

## Research Article

### Study on the Recycling Logistics System Based on Waste Materials

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**Abstract:** This study mainly focus on waste books, reflecting the whole process of the recycling logistics system of waste materials and how establishing through the waste classification, recycling, regeneration and other steps. As the consciousness of environmental protection strengthened, environmental problems cannot be ignored. The recycling logistics system will be improved in the society advancement. From the point of enterprises, technology and recycling logistics of waste materials, the environmental protection and sustainable development will be realized through the improvement of the process.

**Keywords:** Environmental protection, recycling logistics

#### INTRODUCTION

China exist three laws based on generated sources, which are 'Law of Prevention of Solid Waste Pollution of People's Republic of China', 'Law of Promoting Clean of Production People's Republic China' and 'Provisions of Garbage Management of Urban Household'. Because waste materials logistics is not only related to logistics enterprise and waste producers, but also directly related to economic and social benefits. According to the relevant information, Chinese principle is "who pollution, who management" towards the waste treatment, in other words, "pedestrian minding". Zhang (2004) give a study and analysis on waste logistics in china. Hu and Shi (2011) study the development and reflections on waste logistics in the environment of the internet of things. Li (2009) study the new perspective of waste logistics. Zhong (2011) make a discussion on rural waste logistics management. Chen (2010) analyzes the Waste Logistics and its Countermeasure. Dong (2010) makes a research of the waste logistics management in China: problems and countermeasures.

In this study, we focus on waste books, reflecting the whole process of the recycling logistics system of waste materials and how establishing through the waste classification, recycling, regeneration and other steps. As the consciousness of environmental protection strengthened, environmental problems cannot be ignored. The recycling logistics system will be improved in the society advancement. From the point of enterprises, technology and recycling logistics of waste

materials, the environmental protection and sustainable development will be realized through the improvement of the process.

#### WASTE MATERIALS LOGISTICS

**The introduction to waste materials logistics:** According to the national standards, waste materials logistics is that merchandise loses the original use value and is distributed to the special area, finally to form the entity flow under the following activities-collection, classification, package, processing, handling and storage.

**The reason of waste materials logistics:** Under social activities of the production, construction, daily life and so on, items are produced and circulated to some consumption fields.

In this process, waste stone, waste residues, waste gas and waste water are produced during the production is separated from the normal use or valuable goods.

Some of these goods can recycle and reuse, however, the others lose its value, which mean they will not be able to recycle and can only carry on the landfill and fire and finally they will be turned into the waste. In the waste materials, the part of goods is called waste materials logistics.

**The process of waste materials logistics:** At present, there are some logistics methods to process waste materials in China (Table 1).

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Table 1: Logistics ways to process waste materials in China

Method	Scope	Feature
Landfill	Harmless to groundwater by solid waste	Not form a yard, not cover an area, not pollute the environment in the open, prevent odor
Waste incineration	High organic matter content spam	Prevent pollution, germs and pests not breed
Garbage dumps	Pollution of waste	Distances, garbage without further processing, reduce costs
Purification processes	Waste water and waste materials	A good social benefits, the input-output ratio of circulation processing of purification is very low

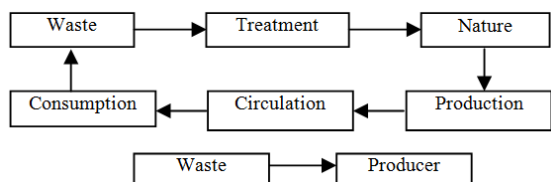


Fig. 1: The flow of recycling logistics

### RECYCLING LOGISTICS

**The introduction of recycle logistics:** Recycling logistics is a kind of entity flow from the buyer return to the supplier that unqualified goods are repaired, returned and packaging containers in working capital uses.

