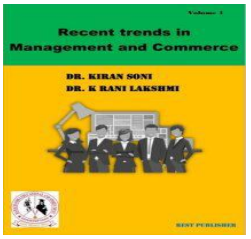
**Recent trends in Management and Commerce**
**Vol: 2(4), 2021**
**REST Publisher**
**ISBN: 978-81-936097-6-7**
**Website: http://restpublisher.com/book-series/rmc/**




# Post-harvest losses in Indian maize amid increasing food insecurity Analysis using TOPSIS method

**Khandekar Sambhaji Atmaram**
SSt College of Arts and Commerce, Maharashtra, India.
Email: sambhajikhandekar@sstcollege.edu.in

## Abstract

Post-harvest loss in harvesting crops Food supply chain from production to their consumption All include loss of food. Spoilage, loss of quality, loss of nutrients, seed By loss of credibility, and loss of business Losses can be classified as weight loss. Importantly, Rotting, mechanical damage, poor handling, temperature, and improper management and handling of moisture Health problems during post-harvest are Major causes of losses. during retailing. "Post-harvest losses" refers measurable in a given production Loss of quantity and quality. These losses can occur at various stages of the post-harvest process. This definition should also take into account product spoilage events. Post-harvest losses of vegetables and fruits From produce in the field to food on a plate Occurs at all points in the value chain. Post-harvest operations include harvesting, Handling, storage, processing, packaging, transportation and include marketing. Diseases Cassava mosaic disease, Cassava brown such as streak and cassava bacterial blight Crop field losses increase and they rot While, large grain borers and cycle moths are the products stored after harvest Major cause of losses. Crop losses per season Vary with the season and from one place to another. Post-harvest Diseases of fruits are caused by pathogenic microorganisms and are a major cause of vegetable losses. Most of the losses are post-harvest Alternaria, Aspergillus, Botrytis, Colletotrichum, Diplodia, Monilinia, Penicillium, Phomopsis, Rhizopus, Mucor and Sclerotinia are caused by fungi such as Alternative: IPR, FP, IPR, and FP. Evaluation Preference: Cultivation, Harvesting, and Drying, Storage, Milling and Paddy transportation. from the result it is seen that Harvesting is got the first rank where as is the Milling is having the lowest rank. The value of the dataset for Post-harvest loss in TOPSIS method shows that it results in Harvesting and top ranking.

**Keywords:** Cultivation, Harvesting, Drying, Paddy transportation.

## Introduction

For harvesting on systematically collected datasets Post management and farmers of various crops, Post-harvest losses, and general social- Economic information and geographic information are included. of farming households, [1] Climate change, like temperature and humidity through changes in various climate variables Post-harvest losses are likely to increase. It also creates an environment for new insect pests to thrive. [2] Global food loss and waste of as much as 32 percent are estimated. Such savings opportunities, global Post-harvest in facing food challenge An urgent need to focus more on loss Recommend. Chronic malnutrition and Such in the face of sluggish yield gains They also question why significant losses persisted wake up [3] Several definitions of post-harvest losses There are, food loss and waste each other An alternative term, PHL is food for human consumption through the stages of the supply chain (FSC). An accidental decrease in the amount of food produced is defined. cause or goal Regardless. [4] Post-harvest losses (PHL) in India Significant and massive economic deficits causing The reduction of PHL in economic, social, and In balancing environmental dimensions Helps achieve stability. Fruits in Indian context and vegetables (F&V) supply chain of PHL To identify important factors [5] Almost 6% storage loss due to inadequate and outdated storage facilities contributes to a A significant proportion of post-harvest losses. In India, about 12 to 16 million tonnes annually of Food grains are wasted, worth about 4 billion US dollars. This amount of food grains To feed about 10% of India's population Adequate and proper storage and storage Reducing losses to meet 10% of India's food will help. requirement. [6] Post-harvest losses and horticulture Deterioration of crop quality are mostly due to pests, Microbial infection, natural ripening processes, and such as heat and drought caused by environmental conditions. and improper Post-harvest handling. [7] Investing In reducing post-harvest losses (PHL) other As with investments, the benefits outweigh the costs carried out if any. Do policy Optimal choices of reporting and mitigation approaches to simplify, levels losses, [8] Investment in reducing post-harvest losses (PHL). So, if the benefits outweigh the costs, other Investments are made in the same way. of losses Quantities of losses at each stage Net of following drivers and mitigation procedures, The principle is to get accurate knowledge of the benefits Inform, optimal choices of mitigation approach Simplification is also important. [9] Post-harvest in food value chains amount (PHL) diet researchers and policy To reduce these losses among classifiers It is increasingly discussed with the design of policies. First, reducing PHL is believed to improve food security because lower PHL will ensure more food availability at lower prices. [10] Despite Comprehensive research and development of remedial techniques, Recommended control measures are limited There are Reducing post-harvest losses There is a lot of information published on related aspects fewer Effects of loss as fully as possible should be analyzed. [11] Evaluated post-harvest and food loss practices A maize farming system in Tanzania. savings Significant losses were incurred

