Establish Performance Assessment Mechanism For Reverse Logistic Of Leather Industry By Cost-Benefit Approach.

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Abstract: Leather manufacturing process , it must be added to many chemical agent, the agent in the manufacturing process, resulting in many a certain degree of environmental pollution of waste water and solid waste damage, so the industry needs to invest a lot of cost for treating wastewater, solid waste, sludge, etc., in order to comply with government regulations and reduce the negative impact of pollutants on the environment.Sludge disposal costs historical data of the present study through Case Studies manner, set and aggregate cases in leather manufacturing process generation, the use of cost-benefit analysis (Cost Benefit Analysis), case studies, expert interviews, and included zero the concept of waste policy (Zero waste strategy) and build cases companies collect sludge treatment effectiveness evaluation mode. The study noted that in case the company currently produces a monthly scale of three million square feet, and sludge removal costs in the second half of 2015, twice as high prices soaring, companies should purchase the case of sludge treatment equipment manufacturer to load the factory the leather sludge, expect this study to provide the leather industry manufacturers and high-end managers understand the leather industry in the future solid waste treatment cost-effective reference.

KeyWords: Zero waste strategy, Cost Benefit Analysis, Environmental Pollution, Leather Industry, 3R

1. INTRODUCTION

The papers will be Taiwan's leather industry as the research object , through reading relevant literature and organize , and explore the environmental pollution caused by leather industry , the use of the concept of zero solid waste , solid waste discuss these one by one if there is the possibility of reduction or recycling resistance, thereby reducing final waste generation ; and further use the occasion of the enterprises to implement zero waste concept , the use of cost-effective method to explore the best mode of implementation of solid waste handling equipment , in order to assess the performance of solid waste processing apparatus of embodiments .

Solid waste collection equipment through implementation of the company's current case -related information , such as investment in manpower, equipment , energy and other expenses and benefits Gudingchengben outside , further cost-benefit analysis in order to investigate the case and sensitivity analysis company imported solid waste the optimum processing apparatus relevant reference scenario , cost - number - benefit (CVP) assessment methodology to compare the proportion of the cost of processing equipment in different situations , presented for decision makers to assess the manner in which the case the company is profitable decisions . In this study, cost-benefit analysis in Leather Industry solid waste processing apparatus for operating affect the performance of the way , hoping to achieve the following research purposes :

(1) Consolidation and integration of enterprise solid waste processing way cost information , such as: investment funds, manpower , equipment and supplies , removal costs and other related costs and benefits.

(2) Build solid waste treatment effectiveness evaluation mode.

(3) Build four solid waste treatment options are compared and validated.

This article will use research methods including cost -benefit analysis and sensitivity analysis. Hereby follows :

(1) Cost-benefit analysis (Cost Benefit Analysis): a mathematical model of the cost of solid waste disposal equipment from consumption of imported cases for analysis ,

the costs associated with aggregated information , and then to explore the cost-benefit analysis of cases currently implemented approach, whether the company has helped .

(2) Sensitivity analysis (Sensitivity Analysis Method): sensitivity analysis based on the selected parameters as a result of this change of sensitivity analysis , use this parameter to change the test case when companies use any of its programs , the benefits are obtained biggest. The last case control programs implemented by the company at present , to give the most appropriate advice company cases , and discuss the case when the company adopts recommendations of this study , it may be required to change the place, do research to improve in order to achieve practical and substantive verification benefit.

2. DISCUSSES THE LITERATURE

This section will be based on literature , introduces the current status of the leather industry , secondly introduces the concept of zero waste strategy combines environmental 3R further explore the cost-effectiveness of the investment after the implementation of zero waste and get it .

2.1 Leather Industry Overview

Leather Industry Department of the leather industry by " tanning industry " and "leather products industry ." The two have formed, the tanning industry is mainly taking raw hides and skins processed tanned mature leather and leather products industry is based on cooked made of leather into processed products .

Activity-based database product benefits noted wet blue leather (Wet Blue, WB) costs accounted for the total cost ratio , from 60% in 2010 rose to 70% in 2011 and to continue during the first half of 2015 , showing an annual rise trend.

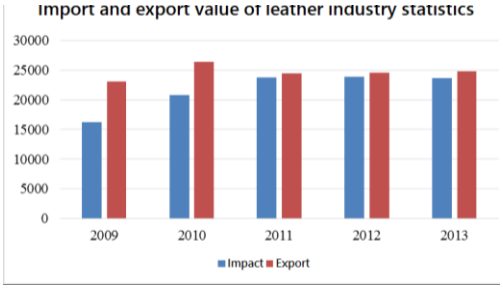

Figure 1 Leather industry import and export value (Unit: NT $ million)

From Figure 1 that Taiwan leather industry in 2008 the value of exports , sustained by the steady growth since 2009 , with more than 25,000 total export value of one million yuan (25 billion) in 2010, imports are also simultaneously affect trade practices has increased steadily

2.2 Leather process wastes

Leather in the manufacturing process will be added chromium salts , dyes, synthetic tannins and other chemical materials , such as leather industry , although the high value-added industry , relative to its waste water and solid waste gas pollution intensity is substantial , and the leather industry is toxic one institutions 15 categories of industrial waste tube , so the industry must do the proper waste water and solid waste treatment , otherwise there will be fines and criminal responsibility .