**The reason of recycling logistics:** The reasons of recycling logistics which enterprises introduce into are as follows:

- Goods returned for access to compensation or refunds
- Return of short-term or long-term leaseholds
- Return to the manufacturer for repair and remanufacture or core parts of return of products
- Recycled containers
- Call back second hand
- Send products to special organizations to upgrade
- Universal products recall

**The flow of recycling logistics:** Figure 1 shows the flow of recycling logistics.

### WASTE BOOKS PROCESSING FLOW AND RECYCLING TECHNOLOGY OF WASTE PAPERS

**Laser phototypesetting technology and selection of printing papers:** Laser phototypesetting technology is to exposure generated latent image in the film by photoelectric conversion of laser phototypesetting machines.

It was promoted in the late 1980 in China, accompanied by the emergence of Chinese characters input system.

The first application of this technology is the newspaper. Digital technology and text input method are applied to PC to edit graphics.

Then, laser phototypesetting technology turns these into the film for the print. This greatly shortens the production cycle, improves the efficiency of publishing and increases the speed of information response.

The papers selection is a science in regulation to the print. The different papers applied to different publications:

- **Letterpress paper:** It is mainly used for the letterpress book and magazine paper and can be divided into four levels (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup>) according to the paper material composition ratio. The number of paper represents the quality level. Tuba is the worse quality. Letterpress paper has the characteristic of ink-absorbing. It is uniform texture, lint free, slightly elastic, opaque, slight water resistance and a certain mechanical strength.
- **Newsprint paper:** It is also called newspaper, mainly used for books and newspapers. Newsprint paper has the characteristic of soft, full of good elasticity, good ink absorption properties. Lint, a certain mechanical strength, lack of transparency and good performance, it is suitable for printing by high speed rotary press. There is a large amount of lignin and other impurities with mechanical wood pulp as raw material to produce.
- **Writing paper:** It is also called cover paper. There is the added color of gray, blue and beige when making.
- **Dictionary paper:** It is an advanced thin paper for books and periodicals. With the characteristics of thin and high strength folding, white and meticulous, slightly transparent, a certain degree of water resistance performance, the dictionary paper is mainly for the print of dictionaries and classic books, which have a number of pages and easy to carry. Dictionary paper has higher requirements on pressure and ink in the print process so that it needs special attention in the print process.

These four kinds of paper above are commonly used for printing publications. And there also have offset paper, coated paper, art paper, embossed paper, writing paper made from bamboo, writing, typing paper, stamp cover paper, copy paper, craft paper and so on.

These papers have their own characteristics, namely apply to different parts of our life.

**Analysis of the recycling process and manufacturing techniques for waste books by simulation software:** The details of recycling and regenerating process for waste books are shown in Fig. 2.

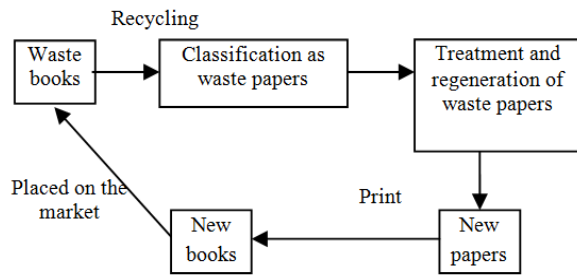


Fig. 2: The recycling and regenerating process of waste books

It describes a process of a new piece of paper from the waste one to the new one and to the waste one.

We realize that it belongs to “single desk queuing system simulation” using Witness 2007. The recycling and regenerating flow of waste paper in Witness2007 is shown in Fig. 3.

The queuing system is a typical problem in discrete event systems. The manufacturing system, production system, service system, repair and maintenance of

equipment, transport and materials material management system are typical of a queuing system, no matter how tangible or intangible.

In this study, the queuing system is the recycling and regenerating process of waste papers applied to production lines. It is like the processing pulp on the production line, from recycling to classification, waiting for regeneration. The arrival size of waste paper is a single arrival. The arrival rate is  $A_i$ , subject to the index distribution and the mean value for  $\beta_A = 5$  min, that is:

$$f(A) = (e^{-s/\beta_A}) / \beta_A \quad (A \geq 0) \quad (1)$$

The processing time of waste paper recycling is  $S_i$ , subject to the index distribution and the mean value for  $\beta_s = 4$  min, that is:

$$F(S) = (e^{-A/\beta_s}) / \beta_s \quad (S \geq 0) \quad (2)$$

The waste paper eventually reaches the production line to complete the paper recycling process through the queue for processing.