during the phase detected. From the perspective of farmers, climate change, Field damage, and pests main causes of losses [13] The transition Traditional post-harvest operations begin with growing Considerably up to mechanized systems in countries Adds investment costs, especially for machinery, Also engine output, and fuel consumption 6-8 Greenhouse Gas Emissions (GHGE) from leads to increase. However, mechanized Under traditional operations compared to systems Post-harvest losses are significantly higher. [14] Building agro-solids production, post-harvest field processing program will prevent loss reduction in smart agriculture. Many processing programs prevent post-harvest losses in agricultural solids production, apple is susceptible to a limited number of diseases, but it is a large amount of wastage in the post-harvest process. [15]

## Materials & Methods

We develop a fuzzy TOPICS analytical Evaluation of customer satisfaction under conditions of uncertainty A model of customer satisfaction system used and general assessment. Validity of assessment Characterization is shown through a case study [1] A model with Prioritize rankings and alternatives Obscure TOPSIS for rendering based approach It is also proposed to provide Throughout this study, Five ATM, POS, Tele Banking, Mobile, and Internet- The authors operationalize a decision-support model of outsourcing for banking services Real banking using data From the case. The proposed model is ITO there to decision makers Helps in decision making It helps to drive the process forward, especially when the parameters are uncertain Where characters are involved and cannot be judged by human judgments. [3] of Fuzzy TOPSIS based approach A model with applications, alternatives Rank and prioritize proposed. Throughout this study, five ATMs, POS, Tele banking, Mobile and Internet-Banking Real Bank to run a decision-support model of outsourcing for services the authors use data from the case. [4] KANUMAN One of the most classical maximization methods, TOPSYS Originally developed by Wang and Lee, this The basic idea of the method is that Selected alternatives positive ideal solution Very short distance and far from negativity Must also have distance. Best solution. [5] Key Between TOPSIS and Fuzzy TOPSIS Difference are evaluation approaches. Qualification Fuzzy TOPSIS Evaluation Performance Defined criteria based on given alternatives is the value of alternatives It is the use of Ambiguous data to disclose. Because given by decision makers Decision-making information is often present inaccurate [6]. A hybrid of the two methods has been highlighted Existing literature. Based on this context, GSD program outcomes as perceived by groups Fuzzy TOPSIS and DEMATEL for estimation A combination of approaches is proposed. [7] A decision AHP and Fuzzy TOPSIS approach and model are proposed. AHP To obtain the weights of the criteria, Obscure TOPSIS is used. Rank ecommerce websites. Weights derived from AHP Fuzzy TOPSIS calculations using them are included in the decision-making process and The rank order is decided based on that these weights. [8] Weight vector of risk factors and ambiguous outcome By using a weighted normal fuzzy The result matrix is generated. Then, FPIS and FNIS From and every failure from FPIS and FNIS The mode distance is calculated respectively. Chen's at the last stage of fuzzy TOPSIS closeness coefficients Processes are received. According to close coefficients, a ranking order of all failure modes is determined. [9] Concepts of FPIS and FNIS are Fuzzy TOPSIS They play an important role practice. A positive ideal solution and the best solution to the negative are the positive or cost criteria, respectively Depending on Maximum or minimum replacement has values. However, in practice, the best a solution is the extreme that can be obtained when evaluating alternatives the values do not need to be the same. [10] To rank Specify alternative and preferred option, far For this purpose, IVSF cosine similarity measure, it's To demonstrate effectiveness and practicality, advertise We use the IVSF set method for strategy selection We proposed. Alternatives and to represent evaluations of criteria. [11] Many based on TOPSIS Criteria for Decision making problems in renewable energy sources A new and A different way has been proposed and some already exist Methods are compared. Then, conflicted Evaluate possible alternatives between criteria To do, related to renewable energy sources A selection of experts is selected. Also, the decision matrix and criterion weights are fuzzy Measured using linguistic values that are converted to values. [12] of To show the efficiency of the weighting method Location is a problem A usage example is provided. Finally, the results of the proposed method, proposed Explanation provided to show validation of interval value Related to the example with some methods from the literature are compared. Reluctance TOPSIS method. [13] This study is a robust ERP selection framework Proposes, including FLPR and alternative ERP systems of evaluation criteria calculated by ranking the weights are obtained by TOPSIS. Food Turkish total real life application in company implemented. [14] AHP is relative weighting of constraints TOPSIS is used for prioritization. RL Developing, developing and investing in technology Doing is the highest ranking for RL adoption are solutions. A constraint of Indian Electronics Industry Beyond empirical evidence supports this framework. RL adoption. [15]

**Cultivation:** Cultivation means growing something or improving its growth, especially crops. Cultivation can be used more figuratively to refer to the same kind of process, besides being an abstract thing like a business or friendship.

