Recycling paper industry: Analysis of raw material consumption in Indonesia

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Abstract. The recycling paper industry has a good potential market. The industry used recycled paper such as Old Corrugated Containers (OCC), Old Newspaper (ONP), mixed waste paper, and Sorted White Ledger (SWL) as raw material. In Indonesia, commonly, the industry got the raw material of about 50% by importing. The government provides regulation to ensure the sustainability of the industrial activity, that is the process of importing recycled paper and internal regulation to increase local raw materials. The objectives of the research were to study the chosen raw material for the recycling paper industry and to analyze the positioning strategy of consumption raw material for the recycling paper industry in Indonesia. This research used a qualitative description method by the Analytical Hierarchy Process (AHP) and Strength Weakness Opportunities Threat (SWOT) analysis. The data were obtained from a questionnaire distributed to the paper industry, paper researcher, and relevant agencies. Based on AHP, the strength criteria to choose raw material is the regulation and availability of raw material with values 0.323 and 0.243; and the alternative chosen is recycled paper raw material import. The result of SWOT analysis, the recycling paper industry in Indonesia, has an Internal Factor Analysis Strategy (IFAS) 0.05, and an External Factor Analysis Strategy (EFAS) -0.03. That showed from SWOT quadrant matrix, the position coordinate point of IFAS and EFAS in quadrant II. That means the positioning strategy is diversification. The government, recycling paper industry, and relevant agencies to corporate to increase the collecting rate of recycled paper.

1. Introduction
The recycling paper industry has good potential in trading trends. From the Indonesia export data of the Harmonized System (HS), Code 4805 products showed a positive value level. Based on export data for the first quarter of 2020, HS Code 4805 paper products are higher than the first quarter of 2019. The export value for the January from April 2019 period was 0.1454 million tons, whereas in the same period in 2020 it was 0.3083 million tons [1]. Based on a press release on the official page of the Ministry of Industry Indonesia, the export value of the processing industry from January to April 2020 has a 7% surplus. The industrial sector contributes the largest foreign exchange from the food industry, followed by several other industries, one of which is the paper industry and paper goods [2].

The consumption of recycled paper for the recycling industry in Indonesia about 6.2 million tons. From the total consumption, about 2.5 million tons are from local. The rest is met by the imported...
recycled paper [3]. The reprocessing ability of recycled paper was investigated by Masriani [4]. The indicating, that the more frequently the fiber structure is recycled, the wettable will be reduced with a smaller swelling ability. If it is repeated to a certain extent the ability of the fiber to expand is reduced. The ability to recycle paper can be observed from a sharp area at the beginning refining on the formation parameters curve [4]. Fiber properties of recycled paper are limits on how many times recycled before decline [5].

The recycled paper raw materials import has a large composition [1] so that the dependence on imported recycled paper raw materials is quite high. In November 2019, the government conducted a review activity on the import regulations for non-hazardous recycled raw materials. This made the government suspend the importation of non-hazardous recycled raw materials [6]. The impact of the postponement of the importation of non-hazardous recycled raw materials has been felt by the recycled paper processing industry [7]. No recycled paper supply to Indonesia makes an inventory of industrial raw materials has a fairly short time [6]. This allows the recycling paper industry which raw material from import to stop production. An alternative that can be done is the industry decreases the number of production processes. The other impact is an increase in demand for local raw materials which makes local price recycled paper raw materials unstable [7].

The objectives of this study were to determine the strategy of procuring recycled paper raw materials in meeting the needs of the recycling paper industry in Indonesia used Analytical Hierarchy Process (AHP) and to analyze the strategy of the used recycling industry in the process of its activities by the position Internal Factor Analysis Strategy (IFAS) and External Factor Analysis Strategy (EFAS) in Strength Weakness Opportunities Threat (SWOT) quadrant matrix.

2. Method
This research used a qualitative method in analyzing the strategy for the procurement of recycled paper raw materials and the strategic position of the recycling paper industry consumption in Indonesia.

2.1. Data collection
The following data collection techniques are used in this research [8]:

a. Observation
   Direct observation in the recycling paper industry from November 2019 to February 2020. The object observed the recycling paper industry in West Java, East Java, and Central Java.

b. Interview
   Interviews were conducted on the problems faced in the fulfillment of recycled paper raw materials in the relevant sections of the recycling paper industry, they are the purchasing department, the production department, and the researcher.

c. Literature review
   Supporting data are taken from relevant literature for the research analysis such as journals, reports of industrial data of Indonesia, and online media.

d. Questionnaire
   Questions were distributed to 50 respondents with the classification of academics, researchers, paper industry practitioners, and policy-related agencies, and 20 expert respondents from a senior researcher, paper industry, and related agencies for policymakers for rating the SWOT analysis and AHP.

