional production branch of one such Indian newsprint media conglomerate. The outcomes of the regional case study are then applied to the entire conglomerate with all its branches across the nation to estimate the total effect of this analysis on the entire organisation and its effectiveness for other print media organisations. This branch is located in Ajmer, a city in Rajasthan in the north-western region of India. This branch is chosen as it represents the majority of operations across all branches, along with local competitors and market expansion potential.

Despite the impressive geographical coverage of the organisation's branches, root-level scope for improvement was identified across two major areas – raw material quality, and area-wise distribution. Firstly, superior vendors have been identified using Weighted Point Plan to assure better quality of material, and a purchase plan is formulated using Excel's material demand forecast. The Weighted Point Plan uses the weighted average of factors to rank the vendors according to the quality or feasibility of material supplied. Secondly, choropleth map has been used to redistribute unsold newspaper copies across target regions to capture unsaturated market demand potentially leading to additional savings of about INR 3,49,000 annually. Choropleth map uses colour intensity to represent comparative density of a metric across various regions. For our use, this metric is the demand saturation level.

Additionally, purchase and sales strategies have been suggested to further generate revenue and create market value. These interventions strengthen wastage reduction, inventory control, production planning, and market expansion as depicted in *Chart-2*, resulting in substantial cost savings and improving long-term financial efficiency. As a result, overall cost saving of more than INR 10,45,000 has been predicted for a single branch. Actual data from 3 years is collected from across multiple departments on a daily basis for this study. For the purpose of this research, the organisation is termed as AB Corporation Limited (ABCL) and the vendors are named from 'A' through 'J' to maintain integrity of personally identifiable data.

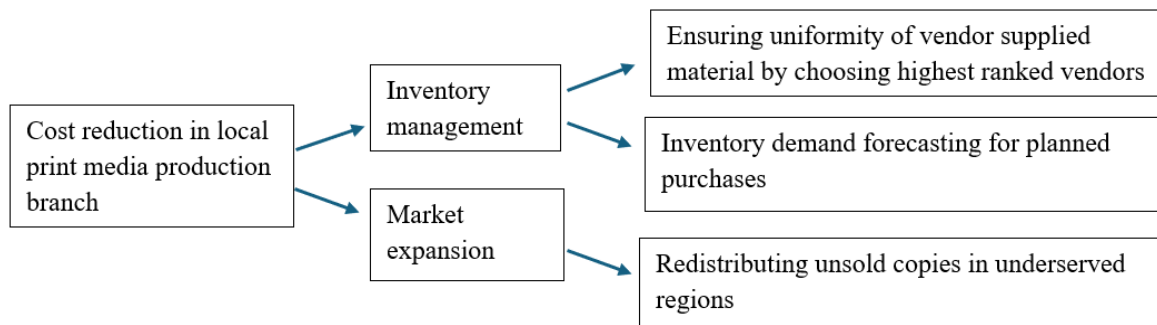


Chart 1: Research flow and objectives

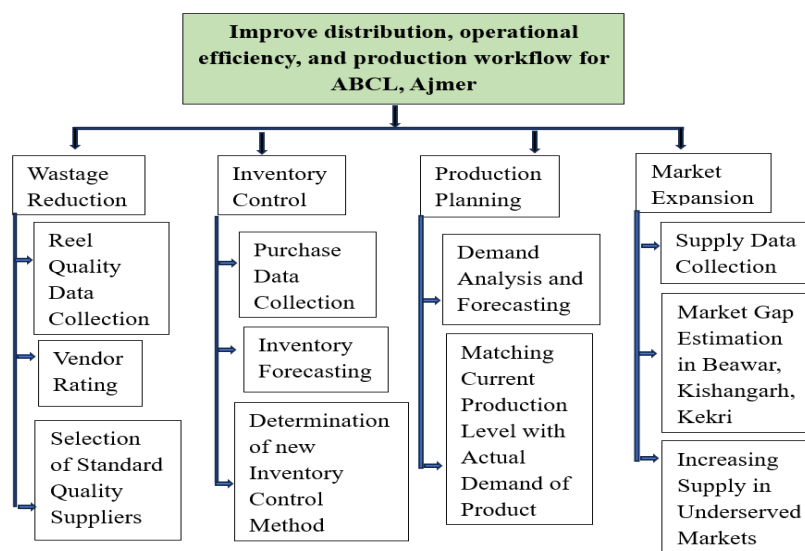


Chart 2: Work breakdown structure

## 2. Literature Review

Previous studies have shown the newsprint media sector to face multiple challenges owing to the digitalisation of print products (Wu et al., 2021). Multiple analysis techniques have been used to study the changes in newspaper consumption trends in the digital era. Some studies have focused on the various business innovation pathways used by world-renowned news brands to adopt to technological change (Aversa et al., 2026). Studies have also suggested ways for newspaper brands to adopt to the changing digital ecosystem (Chen et al., 2018).