**Harvesting:** Harvesting is the harvesting of the useful part or parts of the plant Collection is, and all nutrients By the time they are formed and reach edible parts carried out. suitable maturity. Generally, harvesting 10. Grains reach physiological maturity Or after 15 days.

**Drying:** Drying is a solid, semi-solid, or Evaporation of water or another solvent from a liquid A mass transfer involving removal is the process. This process is often Before selling products or as a final manufacturing step is used packaged.

**Milling:** Grinding A milling tool cuts the material in a rotating motion is a process. As with drilling, different A variety of diameters and different hard nesses This is possible with a wide array of tools. The plant is moving Since rotating to get a clean finish on the milled hole Speed should be high.

**Storage:** Storage is where a computer temporarily or helps retain data permanently mechanism. Flash drives and hard disks most storage devices are digital Because they are the basic component of devices Such as videos, documents, images, and raw data Users to protect all types of information allow

**Paddy transportation:** About 40 million tonnes Food grains by FCI carried throughout year. Movement of food grains is done through railways and waterways. More than 85% of stock movement is done by rail.

## Result and discussions

**TABLE 1.** Post-harvest losses in TOPSIS

| | DATA SET | | | |
|---|---|---|---|---|
| | IPR(high) | FP(high) | IPR(Low) | FP(Low) |
| Cultivation | 47.08 | 169.53 | 19.15 | 32.05 |
| Harvesting | 73.12 | 172.97 | 13.69 | 37.30 |
| Drying | 48.08 | 142.58 | 15.18 | 33.10 |
| Storage | 51.17 | 178.28 | 14.60 | 37.59 |
| Milling | 37.33 | 136.41 | 17.96 | 38.89 |
| Paddy transportation | 55.07 | 166.00 | 12.55 | 35.55 |

These Table 1 TOPSIS of Post-harvest losses Alternative: IPR, FP, IPR, and FP. Evaluation Preference: Cultivation, Harvesting, and Drying, Storage, Milling and Paddy transportation. IPR (high) the Harvesting it is seen that is showing the highest value for Milling is showing the lowest value. FP (high) it is seen that Storage is showing the highest value for Milling is showing the lowest value. IPR (Low) the is seen that Cultivation is showing the highest value for Paddy transportation is showing the lowest value. FP (Low) and it is seen that Hand drill is showing the highest value for corded drill is showing the lowest value.

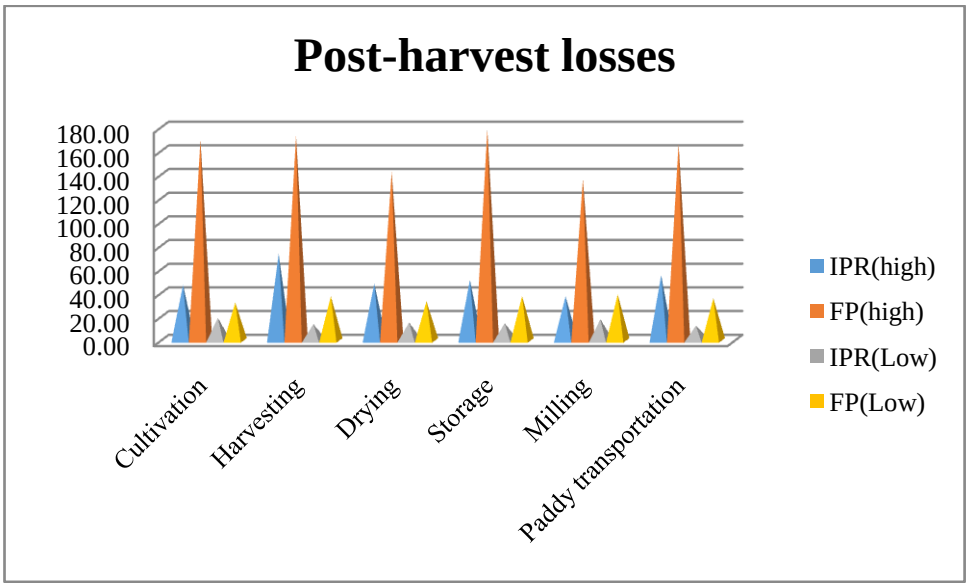



**FIGURE 1.** Post-harvest losses

These FIGURE 1 TOPSIS of Post-harvest losses Alternative: IPR, FP, IPR, and FP. Evaluation Preference: Cultivation, Harvesting, and Drying, Storage, Milling and Paddy transportation.