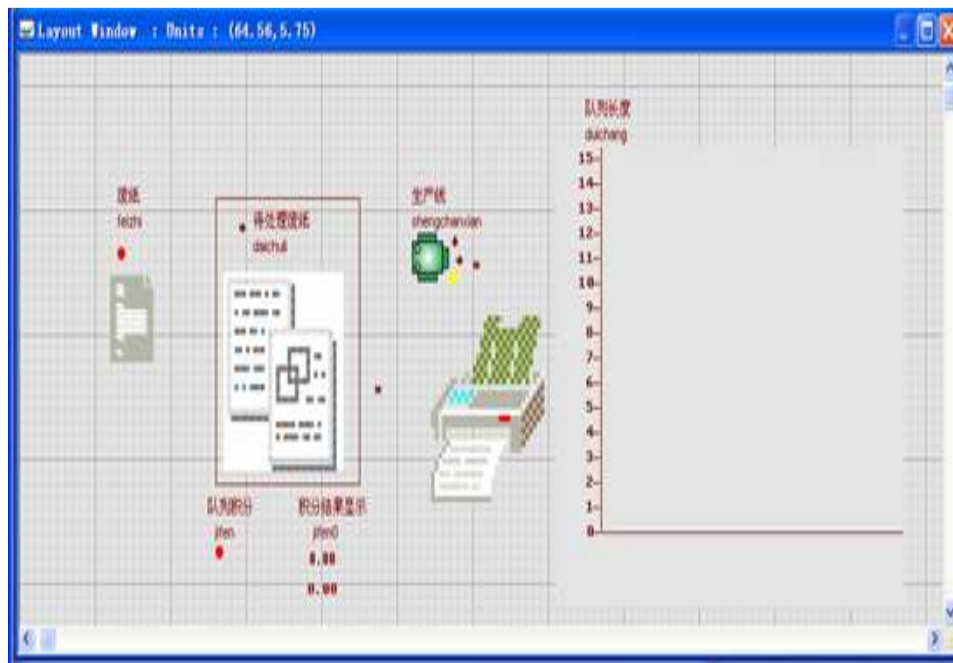


Fig. 3: The recycling and regenerating flow of waste paper in Witness 2007

Name	Total In	Total Out	Now In	Max	Min	Avg Size	Avg Time	Avg Delay Count	Avg Delay Time
daichuli	988	988	0	20	0	2.74	13.89		

Name	Plot	Mean	Standard Deviation	Min Value	Min Recorded At	Max Value	Max Recorded At	Observation Index	Observation Value	Observation Time
duichang	2	0.6500	0.4770	0.0000	5.0000	1.0000	25.000			

Name	Plot	Mean	Standard Deviation	Min Value	Min Recorded At	Max Value	Max Recorded At	Observation Index	Observation Value	Observation Time
duichang	1	0.3500	0.6538	0.0000	5.0000	19.000	410.00			

Fig. 4: The simulation result

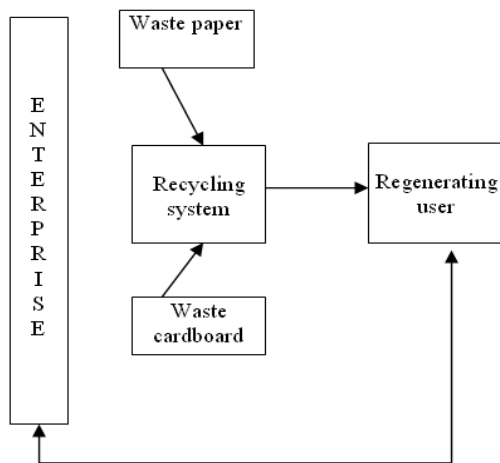


Fig. 5: The recycling and regenerating process of waste papers

The default time unit is 1 month in the simulation clock, running 5,000 simulation time units, to get the integral result according to the dynamic table (Fig. 4).