2.2. Data analysis
Research data analysis techniques consist of using (1) AHP and (2) SWOT analysis. The technique of determining the raw material for the recycling paper industry used AHP [9] was conducted by (a) setting goals, (b) determining criteria, (c) determining alternative options, (d) collecting data by interview and questionnaire, (e) recapping respondent data, (f) determining inconsistencies, and (g) determining of criteria that influence the achievement of goals.
SWOT analysis technique in importing recycled paper raw materials [10] followed several steps including (a) determining the statements of strength and weakness in the system for using imported recycled paper raw materials, (b) determining the statement of opportunities and threat in the fulfillment of recycled raw materials, (c) rating factor, (d) determining value that was carried out on 20 expert respondents with a level of direct reach to the selection of recycled paper raw materials such as the paper industry, senior researcher, and related agencies for policymakers, (d) recapping results from respondents by determining the score on 50 respondents, both internal and external factors in the fulfillment of raw materials for the recycling paper industry, (e) analysing internal factors and external factors and (f) determining strategy position of the SWOT analysis result.

3. Results and Discussion

3.1 AHP analysis of recycled paper raw materials consumption

Based on Figure 1, the AHP structure with five criteria for recycled raw material. Based on Figure 2, the results show inconsistency overall of 0.05. Based on the calculation, the criteria that have a high influence is government regulation in supporting the recycled paper industry of 0.323, then the availability of raw materials is 0.243. That means the industry needed to ensure raw material sustainability. Regulation support the industry to reduce uncertainty [11] and secure production activity of the recycling paper industry. The availability ensures the continuity of the production process. From the Chang research, the key factor to determine raw material is the availability of recycled paper [12]. Meanwhile, the criteria for price, quality, and impurity have each value of 0.183; 0.160; 0.091.

![Figure 1. AHP structure of raw material for the recycling paper industry.](image1)

![Figure 2. AHP result of criteria level.](image2)
Based on Figure 3, alternative imported raw materials have the highest value. This shows that in general, the raw material needs of the recycling paper industry are still fulfilled with imported raw materials. Yamashita’s research showed the collecting rate of recycled paper in Indonesia about 52.5%. That showed the consumption of the recycling paper industry in Indonesia supporting by import on a large scale [13]. The amount of raw material from local is not sufficient for the consumption process [7] [13] and alternative raw material such as nonwood [14] [15] needs to develop research technology.

**Figure 3.** AHP result of alternative level.

### 3.2 SWOT Analysis

The calculation result of the distributed questionnaire can be seen in Tables 1, 2, 3 and 4.

**Table 1.** Calculation of internal factors (strength) SWOT analysis.

| SWOT  | No.  | Indicator                                           | Rating | Score | Rating x Score |
|-------|------|-----------------------------------------------------|--------|-------|----------------|
| Strength | 1    | Availability of recycled paper import               | 4      | 0.121 | 0.484          |
|        | 2    | Quality of recycled paper import                    | 4      | 0.120 | 0.480          |
|        | 3    | Packing of recycled paper import                    | 3      | 0.135 | 0.405          |
|        | 4    | Regulation to support recycled paper import         | 3      | 0.120 | 0.360          |
|        |      | **Total**                                           |        |       | 1.729          |

**Table 2.** Calculation of internal factors (weakness) SWOT analysis.

| SWOT  | No.  | Indicator                                           | Rating | Score | Rating x Score |
|-------|------|-----------------------------------------------------|--------|-------|----------------|
| Weakness | 5    | Price of recycled paper import                      | 3      | 0.124 | 0.372          |
|        | 6    | Cost to process non-paper material from recycled paper import | 4      | 0.126 | 0.504          |
|        | 7    | Impurity of recycled paper import                   | 3      | 0.127 | 0.381          |
|        | 8    | Limit of order recycled paper import                | 3      | 0.127 | 0.381          |
|        |      | **Total**                                           |        |       | 1.638          |

**Table 3.** Calculation of external factors (opportunity) SWOT analysis.

| SWOT  | No.  | Indicator                                           | Rating | Score | Rating x Score |
|-------|------|-----------------------------------------------------|--------|-------|----------------|
| Opportunity | 1    | Availability of recycled paper local                | 4      | 0.122 | 0.488          |
|         | 2    | Research of raw material nonwood                    | 4      | 0.129 | 0.516          |
|         | 3    | Implementation of technology process non-paper material | 4      | 0.124 | 0.496          |
|         | 4    | Support of regulation for collecting recycled paper local | 4      | 0.119 | 0.476          |
|         |      | **Total**                                           |        |       | 1.976          |
Table 4. Calculation of external factors (threat) SWOT analysis.