**TABLE 2.** Squire Rote of matrix

| | | | |
|---|---|---|---|
| 2216.526 | 28740.421 | 366.7225 | 1027.203 |
| 5346.534 | 29918.621 | 187.4161 | 1391.29 |
| 2311.686 | 20329.056 | 230.4324 | 1095.61 |
| 2618.369 | 31783.758 | 213.16 | 1413.008 |
| 1393.529 | 18607.688 | 322.5616 | 1512.432 |
| 3032.705 | 27556 | 157.5025 | 1263.803 |

Table 2 shows the Squire Rote of matrix value.

**TABLE 3.** Post-harvest losses in Normalized Data

| Normalized Data | | | |
|---|---|---|---|
| IPR(high) | FP(high) | IPR(Low) | FP(Low) |
| 0.4 | 1.439 | 0.527 | 0.399 |
| 0.62 | 1.468 | 0.377 | 0.465 |
| 0.408 | 1.21 | 0.418 | 0.412 |
| 0.434 | 1.513 | 0.402 | 0.468 |
| 0.317 | 1.158 | 0.494 | 0.485 |
| 0.467 | 1.409 | 0.345 | 0.443 |

Table 3 Normalized Data shows the informational set for the Cultivation, Harvesting, and Drying, Storage, Milling and Paddy transportation. The Normalized data is calculated from the data set value is divided by the sum of the square root of the column value.

**TABLE 4.** Weight

| Weight | | | |
|---|---|---|---|
| 0.25 | 0.25 | 0.25 | 0.25 |
| 0.25 | 0.25 | 0.25 | 0.25 |
| 0.25 | 0.25 | 0.25 | 0.25 |
| 0.25 | 0.25 | 0.25 | 0.25 |
| 0.25 | 0.25 | 0.25 | 0.25 |
| 0.25 | 0.25 | 0.25 | 0.25 |

Table 4 Weight shows the informational set for the weight all same value 0.25.

**TABLE 5.** Post-harvest losses in Weighted normalized result matrix

| Weighted normalized decision matrix | | | |
|---|---|---|---|
| 0.1 | 0.36 | 0.132 | 0.1 |
| 0.155 | 0.367 | 0.094 | 0.116 |
| 0.102 | 0.302 | 0.104 | 0.103 |
| 0.109 | 0.378 | 0.1 | 0.117 |
| 0.079 | 0.289 | 0.124 | 0.121 |
| 0.117 | 0.352 | 0.086 | 0.111 |

Table 3 Normalized Data shows the informational set for the Cultivation, Harvesting, and Drying, Storage, Milling and Paddy transportation. The Normalized data is calculated from the data set value is divided by the sum of the square root of the column value.

**TABLE 6.** Post-harvest losses in Positive Matrix

| Positive Matrix | | | |
|---|---|---|---|
| 0.155 | 0.378 | 0.086 | 0.1 |
| 0.155 | 0.378 | 0.086 | 0.1 |
| 0.155 | 0.378 | 0.086 | 0.1 |
| 0.155 | 0.378 | 0.086 | 0.1 |
| 0.155 | 0.378 | 0.086 | 0.1 |
| 0.155 | 0.378 | 0.086 | 0.1 |

Table 6 Positive Matrix shows the informational set for the value IPR (high) 0.155, FP (high) 0.378, IPR (Low) 0.086, FP (Low) 0.1097.

