

1. Analysis on Wastepaper Recycling System of Developing Countries Arising from Model Reference Adaptive Theory

モデル規範適応理論に基づく開発途上国の古紙リサイクルシステムの分析

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ABSTRACT; The present study investigated the features of wastepaper recycle system for the adaptation policies of developing countries based on Model Reference Adaptive Theory. When we intend to seek the wastepaper recycle system, it is therefore very important to investigate a number of paths that converge the sustainable development environment. Bangkok is facing the problems related to the waste disposal because of the limited capacity of incineration, composting plants, and only few open dumping sites. This study aims especially to inform business leaders, wastepaper suppliers, and pulp and paper manufactures to cooperate and set up an office paper recycling scheme for the manufacturing of new paper products. Manufactures in Thailand often face shortages in imported wastepaper. It would be desirable to increase the domestic wastepaper supply not only for the economic benefits but also for the environmental benefits as well. With the depletion of natural resources occurring throughout Thailand, the reduction of the use of natural resources would be a positive thing for Thailand environment.

KEYWORDS; Model reference adaptive theory, Wastepaper, Recycle, and Thailand

1. Introduction

Bangkok, the capital of Thailand, is a city of approximately six million people with an area of 1,568.74 square kilometers. Like most big cities in the world it has its share of drawbacks, namely, heavy traffic congestion, housing shortages, unemployment, and environmental pollution.

One of the biggest environmental problems in Bangkok is solid waste disposal.

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According to the Bangkok Solid Management (SWM) Master Plan, the amount of solid waste generated (on collection basis) in Bangkok per day is estimated to reach 8,700 tons in the year 2000. At present, the solid waste generation rate in Bangkok is 0.86 kilograms per capita per day. However, if this current trend continues, the actual volume of solid waste generated will exceed the estimated 8,700 tons per day.

This is an average annual growth rate of 8.256%. If this rate continues, the solid waste generated volume will be 11,000 tons per day in the year 2000 and 120,000 tons per day by the year 2030.

According to the SWM Master Plan, about 47% of the collected waste was residential waste and the remaining 53% was from businesses and other sources. Business waste increased by 5.5% annually which is greater than the residential waste that increased at a rate of 3.57% per year. If these rates continue, business waste will be 60% of the total waste generated volume by the year 2000 and 70% by the year 2030. This implies that the increase in business waste is a greater problem than the residential waste.

2. Model Reference Adaptive Model

When we intend to seek is the sustainable environment based on the reasonable value decision criteria. It is therefore very important to investigate a number of paths which converge to the sustainable environment and investigate the adaptation policies of the systems and its stability based on Model Reference Adaptive Theory (Yamamura, 1977, 1979, 1980, 1983, 1985, 1986, 1989a, 1989b, 1990, 1991a, 1991b, 1992a, 1992b, 1993, 1998, 1999, 2000; Yamamura and Thirumurthy, 1996).

The model takes the sustainable environment to be based on the reasonable value decision criteria as a reference model and the actual environment as adjustable model.

According to the comparison of these two environments, there are four models of adaptation of the actual environment to the sustainable environment.

The primary model is parallel model. This model considers the adaptation policy which is adaptable to sustainable environment by direct comparison between the two environments.

The second model is a series model. This model introduces a reasonable environment standard into the environment straightway, and the model considers the adaptation policy which is adaptable to sustainable environment in the actual environment. The actual environment faces rapid collapse, and in this model, the stabilizing of actual environment must be immediately attempted by the introduction of reasonable value decision criteria.

The parallel series and series parallel models are in the middle of above-mentioned models.

The third model is parallel-series model. This model is based on the correction of adaptation policy with the maximization of development and environment by the sustainable

environment. Moreover, this model is the case of adaptation's being possible to the sustainable environment into the actual environment with either adaptation policy with the maximization of development or environment.

The fourth model is a series-parallel model. In this model, both adaptation policies with the maximization of development and environment are defined as unstable. Moreover, this model is in the case of adaptation's being possible to the sustainable environment into the actual environment with both adaptation policies with the maximization of development and environment.

It is important to note that the actual environment is to become the effective circulation when thinking of adaptation policies by these models.