Most studies on the print media sector focus on qualitative analysis rather than quantitative, financial or revenue analysis. For instance, researchers have focused on sentiment analysis studies of newspaper content (Chandra et al., 2025) or on the comparative analysis of news contents (Nwantah et al., 2025). Some studies have focused on the interactivity of newsprint and the content quality and have compared print media against its digital alternatives (Frohlich et al., 2017).

Only a handful research papers were found to integrate the financial aspect of newsprint production on an industrial scale. One such study determined the effect of industrial competition on newsprint earnings (Wang et al., 2025). Another study forecasted the demand of newsprint in US markets (Hetemaeki & Obersteiner, 2001). But no single research was found to focus on all of the problems statements like the organisation level operations and cost or inventory

management. While some papers have demonstrated techniques for demand forecasting (Sarker, 2024), some others have emphasised supply chain management for inventory control (Sartika et al., 2018). Most researchers agree inventory management to be an indisputable factor in generating profits (Banyoma, 2006; *Inventory Management in the Era of Big Data - Dimitris Bertsimas, Nathan Kallus, Amjad Hussain, 2016, n.d.*) while some have even used the case study method to support their suggestions ("Solving Time Critical Newspaper Production/Distribution System," n.d.; Tshibangu, 2014). One research has even studied the inventory life cycle of newspapers (Dahlbo et al., 2005).

While some studies have singularly focused on newspaper demand forecasting from consumers' point of view (Cardoso & Gomide, 2007; "Forecasting Newspaper Demand with Censored Regression," n.d.; Shi, 2022) others have studied the industry from the lens of market expansion potential (Rothmann & Koch, 2014). Studies reviewing similar vendor rating methods like the weighted point plan have also been found (Dempsey, 1978; Weber et al., 1991). Some studies have focused on the role of data analytics for audience engagement in news media houses (Maurya & Kumar, 2024; Muhindo, 2025) but only few have used such analytics for production or revenue monitoring. One such study includes a comprehensive discussion on the economics behind newspaper production (Reddaway, 1963). Most researchers have a positive outlook towards the inculcation of data analytics in production and news optimisation.

### 3. Problem Identification & Research Methodology

#### Problem Statement 1

#### Vendor Rating and Inventory Demand Forecasting for Ensuring Fresh and Uniform Quality Material

##### 1) Problem Background

Newsprint reels constitute the largest portion of inventory costs for ABCL (ABCL henceforth refers to ABCL Ajmer branch). To ensure an uninterrupted supply of reels, the stores department places bulk orders with multiple reel vendors whenever a material shortage is imminent. Due to vendor's negligence or technological inefficiencies, reels of a single batch supplied by the same vendor have substantial variances in weight. Since six reels are parallelly placed on a single machine, inconsistent reel weights lead to the lightest reel being exhausted first, rendering the newsprint material of the remaining reels unused. The excess total waste (calculated by subtracting minimum unavoidable waste from total waste) generated in 2025 was 41,871 kg which amounted to INR 6,97,775. The two causes of material losses were identified to be inconsistent reel weights being supplied by some of the vendors, and ABCL's Just-In-Time Inventory ordering system leading to competent vendors not getting enough time for bulk order preparation which also affects quality of material supplied.

##### 2) Data Collection

To first check the extent of the problem, data of daily wastage generated in 2025 was collected from ABCL's Excel records. Following this, data of reels supplied, from FY 2023 onwards, by each vendor was collected in the form of individual Excel sheets. About 390 such sheets were collected where one sheet represented a single order placed with a single vendor.

Finally, data of purchases made in 2025 was collected to assess the most recent year's inventory demand as well as to check the discounts, freight charges, and other details which will be useful to rank vendors. ABCL's Excel records were cleaned and combined and relevant columns were used to prepare a single Excel worksheet with 365 rows and 12 columns showing waste generated for each day in 2025. Excel's features like, 'Merge and Center,' 'Sort,' 'Filter,' and 'Freeze Panes' were utilized to achieve the desired results.

##### 3) Data Analysis

The total wastage in 2025 calculated using Excel's sum feature was 60,903 kg amounting to INR 10,09,973. From this, the minimum possible wastage was subtracted to find the excess avoidable wastage (INR 6,97,775). *Chart-3* in the subsequent section depicts the types of wastes generated, from removing the 'wrapper' and 'layer' to consuming the newsprint material to finally reach the 'core.'