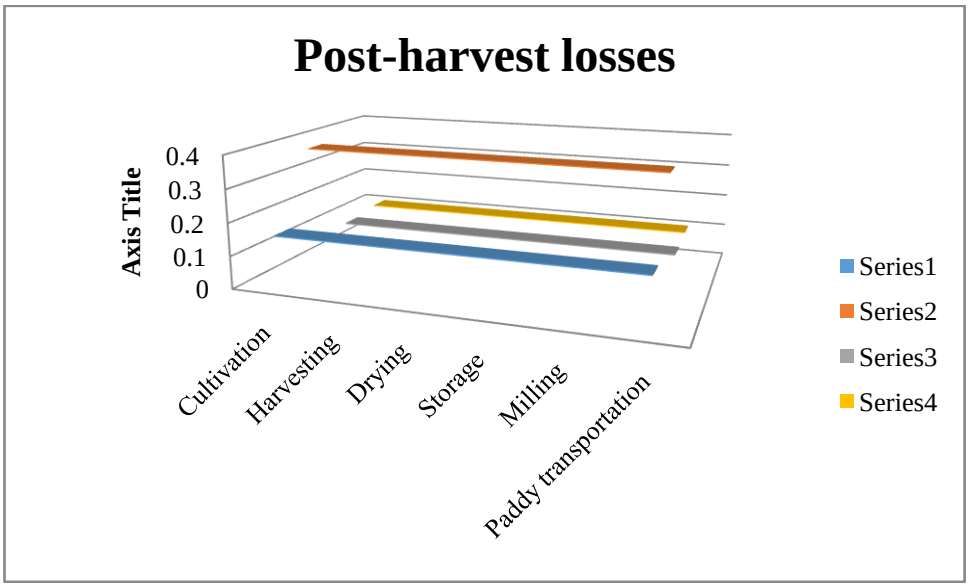



**FIGURE 2**. Positive Matrix

Figure 2 Positive Matrix shows the informational set for the value IPR (high) 0.155, FP (high) 0.378, IPR (Low) 0.086, FP (Low) 0.1097.

**TABLE 7.** Post-harvest losses in Negative matrix

| | Negative matrix | | | |
|---|---|---|---|---|
| Cultivation | 0.079 | 0.289 | 0.132 | 0.121158 |
| Harvesting | 0.079 | 0.289 | 0.132 | 0.121158 |
| Drying | 0.079 | 0.289 | 0.132 | 0.121158 |
| Storage | 0.079 | 0.289 | 0.132 | 0.121158 |
| Milling | 0.079 | 0.289 | 0.132 | 0.121158 |
| Paddy transportation | 0.079 | 0.289 | 0.132 | 0.121158 |

Table 7 Negative matrix shows the informational set for the value IPR (high) 0.079, FP (high) 0.289, IPR (Low) 0.132, FP (Low) 0.121158

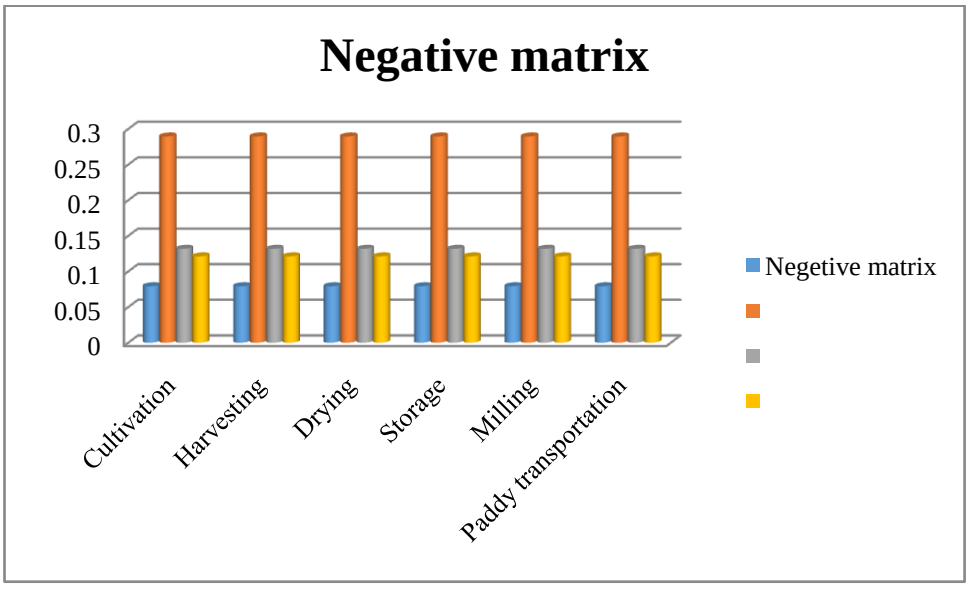



**FIGURE 3.** Negative matrix

Figure 3 Negative matrix shows the informational set for the value IPR (high) 0.079, FP (high) 0.289, IPR (Low) 0.132, FP (Low) 0.121158

**TABLE 8.** Post-harvest losses in Si Positive & Si Negative & Ci

| | SI Plus | SI Plus | Ci |
|---|---|---|---|
| Cultivation | 0.073882 | 0.0738816 | 0.507993 |
| Harvesting | 0.021353 | 0.0213526 | 0.84336 |
| Drying | 0.09432 | 0.0943198 | 0.308033 |
| Storage | 0.051626 | 0.0516264 | 0.656653 |
| Milling | 0.124478 | 0.1244784 | 0.061715 |
| Paddy transportation | 0.047581 | 0.0475809 | 0.645821 |