In addition, I also use network resources to find the recycling and regenerating system of waste paper and waste cardboard in related businesses (Fig. 5).

**Business process reengineering:** Process reengineering rebuilds a new flow on the enterprise's existing process for investigation and analysis, diagnosis and design. BPR is known as business process reengineering.

BPR emphasizes on the business process for the transformation object and center. With the target of concerning the customers' needs and satisfaction degrees, existing business processes for fundamental rethinking and radical redesign. Making use of advanced manufacturing technology, information technology and modern management tools, maximize the integration of technical features and management functions. Breaking the traditional and type functions organizational

structures, eventually a new is rebuild. Thus, it will great improve cost, quality, service and speed in the way of enterprises management.

BPR includes of idea reengineering, process reengineering, organization reengineering, pilot and switch and achievement of the perspective target.

**Firstly, the idea is reengineered:** So-called idea reengineering is what human beings have to set a concept of thinking, as a whole, the correct, long term and brand new recycling logistics system.

The logistics system must adapt the needs from now to future society for a long time. It can meet the requirements of people desiring waste research on their side. Thereby, a separate and recycling system is created, can sort and reprocess the waste which we abandoned and ultimately achieving the recycling targets. In other words, this is an idea that we need to build such an imaginary space and work hard to create it.

**Secondly, process reengineering:** According to what we have in process, on the basis of investigation and analysis of the existing waste-processing equipment, realizes advantages and disadvantages of this existing recycling equipment. Analysis and diagnosis of their shortcomings after a redesign see whether these shortcomings or deficiencies to remedy those deficiencies being improved and then rebuild the new process system.

As waste books, for example, process reengineering requires us to break the traditional idea that the existing books read becomes waste papers. Establishing a new classification and recycling and circulatory system, the waste papers will be in the state of decomposition and regeneration, in order to have the opportunity once again to contribute to the creation of new papers and new books.

**Thirdly, organization reengineering:** It is necessary to evaluate and reform the organization structure prior to implementation of the new design process, including human resources and technology.

In other words, we need adjust the personnel appropriately, meanwhile the technology to improve. Improving overall staff's cultural level of science and technology needs the introduction of high-tech talent and pre-job training of its backward technology personnel in order to adapt to new environment and application.

**Fourthly, pilot and switch:** So-called pilot is to test new processes and debug new equipment in a small area, seeing these new production and processing methods whether meet the social development needs.

They are replaced and improved for not proper places or the concept and practical application being great different in the process of reconstruction, adapting to the production processing mode in the new environment.

**Finally, it is to achieve the perspective target:** The subject of recycling and regenerating of waste books lies in improving and reengineering technology-environmentally to achieve sustainable development and social benefits, economic benefits and environmental benefits in the way of green and environmental protection.

### CONCLUSION

A series of data are acquired about the reaching characteristics of waste paper processing, the queue system of maximum, minimum and average, as well as the waiting time by study of the recycling logistics system of waste books.

To draw the conclusion: the line length and layout design affect efficiency improvements of the product directly. Under the conditions of the same number of machines, simulation improved by Witness 2007, the recycled paper processing speed is increased of 5-10% than the actual application.

The discussion on establishment and development of the recycling logistics system of waste materials in today's society, it is to awaken people to raise

environmental awareness, strengthen ecological environment construction, effective use of resources around and maximize the value to human beings.

Enterprises involved are introduced in the recycling logistics industry of waste materials through efforts. It is important to disposal of waste proper, with sustainable ecological perspective, to improve our living environment, to end the continuing situation in China as soon as possible "pollution first and treatment after", truly to achieve a good result of industrialization, reduction, decontamination and resources in this way.

The resources recycling and economy circulating will be the Chinese development trend.

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