Next, to actually address the issue of vendor mismanagement, standard deviations have been calculated using Excel's 'STDEV.P' function for each vendor based on the weights of reels supplied by them since FY 2023 and boxplots have been used to visualise these deviations for each vendor. To rank the vendors, a pivot table has been created as shown in *Table-1* with row labels as the names of vendors and the columns respectively being averages of price per reel, freight charges incurred per reel, discount provided by a vendor per reel, and quantity of material obtained in kg per reel. Standard deviation earlier calculated has been added as another column. These columns represent the metrics (or variables) used to rank vendors. Each metric has been assigned a weight as per its importance to proceed with the Weighted Point Plan for vendor ranking, with Standard Deviation being assigned the highest weight as it is the primary metric for further decisions.

**Table 1:** Metrics (variables) used for vendor rating with the weights assigned to each metric. The total weight is 100

| Vendor      | Average of Price per Reel | Average of Freight per Reel | Average of Discount per Reel | Average of Quantity per Reel | Standard Deviation |
|-------------|---------------------------|-----------------------------|------------------------------|------------------------------|--------------------|
| A           | ₹ 16,402.32               | ₹ 494.07                    | -                            | 400.06                       | 19.03              |
| B           | ₹ 16,547.87               | ₹ 468.96                    | 725.17                       | 387.64                       | 22.15              |
| C           | ₹ 17,672.47               | ₹ 509.33                    | -                            | 388.41                       | 13.99              |
| D           | ₹ 20,472.81               | -                           | ₹ 616.11                     | 393.71                       | 13.25              |
| E           | ₹ 16,121.09               | ₹ 1,281.42                  | ₹ 1,033.40                   | 413.36                       | 11.29              |
| F           | ₹ 15,269.54               | ₹ 452.65                    | ₹ 990.87                     | 381.74                       | 18.83              |
| G           | ₹ 17,113.04               | ₹ 900.69                    | -                            | 391.40                       | 13.35              |
| H           | ₹ 15,692.38               | -                           | ₹ 759.00                     | 379.50                       | 17.23              |
| I           | ₹ 15,746.12               | ₹ 428.13                    | ₹ 1,419.39                   | 381.25                       | 21.10              |
| J           | ₹ 38,109.78               | ₹ 1,319.44                  | -                            | 280.51                       | 15.66              |
| Grand Total | 17334.32975               | 427.9812352                 | 866.1312053                  | 382.9172205                  |                    |
|             | Var. 1                    | Var. 2                      | Var. 3                       | Var. 4                       | Var. 5             |
| Weights     | 20                        | 10                          | 10                           | 10                           | 50                 |

After this, each vendor is given a score for every variable and the composite score is calculated using the sum function. For standard deviation, and average price and freight per reel variables, the formula used is  $[(\text{Min of all values of the variable across vendors} / \text{Actual value of variable of the vendor in consideration}) * \text{Weight assigned to variable}]$  as the lesser they are the better. For average discount and quantity per reel variables, the formula used is  $[(\text{Actual value of variable of the vendor in consideration} / \text{Max of all values of$

$\text{the variable across vendors}) * \text{Weight assigned to variable}]$  as the higher they are the better. After the calculation of composite score for every vendor, Excel's 'RANK.AVG' function has been used to rank the 10 vendors with highest composite score assigned the first rank, as shown in *Table-2*. Finally, the vendor names have been coloured, with green colour representing the most superior vendors, yellow showing vendors with tolerable performance, and red showing incompetent vendors.

**Table 2:** Table showing the Weighted Point method for ranking vendors.

| Vendor | Var. 1 (Min/Actual)*Weight | Var. 2 (Min/Actual)*Weight | Var. 3 (Actual/Max)*Weight | Var. 4 (Actual/Max)*Weight | Var. 5 (Min/Actual) | Composite | Rank |
|--------|----------------------------|----------------------------|----------------------------|----------------------------|---------------------|-----------|------|
| A      | 19                         | 8                          | 0                          | 10                         | 30                  | 66        | 9    |
| B      | 18                         | 8                          | 5                          | 9                          | 25                  | 67        | 8    |
| C      | 17                         | 7                          | 0                          | 9                          | 40                  | 74        | 5    |
| D      | 15                         | 10                         | 4                          | 10                         | 43                  | 81        | 2    |
| E      | 19                         | 2                          | 7                          | 10                         | 50                  | 89        | 1    |
| F      | 20                         | 8                          | 7                          | 9                          | 30                  | 75        | 4    |
| G      | 18                         | 4                          | 0                          | 9                          | 42                  | 73        | 7    |
| H      | 19                         | 10                         | 5                          | 9                          | 33                  | 77        | 3    |
| I      | 19                         | 9                          | 10                         | 9                          | 27                  | 74        | 6    |
| J      | 8                          | 2                          | 0                          | 7                          | 36                  | 53        | 10   |

Lastly, to reduce overreliance on Just-In-Time inventory ordering system which renders multiple competent vendors unable to fulfil bulk order on short notice, Excel's forecast sheet has been used to predict newsprint inventory demand in advance. Also, a purchase plan has been formulated as follows:

The average daily newsprint material consumption in 2025, as found from ABCL's Excel records, was 5,159.344 kg. From the purchase data, the average time gap between two subsequent reel receipts was calculated to be 5.95 days.