Table 8 Si Positive & Si Negative & Ci shows the graphical representation

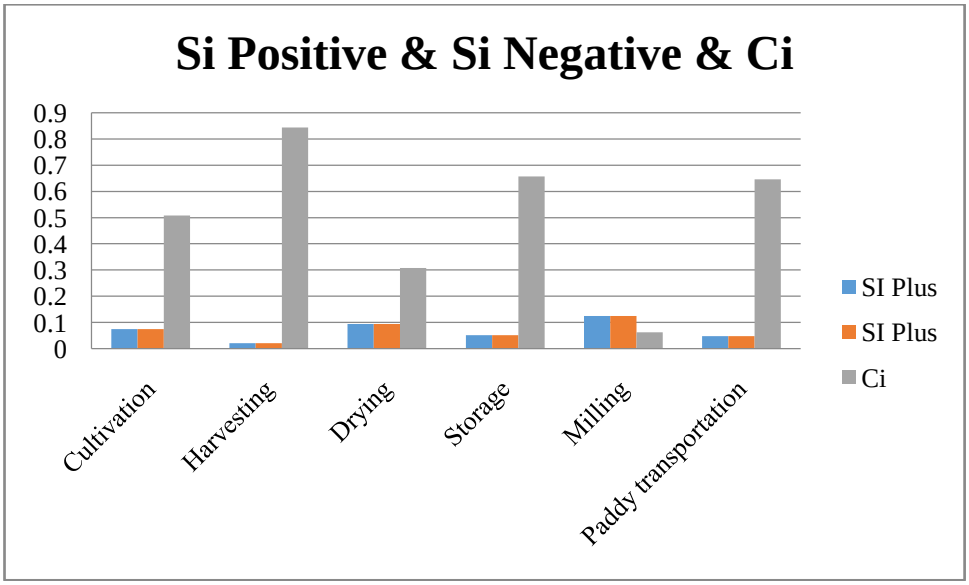



**FIGURE 4.** Post-harvest losses in Si Positive & Si Negative & Ci

Figure 4 Si Positive & Si Negative & Ci shows the graphical representation

**TABLE 9.** Post-harvest losses in Rank

| | Rank |
|---|---|
| Cultivation | 4 |
| Harvesting | 1 |
| Drying | 5 |
| Storage | 2 |
| Milling | 6 |
| Paddy transportation | 3 |

Table 9 shows the from the result it is seen that Harvesting is got the first rank where as is the Milling is having the lowest rank.

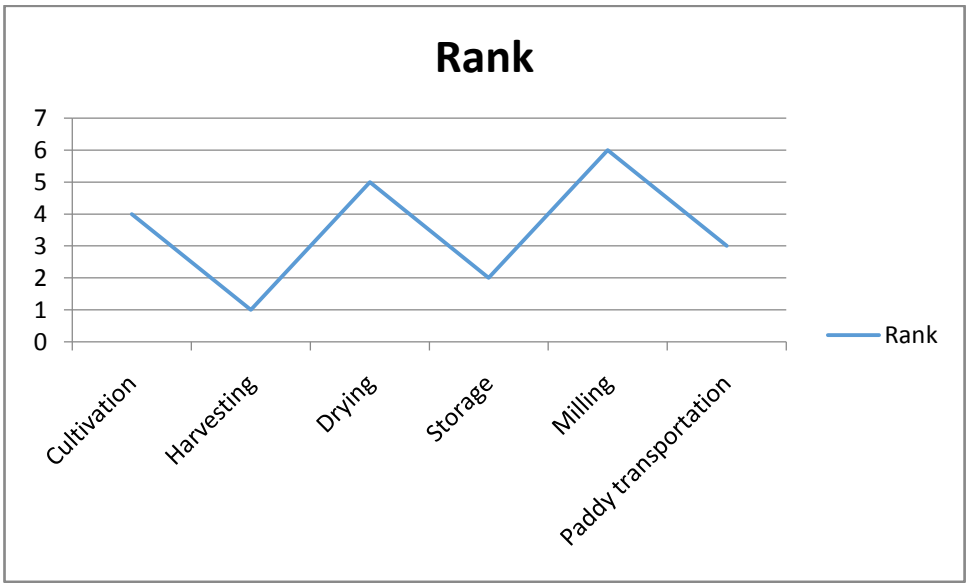



**FIGURE 5.** Rank

Figure 5 shows the from the result it is seen that Harvesting is got the first rank where as is the Milling is having the lowest rank.

