Root cause analysis of newsprint waste using pareto analysis and cause and effect matrix

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Abstract. The dynamic business environment has changed the mindset of printing industry, which enhanced the focus towards waste management as its critical issue in printing industry. Printing waste is also leading to financial loss and developing environmental issues. This scenario motivates to perform root cause analysis of newsprint waste, which can help to reduce waste and to improve the environmental conditions. In this paper, the root cause of newsprint waste is identified using Pareto analysis and cause and effect matrix. The result shows that web break between operation and the wrong roller setting are the root causes of newsprint waste. At the end of this study, few improvement measures are suggested and implemented for validating the improvement.

Keywords: Pareto Analysis, Newsprint waste, Cause & effect matrix.

1. Introduction

In the newspaper printing industry, high-speed web machines are used; this high speed causes enormous wastage. The waste leads financial losses for printing industry as well as develops environmental issues. The competitive business culture motivates printing industry to focus on environmental issues, which change the approach of the printing industry towards waste management.

2. Methodology

Root Cause Analysis (RCA) is a problem-solving process, which helps in conducting an investigation into an identified incident and problem. RCA practice tries to solve problems by identifying the root causes of events and proposes some improvement actions to reduce the intensity of root cause. Root cause analysis (RCA) requires the investigators to look beyond the solution to the immediate problem and understand the fundamental or underlying causes of the situation and put them right, thereby preventing re-occurrence of the same issue. This may involve the identification and management of processes, procedures, activities, inactivity, behaviors or conditions. The benefits of comprehensive root cause analysis are identification of permanent solutions, prevention of recurring failures, and introduction of a logical problem-solving process applicable to issues and non-conformities of all sizes. The key to effective problem prevention is detecting the causes of a problem that has occurred. Root cause analysis involved five steps, which are shown in Figure 1.
2.1. Define the problem
In this step of RCA, the problem is identified based on the literature survey and available historical data. The historical data is collected and analyzed, which shows that printing waste is enormous, and its effects on the efficiency of an organization. This scenario motives for developing the problem statement as root cause analysis of newsprint waste using Pareto analysis and cause and effect matrix.

2.2 Collect data
In this step of RCA, needs to validate the developed problem statement. The newsprint waste is a combination of printed waste, sweeping waste, tear of waste, reel end waste, and others. The data was collected for one month based on identified categories and plotted the Pareto chart for identifying the most contributing factor for newsprint waste. Pareto chart (figure 2) concludes that printed waste is contributing 53.5 %, and hence it is the critical factor for newsprint waste. The Pareto chart also shows that there is huge newsprint waste, i.e., 2516 Kg/month, and the organization needs to focus on reducing the newsprint waste; hence, the developed problem statement is valid and shows the need for RCA for newsprint waste.
2.3. Identify possible causes
In this stage, identify as many causal factors or causes as possible for selected problems or issues. The literature survey and discussion with experts have identified few causes for printed waste, such as web breaks between operation, auto pasting of copies, incorrect pre-setting, inappropriate machine setting, unbalance ink-water combination, unsuitable dosing of a fountain, wrong roller setting, variation in cut off, and irregular inking. A total nine causes were identified for printed waste issue.

2.4. Identify root cause
This step helps to investigate the root cause of a problem or issue. There are different methods available for identifying the root cause of problems such as fishbone diagram, failure mode effect analysis, Why-why analysis, and cause and effect matrix. In this study, the cause and effect matrix has been used to investigate the root cause of printed waste, which comprises potential causes and evaluation criteria. The experts are selected in the category of managers, team leaders, and maintenance engineers to identify the evaluation criteria, who have the experience of more than five years. A total 13 experts are involved for identifying the evaluation criteria, and experts have suggested the evaluation criteria such as frequency of incidence, effect on waste, cost-saving possibility and achievability of solution. The matrix was developed and shown in Table 1. Further, experts are also involved in investigating the root cause of printed waste, for that experts have asked to share their opinion based on rating scale of 1-10, which is varying from 1-no effect to 10-very strong effect. The experts have suggested for considering the equal importance for all evaluation criteria, i.e. 0.25. Table 1 shows the scale for which experts have given maximum response. It also shows that the web breaks between operation and wrong roller setting are root causes of printed waste.
Table 1. Cause and effect matrix for printed waste.

| Sr. No | Potential causes                        | Cost-saving possibility | Frequency of incidence | Effect on waste | Achievability of solution | Total |
|--------|----------------------------------------|-------------------------|------------------------|-----------------|---------------------------|-------|
| 1      | Web breaks between operation           | 6                       | 8                      | 9               | 6                         | 7.25  |
| 2      | Auto pasting of copies                 | 7                       | 9                      | 4               | 4                         | 6     |
| 3      | Incorrect presetting                   | 5                       | 7                      | 6               | 3                         | 5.25  |
| 4      | Inappropriate machine setting          | 4                       | 5                      | 4               | 7                         | 5     |
| 5      | Unbalance ink-water combination        | 6                       | 5                      | 4               | 7                         | 5.5   |
| 6      | Unsuitable dosing of fountain          | 7                       | 7                      | 5               | 4                         | 5.75  |
| 7      | Wrong roller setting                   | 7                       | 5                      | 7               | 8                         | 6.75  |
| 8      | Variation in cut off                   | 5                       | 5                      | 5               | 9                         | 6     |
| 9      | Irregular inking                       | 7                       | 6                      | 6               | 4                         | 5.75  |

2.5 Recommendations and implement solutions

The recommendations are suggested to avoid the root cause of printed waste. The improvement measures are developed by considering cost and effort aspects. The suggested improvement measures are shown in Table 2. The proposed improvement measures are implemented, and again data has been collected for ensuring the improvement in the process. The data is collected for one month after the improvement and represented by Pareto chart as shown in Figure 3, which shows the total waste as 853 Kg/month. The result shows that the quantity of printed waste is reduced significantly.

Table 2. Root causes of printed waste and suggested improvement measures.

| Sr. No | Root Causes of printed waste | Improvement Measures                                                                 |
|--------|------------------------------|--------------------------------------------------------------------------------------|
| 1      | Web breaks between operation | Check the quality of the reel before mounting on a machine for printing.             |
|        |                              | Develop standard operating procedures (SOP) for reel handling and stocking.          |
|        |                              | Regularly monitor the speed of the roller.                                           |
|        |                              | Develop SOP for daily maintenance, cleaning, and electrical maintenance.             |
| 2      | Wrong roller setting         | Develop SOP for roller setting.                                                     |
|        |                              | Regularly provide training to the operator related to machine handling and especially related roller setting. |
|        |                              | Develop the mechanism for monitoring the roller setting.                             |
3. Conclusions
The identification of the root cause of newsprint waste is more straightforward and systematically by using Cause effect matrix and Pareto analysis. In this study, various causes of newsprint waste have been identified and investigated root causes for newsprint waste. The suggested improvement measures have reduced the waste by 1303 Kg/month i.e. it helps to reduce the waste by 60.43%. The reduction in waste improves efficiency and reduces environmental issues. It can be concluded that training and operation awareness to operator with a practical waste management approach can help printing industry to maintain the newsprint waste at minimum level, which can further help to achieve the waste target of 3.5% or less can be obtained easily.

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