*Expected consumption in 5.95 days = (average daily consumption\*5.95) = 30,698.1 kg*

*Average weight of reel of top three suppliers = 388.6551 kg*

*Expected number of reels consumed in 5.95 days = (expected consumption in 5.95 days/average reel weight) = (30,698.1 kg/388.6551 kg) = 79 reels.*

Thus, 79 reels delivered in every 6 days should suffice for ABCL's inventory needs without leading to undersupply or obsolescence due to oversupply.

## Problem Statement 2 - Market Share Capturing through Newspaper Redistribution

### 1) Problem Background

ABCL supplies newspaper copies across four regions, which are, Ajmer, Kishangarh, Beawar, and Kekri. Due to newspaper supplies not being planned according to the relative population and demand of the four regions, multiple copies return unsold every day from Ajmer, while there is scope for sales increase in the other three regions. From 16 November 2024 to 15 June 2025, a total of 59,725 newspaper

copies returned unsold with an average of approximately 287 copies returning per day. While demand in Ajmer is oversaturated, manual documentation and lack of data analysis renders surrounding regions undersupplied without branch management's knowledge.

### 2) Data Collection

Firstly, the data of population in Ajmer, Kishangarh, Beawar and Kekri was collected from official government sources. Following this, newspaper sales data across the 4 regions was collected from handwritten records and entered into Excel. Finally, 7 months' data showing number of unsold copies across Ajmer was also collected as images from handwritten documentation by the store manager. As mentioned previously, manual documentation is another major issue across local branches which leads to management's ignorance towards data trends. The data of sales in the 4 regions was computerized from hard copy format and converted to an Excel sheet with 4 columns representing the 4 regions, and the date of recording the sales being another column.

### 3) Data Analysis

Firstly, the average unsold copies per day were subtracted from the sales of Ajmer to get the net sales. Then, using Excel's 'Average' function, the daily average of sales of Ajmer, Kishangarh, Beawar, and Kekri was calculated and noted against the current population of the respective regions.

Following this, the ratio of average sales versus population was calculated for every region. This ratio was subtracted from the ratio calculated for Ajmer, and the resultant was multiplied by the region's population to estimate the potential for increase in sales as shown in Table-3.

**Table 3:** Calculation of additional number of newspaper copies required for supply in Kishangarh, Beawar, and Kekri

|                                           | Ajmer     | Kishangarh | Beawar   | Kekri    | Total |
|-------------------------------------------|-----------|------------|----------|----------|-------|
| Population                                | 31,08,008 | 5,03,229   | 1,68,756 | 2,43,965 |       |
| Average sales                             | 41923     | 6067       | 2075     | 2096     | 52161 |
| Sales/Population                          | 0.013     | 0.012      | 0.012    | 0.009    | 0.046 |
| Ratio to be increased                     | -         | 0.001      | 0.001    | 0.005    | 0.008 |
| Number of copies to be increased per day- |           | 721        | 201      | 1195     | 2117  |

Following this, the average number of unsold copies were also redistributed as per the following formula:

*Number of unsold copies allocated to a region = (Ratio to be increase for region/Total ratio to be increased)\*Number of average unsold copies*

On an average, 287 copies remain unsold per day, of which 55, 46, and 187 are respectively allocated to Kishangarh, Beawar, and Kekri by the given method. These methods use simple unitary logic to devise a new distribution plan, thus being efficient and conveniently implementable. A choropleth chart was used to depict the 4 regions as per their demand

saturation level. Choropleth was chosen as it provides a simple and intuitive way to visualize and compare geographic data using colour or shading, allowing quick identification of spatial patterns, trends, and areas of high or low values across regions.

Finally, conditional formatting was used on the unsold copies' data to visualise days with higher number of unsold copies, and this data was also plotted as a scatter plot with dates on the X-axis and number of unsold copies on the Y-axis and a second degree polynomial trendline was fitted to best represent the observed trend of unsold copies. Also, on some days like 27 January (one day after Republic Day – National Holiday), no distribution takes place as workers are on leave on the previous day hence, no printing is done for that day.

These days are considered outliers as they may give false information of 0 unsold copies, when copies were not distributed in the first place. Hence, these days are not considered. The total estimated annual savings after eradicating this problem are obtained by multiplying the average number of unsold copies per day (287) by the lost revenue per copy (INR 3.33). This estimate is multiplied by the number of days in the year (365) to obtain the potential savings of INR 3,48,834.15.