## Conclusion

From the result it is seen that Harvesting is got the first rank where as is the Milling is having the lowest rank. Significant Maize during post-harvest handling Loss in both quantity and quality of grains occurs. The reasons for this are biological, socio- Economics and policy related. For these identify the causative biological factors and harvest Research and private in post-technology development appropriate government for both sector involvements Address these by formulating policies can do propagation. of infrastructure such as storage facilities in developing countries Construction, knowledge from industrialized countries, and For reduction of PHL, with the transfer of technologies led to Proper policy implementation and appropriate Using techniques/tools/techniques The need to remove or reduce PHL by has Identify important causal factors and understand their position in the hierarchy Their mathematical modeling is used by decision makers To delete or reducing them. Hence, there is an urgent need to intervene in the existing problems. Additionally, Effective and efficient intervention Policies and strategies should be developed. Many based on TOPSIS Criteria for Decision making problems in renewable energy sources a new and A different way has been proposed and some already exist Methods are compared. Then, conflicted Evaluate possible alternatives between criteria To do, related to renewable energy sources A selection of experts is selected. Also, the decision matrix and criterion weights are fuzzy Measured using linguistic values that are converted to values. Post-harvest in food value chains amount (PHL) diet researchers and policy to reduce these losses among classifiers It is increasingly discussed with the design of policies. First, reducing PHL is believed to improve food security because lower PHL will ensure more food availability at lower prices. Despite Comprehensive research and development of remedial techniques, Recommended control measures are limited There are Reducing post-harvest losses There is a lot of information published on related aspects fewer Effects of loss as fully as possible should be analyzed.

## Reference

1. Fasanghari, Mehdi, Navid Gholamy, S. Kamal Chaharsooghi, Shohre Qadami, and Mohamad Soltani Delgosha. "The fuzzy evaluation of E-Commerce customer satisfaction utilizing fuzzy TOPSIS." In 2008 International Symposium on Electronic Commerce and Security, pp. 870-874. IEEE, 2008.
2. Ravasan, Ahad Zare, Payam Hanafizadeh, Laya Olfat, and Mohammad Taghi Taghavifard. "A fuzzy TOPSIS method for selecting an e-banking outsourcing strategy." International Journal of Enterprise Information Systems (IJEIS) 13, no. 2 (2017): 34-49.
3. Papapostolou, Aikaterini, Charikleia Karakosta, Georgios Apostolidis, and Haris Doukas. "An AHP-SWOT-Fuzzy TOPSIS approach for achieving a cross-border RES cooperation." Sustainability 12, no. 7 (2020): 2886.
4. Hota, H. S., L. K. Sharma, and S. Pavani. "Fuzzy TOPSIS method applied for ranking of teacher in higher education." In Intelligent Computing, Networking, and Informatics, pp. 1225-1232. Springer, New Delhi, 2014.
5. Chen, Ting-Yu. "Interval-valued fuzzy TOPSIS method with leniency reduction and an experimental analysis." Applied Soft Computing 11, no. 8 (2011): 4591-4606.
6. Sangaiah, Arun Kumar, Prabakar Rontala Subramaniam, and Xinliang Zheng. "A combined fuzzy DEMATEL and fuzzy TOPSIS approach for evaluating GSD project outcome factors." Neural Computing and Applications 26, no. 5 (2015): 1025-1040.
7. Yu, Xiaobing, Shunsheng Guo, Jun Guo, and Xiaorong Huang. "Rank B2C e-commerce websites in e-alliance based on AHP and fuzzy TOPSIS." Expert Systems with Applications 38, no. 4 (2011): 3550-3557.