3. Office Paper Recycling Potential

Questionnaires were done in the central district of Bangkok. The office wastepaper collection activities in the Bang Rak district of Bangkok were the main focus of the questionnaires. Questionnaires were distributed by hand to relevant business offices located along Silom Road and Surawong Road from August 9th to August 21st, 2000. The number of sampling offices was 100 and the types of businesses were divided into 5 types. These were development stores, general business offices, (excluding banking, finance and insurance offices), hotels, banks, finance and insurance offices, and others. Distributing questionnaires by hand was a very time consuming project but an effective method. All of the questionnaires were returned. The questionnaires were returned with the name of the company, its telephone number, and a contact person.

From the acquired questionnaires, the main results were summarized as follows;

1) With regard to the importance of office paper recycling, 98% of the questionnaires indicated that recycling is important and it should not be ignored. The reason that recycling is important are: ①to decrease the amount of solid waste (35%), ②to conserve the natural resources (27%), ③to protect the degradation of the quality of the environment (26%), ④people should give more attention to this topic (8%), ⑤lessen the operating cost of the office (3%) and ⑥to maximize paper utilization (1%).

The remaining 2% replied that it is not important for them to do office paper recycling because they do not have that much wastepaper to recycle.

2) The question regarding the amount of attention that the office gives to collecting wastepaper showed that 71% of the sample paid some attention, 16% paid a lot of attention, and 13% did not pay attention at all. This implies that it might be possible to introduce some sort of office paper recycling scheme into many offices.

3) With regard to the question of what the offices are doing with their paper, the results showed that 44% of the offices were selling and reusing their wastepaper 25% of the offices were reusing their wastepaper only. The others were contracting their wastepaper to a cleaning company. This wastepaper was sent to the central solid waste management system of the building. This shows that the offices were concerned about the reduction of the overall paper costs in their business.

4) In the offices that are only selling wastepaper, 49 offices were contacted by minor wastepaper buyers or garbage peddlers, 7 offices contacted wastepaper buyers, and 8 offices commissioned housekeepers to handle the wastepaper.

5) With regards to the separating situation of the wastepaper, 46% of the offices were separating their wastepaper. The remaining business was not separating their wastepaper. Of the remaining 54%, 68% of them indicated that it is not a necessary for them to separate their wastepaper. 32% think that there is a necessity to do so. The reasons not doing so were ①they have no time to separate it (18%), ②they have only one type of wastepaper (11%), ③they have no staff to handle it (10%), ④they do not have that much wastepaper (10%), ⑤they do not know how to implement a paper recycling scheme (3%), and ⑥wastepaper buyers are already sorting the paper for them.

6) The reasons why it was necessary to separate wastepaper in the future are that ①it will be easy to recycle (16%), ②officers can reuse it easily (10%), ③the amount of solid waste will decrease, ④it is good for natural resource conservation (3%), and ⑤lessen the operation cost of the office.

From the total estimation amount of generated wastepaper, it shows that wastepaper from general business, banking, finance, and insurance more that 65% of the total amount is from this group. It would be productive if this big amount of wastepaper was collected.

According to the results from the calculation, the generated wastepaper amount from the business offices can be applied to the overall Bangkok area. The total estimated buildings in the Bangkok area were 135. This is equal to 2,700 offices. The general business offices generated about 6,072 tons of wastepaper per year. While banking, finance, and insurance offices generated about 7,885 tons of wastepaper per year.

Therefore, the amount of wastewater from business offices in the Bangkok Metropolis and the Bang Rak district was bout 20,260 tons per year in 2000. This is 2.4% of the total amount of wastepaper consumed in Thailand in 2000.

4. Conclusion

In Bangkok, implementing an office paper recycling scheme can be tried out by present office staffs. As far as the limitation of time and the number of staff to take over the scheme, it is possible to adopt even a desktop separation plan to be used in the office. This way wastepaper will be separated into higher grades and will maximize the value of wastepaper and lead to the lowest level of contamination. This can easily be incorporated into office systems. Each participant will receive a small desktop container where they can place recyclable paper. When the container is full, it is emptied into a central collection container by the participant or the cleaning staff on a daily, weekly, or occasional basis. Thus, desktop separation can be done without taking any more extra staff members.

At present, there are some offices that are now separating and reusing recycled paper products. These offices should be illustrations for other offices to follow. An increase in the office wastepaper recovery rate is easy to achieve because the waste is clean and centrally located. The lack will of the business and commercial office's decision makers to initiate a recycling plan are two main factors influencing office paper recycling. There are numerous instances of good schemes that have been implemented in other countries. To introduce an office paper recycling scheme into a business, it is necessary to find the most appropriate collection and separation system in these offices. A suitable recycling system would be one that meets the requirements of the offices and produces different grades of recycled paper for the offices to use.

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