## 4. Results and Discussion

### 4.1 Results for Analysis of Problem Statement 1

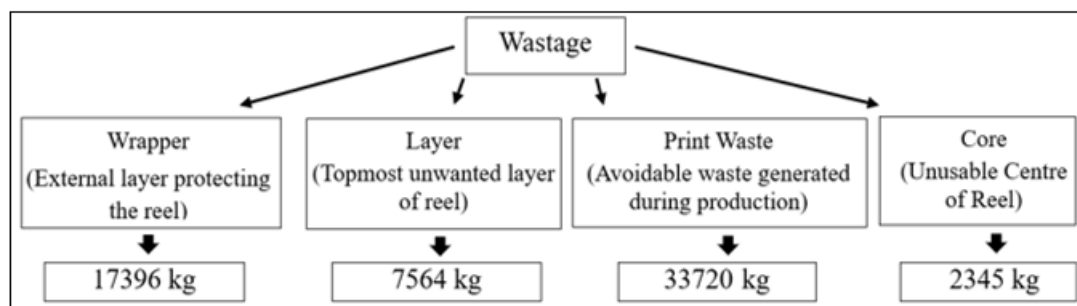


**Chart 3:** Types and amount of production wastes generated annually as recorded in calendar year 2025

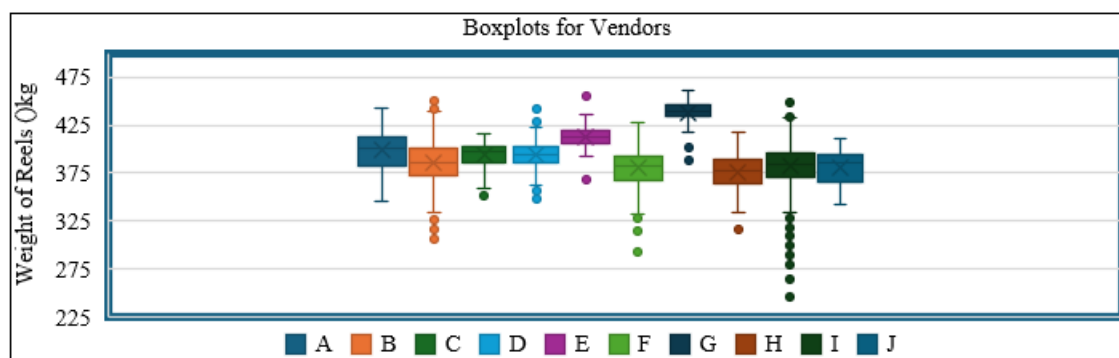


**Chart 4:** Boxplots to visualise the deviations in reel weights for each vendor using data of reels purchased in FY 2023, 2024, and 2025

As can be seen, vendor 'I' has the highest number of outliers. Finally, after forecasting the purchase requirements of ABCL, the following result was obtained:

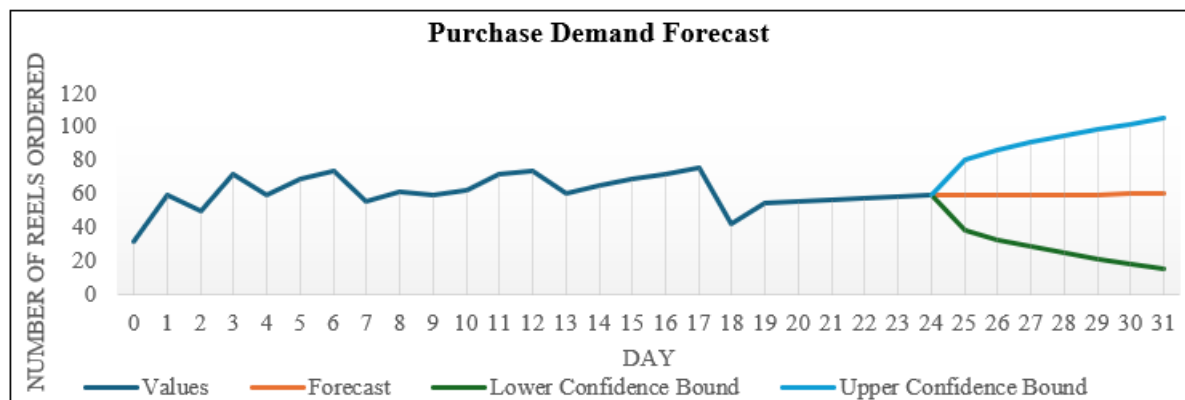


**Chart 5:** Purchase demand forecast for placing order of newsprint reels using data of all reels purchased in calendar year 2025