8. Kutlu, Ahmet Can, and Mehmet Ekmekçioğlu. "Fuzzy failure modes and effects analysis by using fuzzy TOPSIS-based fuzzy AHP." Expert systems with applications 39, no. 1 (2012): 61-67.
9. Roszkowska, Ewa, and Dariusz Kacprzak. "The fuzzy saw and fuzzy TOPSIS procedures based on ordered fuzzy numbers." Information Sciences 369 (2016): 564-584.
10. Farrokhizadeh, Elmira, Seyed Amin Seyfi-Shishavan, Fatma Kutlu Gündoğdu, Yaser Donyatalab, Cengiz Kahraman, and Seyyed Hadi Seifi. "A spherical fuzzy methodology integrating maximizing deviation and TOPSIS methods." Engineering Applications of Artificial Intelligence 101 (2021): 104212.
11. Rani, Pratibha, Arunodaya Raj Mishra, Abbas Mardani, Fausto Cavallaro, Melfi Alrasheedi, and Afaf Alrashidi. "A novel approach to extended fuzzy TOPSIS based on new divergence measures for renewable energy sources selection." Journal of Cleaner Production 257 (2020): 120352.
12. Tavakkoli-Moghaddam, Reza, Hossein Gitinavard, Seyed Meysam Mousavi, and Ali Siadat. "An interval-valued hesitant fuzzy TOPSIS method to determine the criteria weights." In International Conference on Group Decision and Negotiation, pp. 157-169. Springer, Cham, 2015.
13. Çakır, Süleyman. "Selecting appropriate ERP software using integrated fuzzy linguistic preference relations–fuzzy TOPSIS method." International Journal of Computational Intelligence Systems 9, no. 3 (2016): 433-449.
14. Prakash, Chandra, and Mukesh Kumar Barua. "Integration of AHP-TOPSIS method for prioritizing the solutions of reverse logistics adoption to overcome its barriers under fuzzy environment." Journal of Manufacturing Systems 37 (2015): 599-615.
15. Cengiz Toklu, Merve. "Interval type-2 fuzzy TOPSIS method for calibration supplier selection problem: A case study in an automotive company." Arabian Journal of Geosciences 11, no. 13 (2018): 1-7.
16. Hengsdijk, H., and W. J. De Boer. "Post-harvest management and post-harvest losses of cereals in Ethiopia." Food Security 9, no. 5 (2017): 945-958.
17. Tefera, Tadele. "Post-harvest losses in African maize in the face of increasing food shortage." Food security 4, no. 2 (2012): 267-277.
18. Kaminski, Jonathan, and Luc Christiaensen. "Post-harvest loss in sub-Saharan Africa—what do farmers say?." Global Food Security 3, no. 3-4 (2014): 149-158.
19. Bendinelli, William Eduardo, Connie Tenin Su, Thiago Guilherme Péra, and José Vicente Caixeta Filho. "What are the main factors that determine post-harvest losses of grains?." Sustainable production and consumption 21 (2020): 228-238.
20. Raut, Rakesh D., Bhaskar B. Gardas, Manoj Kharat, and Balkrishna Narkhede. "Modeling the drivers of post-harvest losses–MCDM approach." Computers and Electronics in Agriculture 154 (2018): 426-433.
21. Mogale, D. G., Sri Krishna Kumar, and Manoj Kumar Tiwari. "Green food supply chain design considering risk and post-harvest losses: A case study." Annals of Operations Research 295, no. 1 (2020): 257-284.
22. Kasso, Mohammed, and Afework Bekele. "Post-harvest loss and quality deterioration of horticultural crops in Dire Dawa Region, Ethiopia." Journal of the Saudi Society of Agricultural Sciences 17, no. 1 (2018): 88-96.
23. Chegere, Martin Julius. "Post-harvest losses reduction by small-scale maize farmers: The role of handling practices." Food Policy 77 (2018): 103-115.
24. Dos Santos, Sidione Ferreira, Ryzia de Cassia Vieira Cardoso, Ísis Maria Pereira Borges, Amanda Costal e Almeida, Emily Sodré Andrade, Isabela Ormonde Ferreira, and Leandro do Carmo Ramos. "Post-harvest losses of fruits and vegetables in supply centers in Salvador, Brazil: Analysis of determinants, volumes and reduction strategies." Waste Management 101 (2020): 161-170.
25. Minten, Bart, Seneshaw Tamru, and Thomas Reardon. "Post-harvest losses in rural-urban value chains: Evidence from Ethiopia." Food Policy 98 (2021): 101860.
26. Ahmed, Asma A. "Post-harvest losses of fish in developing countries." Nutrition and health 19, no. 4 (2008): 273-287.
27. Gardas, Bhaskar B., Rakesh D. Raut, and Balkrishna Narkhede. "Evaluating critical causal factors for post-harvest losses (PHL) in the fruit and vegetables supply chain in India using the DEMATEL approach." Journal of cleaner production 199 (2018): 47-61.
28. Gummert, Martin, Christopher Cabardo, Reianne Quilloy, Yan Lin Aung, Aung Myo Thant, Myo Aung Kyaw, Romeo Labios, Nyo Me Htwe, and Grant R. Singleton. "Assessment of post-harvest losses and carbon footprint in intensive lowland rice production in Myanmar." Scientific Reports 10, no. 1 (2020): 1-13.
29. Sanjeevi, P., B. Siva Kumar, S. Prasanna, J. Maruthupandi, R. Manikandan, and A. Baseera. "An ontology enabled internet of things framework in intelligent agriculture for preventing post-harvest losses." Complex & Intelligent Systems 7, no. 4 (2021): 1767-1783.