| Threat | No. | Indicator | Rating | Score | Rating x Score |
|--------|-----|-----------|--------|-------|----------------|
| 5      | Increasing the collecting rate of recycled paper | 4 | 0.126 | 0.504 |
| 6      | Synergy and coordination of strategic sector | 4 | 0.127 | 0.508 |
| 7      | Research and implementation of raw material nonwood | 4 | 0.127 | 0.508 |
| 8      | Bargaining power of price of recycled paper local | 4 | 0.127 | 0.508 |
| Total  |     |           |        |       | 2.028 |

The priority strategy as seen in Table 5. The highest rank in quadrant matrix II. We can calculate IFAS and EFAS for plotted the positioning strategy on the quadrant matrix SWOT [8]. Coordinate point IFAS and EFAS (0.05,-0.03).

Table 5. Priority strategy based on SWOT analysis.

| Quadrant | Coordinate | Matrix Area | Rank | Priority Strategy |
|----------|------------|-------------|------|-------------------|
| I        | (1.729 ; 1.976) | 3.417 | 3 | Growth |
| II       | (1.729 ; 2.028) | 3.506 | 1 | Diversification |
| III      | (1.638 ; 1.976) | 3.237 | 4 | Turnaround |
| IV       | (1.638 ; 2.028) | 3.322 | 2 | Defensive |

Figure 4. Quadrant matrix SWOT analysis.

Based on the calculations, it is found that the recycled paper raw materials in Indonesia are in the quadrant II position. The strategy position from the calculation is Strength-Threat (ST) in quadrant II. ST strategy uses the strength from the advantage of import recycled paper raw material and maintenance of the threat [8]. This states that there needs to be a diversification step towards alternative local raw materials. The material used local paper raw materials and local nonwood raw materials with the support of government regulations for the recycling paper industry in Indonesia.
The collecting rate of recycled paper increased by regulatory support [11]. It threatens downgrading quality such as high moisture content and unusable [16]. The regulatory to promote recycling paper many environmental benefits [16], to be economically sustainable [12], to increase environmental awareness [17], and to design policies recycled paper [11]. Liu’s research suggested for the policymaker to make relevant policies and specifications of the recycling industry [18].

3.3 Recommendation
The collected paper raw materials in Indonesia is generally fulfilled from recycled paper import. Based on observation data the use of the imported raw materials is prioritized for products with high strength requirements. Research shows the freeness value of the imported recycled paper is higher than the local recycled paper. Its because the Double Sorted Old Corrugated Container (DSOCC) imported recycled paper has a good quality level and OCC from product packaging paper for high performance. So that the recycling rate of fiber is still very good [4]. Another reason is the security level of the availability of local raw materials which is not sufficient for the processing capacity [7] and collecting rate of recycled paper in Indonesia [13].

From Masriani’s research, recommendations to use endoglucanase in refining top layer recycled paper product. Endoglucanase reduces the refining time by up to 50% so that it will reduce costs. Masriani found the refining process can be shorter and the fiber adequate for the bonding process [19]. The properties of local recycled paper can maintain with the addition of endoglucanase in the refining process. AHP and SWOT analysis are regulatory support in meeting raw materials. that’s policies and the provision of local raw materials. Regulatory local recycled paper to increase the collecting rate by promoting the recycling of used products [11]. The government can be supporting nonwood raw materials from research results to implementation to industrial scale. Based on Kardiansyah’s research, Oil Palm Empty Fruit Bunches (OPEFB) can be used as raw material for cartons[14] [20]. Kardiansyah’s research [15] also analyzed the ability of other nonwood raw materials, kenaf, as other papers product. Wirawan research used additive xylan and Carboxymethyl Cellulose (CMC) to improve the quality of local recycled paper [21] [22].

Recycling sustainability contributed to many aspects [23]. Awareness of the recycling paper of consumers can be contributed to an increase in the collecting rate of recycled paper. The government, consumer, and recycling paper industry can collaborate for the sustainable recycling system [13]. Subsidizing the recycling paper industry to promote the economic sustainability of the recycling paper industry [23].

4. Conclusions
Based on the AHP, the criteria values in determining recycled paper raw materials are regulations, availability, price, quality, and impurity with each value of 0.323; 0.243; 0.183; 0.160; 0.091. The alternative raw material is chosen from import recycled paper. Supported by SWOT analysis, recycled paper raw material import, the positioning strategy in quadrant II, diversification. The government to support alternatives besides recycled paper raw materials import. The government and relevant agencies to corporate through the support and regulation of raw material for the recycling paper industry in Indonesia.

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