## 4.2 Results for Analysis of Problem Statement 2

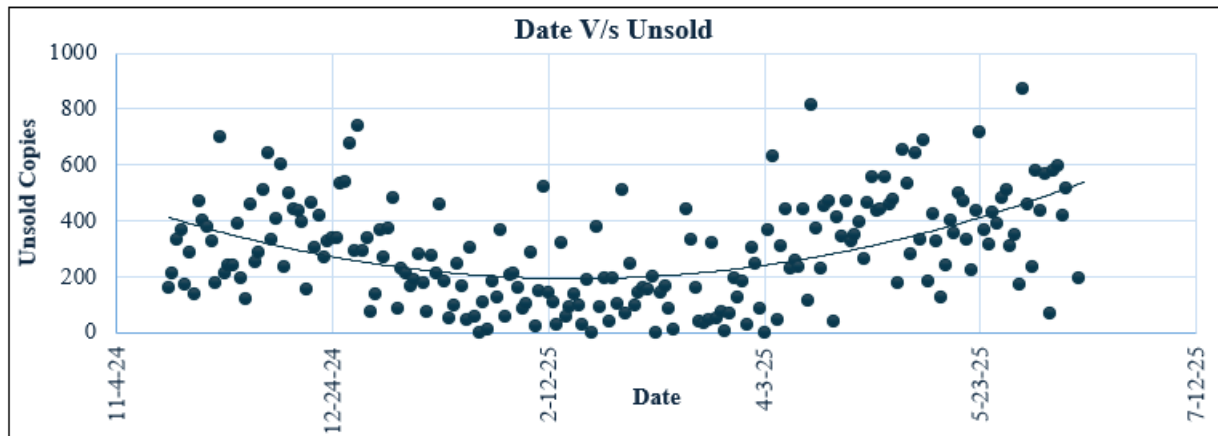


**Chart 6:** Scatter Plot showing date-wise number of copies returning unsold for 7 months, with trendline showing quadratic function

The choropleth in *Chart-7* shows the demand saturation level for the four regions of Ajmer, Kishangarh, Beawar, and Kekri with lighter shades being used for unfulfilled market demand and darker shade of Ajmer representing oversaturated demand, leading to return of unsold copies. The other unshaded regions may be ignored. The percentages adjacent to the shaded regions represent the contribution of those regions towards the total sales.

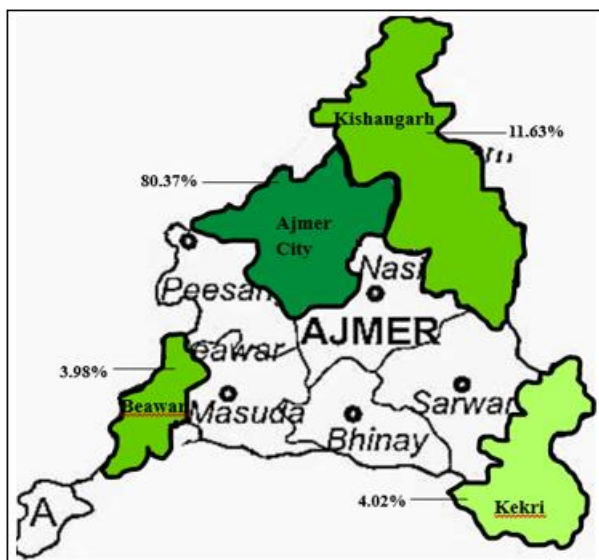


**Chart 7:** Demand saturation level - lighter shaded regions have higher potential for market expansion.

After the analysis of the two problem statements, the respective savings estimated are INR 6,97,775 and INR 3,48,834.15 leading to a staggering total of INR 10,46,609.15 in lost savings.

According to data from the Audit Bureau of Circulation and the annual reports and media disclosures of the top 5 newsprint conglomerates in India by circulation, the average number of newspaper production sites of a single company is 30. If one branch can save INR 10,46,609.15 as per this study, an entire company may save approximately INR 3,13,98,274.5 per annum. This adds a significant amount to profit for re-investment or other operational tasks.

## 5. Conclusion and Recommendations

After analysing the wastage data, it can be established that a substantial financial loss is incurred due to variations in reels supplied by incompetent vendors. To counter this, the vendor ranking system has been established leading to the conclusion that the three top performing vendors, which are 'E,' 'D,' and 'H' in this case, should always be preferred for future dealings. When the three top ranked vendors are unable to supply orders, then the moderately performing ones, which are 'F' and 'C,' may be resorted to. For the vendors to be able to fulfil orders, the purchase plan should be communicated in advance instead of using the Just-In-Time inventory system. The purchase plan suggests an order quantity of 79 reels once in a time period of every 6 days to establish consistency and give vendors adequate time to prepare orders in advance. Also, by placing orders in advance, ABCL can attract a larger pool of vendors to participate in its supply chain rather than relying on the limited few available at the last moment, thereby gaining more options and benefiting from increased vendor competition. Furthermore, this vendor ranking system should be communicated with vendors so that they may gain a critical review of their performance regularly and improve supply quality.

From the data of unsold copies, it can be interpreted that late January and early February record the least number of copies returning unsold with the numbers increasing in November and May through June, as can be seen in the quadratic trend observed. Hence, these months require additional sales and marketing efforts. The region-wise sales analysis shows a significant potential for market expansion in Kekri, as has been depicted by the choropleth chart.

In conclusion, the following steps are recommended to increase savings, reduce wastage, and enhance overall operational efficiency to sustain ABCL's revenues and long-term growth while adapting to changing technological environments and evolving financial expectations:

- 1) Vendors should be given regular feedback on their performance evaluated, based on the vendor ranking system.
- 2) Purchase plan should be communicated with vendors so that they may prepare reel orders accordingly.

- 3) Production for every month should be adjusted according to the number of copies returning unsold.
- 4) Marketing and sales efforts should be focused towards high-potential underserved regions.
- 5) Recordkeeping should shift towards computers from unsystematic manually maintained registers.

These analysis techniques may be utilised as general guidelines across all newsprint media organisations to efficiently manage inventory and operations, and increase savings by reducing wastage. While the research may be limited by specific set of problems faced by one organisation, these problems are often the root cause of many other revenue leakages. The analysis techniques provided in this study are an eye-opening check on how organisations might waste massive amounts on unnoticed wastages which can be reduced by proper data analysis. These techniques may be moulded according to the specific requirements of a particular organisation. Future studies in this domain might inculcate more diverse analysis methods towards such a cause.

## References

- [1] Aversa, P., Cozzolino, A., & Basil, A. (2026). Business model innovation pathways: Digital transformation after disruption at The New York Times and The Washington Post. *Research Policy*, 55(8), 105536. <https://doi.org/10.1016/j.respol.2026.105536>
- [2] Banyoma, F. (2006). *Inventory management and profitability in new vision printing and publishing Company*. <http://hdl.handle.net/20.500.12306/13945>
- [3] Cardoso, G., & Gomide, F. (2007). Newspaper demand prediction and replacement model based on fuzzy clustering and rules. *Information Sciences*, 177(21), 4799–4809. <https://doi.org/10.1016/j.ins.2007.05.009>
- [4] Chandra, R., Zhu, B., Fang, Q., & Shinjikashvili, E. (2025). Large language models for newspaper sentiment analysis during COVID-19: The Guardian. *Applied Soft Computing*, 171, 112743. <https://doi.org/10.1016/j.asoc.2025.112743>
- [5] Chen, C.-H. S., Wu, M.-S. S., Nguyen, B., & Li, S. (2018). Digitally facilitated newspaper consumption and value co-creation. *The Bottom Line*, 32(1), 16–46. <https://doi.org/10.1108/BL-09-2018-0038>
- [6] Dahlbo, H., Koskela, S., Laukka, J., Myllymaa, T., Jouttijärvi, T., Melanen, M., & Tenhunen, J. (2005). Life cycle inventory analyses for five waste management options for discarded newspaper. *Waste Management & Research*, 23(4), 291–303. <https://doi.org/10.1177/0734242X05054713>
- [7] Dempsey, W. A. (1978). Vendor selection and the buying process. *Industrial Marketing Management*, 7(4), 257–267. [https://doi.org/10.1016/0019-8501\(78\)90044-5](https://doi.org/10.1016/0019-8501(78)90044-5)
- [8] Dobler, D. W., & Burt, D. N. (1996). *Purchasing and supply management: Text and cases* (6th ed.). McGraw-Hill.
- [9] Forecasting newspaper demand with censored regression. (n.d.). *Journal of the Operational Research Society*. Retrieved October 6, 2026, from <https://www.tandfonline.com/doi/abs/10.1057/palgrave.jors.2602637>
- [10] Frohlich, D. M., Ely, P., Moore, H., Golsteijn, C., Egglestone, P., Mills, J., Rogers, J., Metcalf, T., Stone, K., & Menicou, M. (2017). Designing interactive newsprint. *International Journal of Human-Computer Studies*, 104, 36–49. <https://doi.org/10.1016/j.ijhcs.2017.03.002>
- [11] Gopalakrishnan, P. (1998). *Purchasing and materials management*. Tata McGraw-Hill.
- [12] Hetemaeki, L., & Obersteiner, M. (2001). *US Newsprint Demand Forecasts to 2020*. <https://pure.iiasa.ac.at/id/eprint/6454/>
- [13] *Inventory Management in the Era of Big Data—Dimitris Bertsimas, Nathan Kallus, Amjad Hussain, 2016*. (n.d.). Retrieved October 6, 2026, from <https://journals.sagepub.com/doi/abs/10.1111/poms.2>
- [14] Maurya, M. K., & Kumar, A. (2024). Audience Data and Editorial Decision-Making: Evolution and Applications of Web Analytics in Newsrooms. *Journal of Media Ethics*, 39(4), 263–278. <https://doi.org/10.1080/23736992.2024.2418037>
- [15] Muhindo, C. (2025). Investigating the role of data analytics in news production and distribution: A case of Nation Media Group, Uganda. *Executive Masters in Media Leadership and Innovation*. [https://ecommons.aku.edu/etd\\_ke\\_gsmc\\_ma-medleader/30](https://ecommons.aku.edu/etd_ke_gsmc_ma-medleader/30)
- [16] Nicholls, T., Shabbir, N., & Nielsen, R. (2017). *The global expansion of digital-born news media*. Reuters Institute for the Study of Journalism. <https://ora.ox.ac.uk/objects/uuid:553299ac-1f8b-4d98-a270-0260a3963c51>
- [17] Nwantah, N. F., Okpongpong, G. I., & Osamor, J. A. (2025). A comparative analysis of Punch and Guardian newspapers coverage of food insecurity in Nigeria. *Social Sciences & Humanities Open*, 12, 101994. <https://doi.org/10.1016/j.ssaho.2025.101994>
- [18] Reddaway, W. B. (1963). The Economics of Newspapers. *The Economic Journal*, 73(290), 201–218. <https://doi.org/10.2307/2228533>
- [19] Rothmann, W., & Koch, J. (2014). Creativity in strategic lock-ins: The newspaper industry and the digital revolution. *Technological Forecasting and Social Change*, 83, 66–83. <https://doi.org/10.1016/j.techfore.2013.03.005>
- [20] Sarker, M. S. (2024). Optimal Decision-Making for Newspaper Inventory: Balancing Demand Uncertainty and Profitability. *Journal of Knowledge Learning and Science Technology ISSN: 2959-6386 (Online)*, 3(3), 261–271. <https://doi.org/10.60087/jklst.vol3.n3.p.261-271>
- [21] Sartika, V., Hisjam, Muh., & Sutopo, W. (2018). Supply chain risk management of newspaper industry: A quantitative study. *AIP Conference Proceedings*, 1931(1), 030018. <https://doi.org/10.1063/1.5024077>
- [22] Shi, J. (2022). Application of the model combining demand forecasting and inventory decision in feature based newsvendor problem. *Computers & Industrial Engineering*, 173, 108709. <https://doi.org/10.1016/j.cie.2022.108709>
- [23] Solving time critical newspaper production/distribution system: A case study of Matichon Newspaper Company in Thailand. (n.d.). *International Journal of Agile Systems and Management*. Retrieved October 6, 2026,

from

<https://www.inderscienceonline.com/doi/10.1504/IJAS>  
M.2013.055008

- [24] Thomopoulos, N. T. (2015). Demand Forecasting for Inventory Control. In N. T. Thomopoulos (Ed.), *Demand Forecasting for Inventory Control* (pp. 1–10). Springer International Publishing. [https://doi.org/10.1007/978-3-319-11976-2\\_1](https://doi.org/10.1007/978-3-319-11976-2_1)
- [25] Tshibangu, W.-M. A. (2014). Material handling, inventory and productivity improvement—A Lean Six Sigma approach case study. *2014 11th International Conference on Informatics in Control, Automation and Robotics (ICINCO)*, 02, 700–707. <https://ieeexplore.ieee.org/abstract/document/7049676>
- [26] Wang, X., Shao, W., Zhu, L., & Kong, D. (2025). Media competition and earnings management: Evidence from China's county newspaper conglomeration reform. *Journal of Accounting and Public Policy*, 54, 107371. <https://doi.org/10.1016/j.jaccpubpol.2025.107371>
- [27] Weber, C. A., Current, J. R., & Benton, W. C. (1991). Vendor selection criteria and methods. *European Journal of Operational Research*, 50(1), 2–18. [https://doi.org/10.1016/0377-2217\(91\)90033-R](https://doi.org/10.1016/0377-2217(91)90033-R)
- [28] Wu, L., Zhang, F., Chang, S. J., & Zhang, Z. (2021). How do the internet technological developments shift the consumption pattern of paper products? Evidence from China. *Technology in Society*, 67, 101731. <https://doi.org/10.1016/j.techsoc.2021.101731>