Any leather complete the manufacturing process should include (1)Water treatment field (2)Tanning process , re -tanning, dyeing (3)Greasing process (4)Finishing process. The four-part deal with finishing treatment.

Leather according to their different uses of the unit and the formula used in the process may vary , the main source of solid waste generated by the leather industry can be broadly divided into three categories :

(1)Leather tanning process through the trim,cut in sand and other procedures produced cut,side leather and so on.

(2)Inorganic sludge generated from the wastewater treatment plant.

(3)Plastic and other waste oil and oil and grease separator cut in the process of arising.

(4)Waste output unit of the circumstances of each process.

The main sources of waste dander tanneries are: cut meat scraps, crumbs edge of the skin and skin powder. Wherein the cutting meat scraps chromium-free , it can be made direct use of plastic oil , industrial oil , etc., and pink skin and scrap edge of the skin due to the presence of Cr in , you must first treatment before re-use .Waste treatment of dandruff are: landfill , incineration , pyrolysis and the like.

Leather most important source of sludge generated in the process of hair removal, ash removal , chrome tanning process. Without cause secondary pollution of the environment , coupled with Taiwan's land is small, the final disposal of sludge in general tend to be resource recycling ,the more common approach are: health buried , marine dumping , composting , incineration. " Dander " generated by the leather industry , in the tanning process , only 20% of the weight of raw hides matter into leather can be sold , the rest are discarded as waste .

Thus, the " tannery waste recycling " has become an important topic of concern at home and abroad , Chinese scholars have also developed the use of leather, chrome leather waste Preparation of solid amino acid chelate method (Rom Star , 2013) .

2.3.1 Zero Waste is defined

Zero Waste means a product in the design and management of the program , to reduce the generation of waste and resource conservation and recovery of all resources.

In the consumer sector is the adoption of zero spam policy , the implementation of reduction, reuse , recycling , composting , buy products , recyclable or compostable material non-toxic products .

In order to achieve zero-waste goal , you need a clearer definition of the relevant regulations and the implementation of the principles as follows :

1.The waste can be safely and effectively be recycled , treated or re- manufacturing environment or may return to the market

2.Reduce waste generation and the environmental impact caused by the end of the process , but also to manage the source of the start, from the relevant reduction, re-design , re-use , refill , regeneration, recycling, repair , compost , etc., to achieve resource recovery efficiency.

3. Application of re- production and distribution systems produced by the prevention of waste , reducing a significant impact on the global environment , bring more security well-being of the planet toward ecologically sustainable.

2.3.2 Development of the concept of zero waste

June 1992 United Nations convened the " The United Nation Conference on the Human Environment " in Rio , Brazil. The meeting proposed " Agenda 21 " and then can sustainable development strategy , which examines issues concerning proper handling of waste , contains several important policy: "Waste minimization quantization", "Maximize waste recycling and resource recovery" , " Furtherance of the proper treatment and disposal of waste"

The so-called "Zero waste society"that the establishment of a " Recycle - Oriented Society" ,instead of " Throw-Away Society ".

2.3.3 Zero Waste model combining environmental 3R

2014 Jinhui Li , who had proposed a zero waste through the implementation of the concept and the steps shown in Figure 2(Jinhui Li，2014)

In order to minimize the inevitable increase in all kinds of waste , waste of modern society and the misallocation of resources and low efficiency performance. Any waste generation , including waste energy, water depletion , land , waste also represents increased pressure on the environment caused by the soil , environmental pollution , will eventually be back to virtually a tremendous additional economic costs to to preempt the damage caused by solid waste.

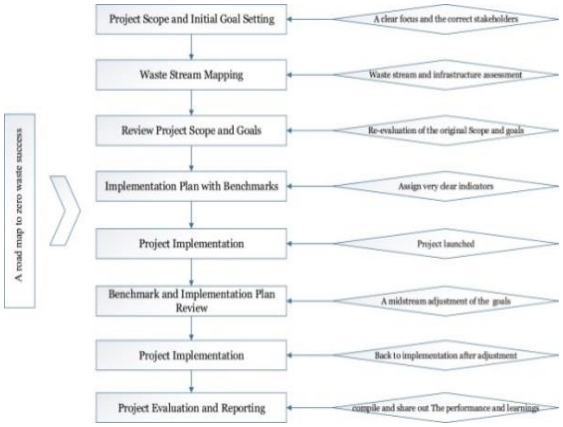

Figure 2 conceptual view of the implementation of Zero Waste

If you have to consider environmental factors in product design to the output of the process, it will be called Environmental logistics .The core concept of green logistics scholars in turn , that is environmentally friendly 3R-Recycling, Reduce, Reuse binding target of zero waste concept , and adding raw materials with periodic linear model, shown in Figure 2-10 .

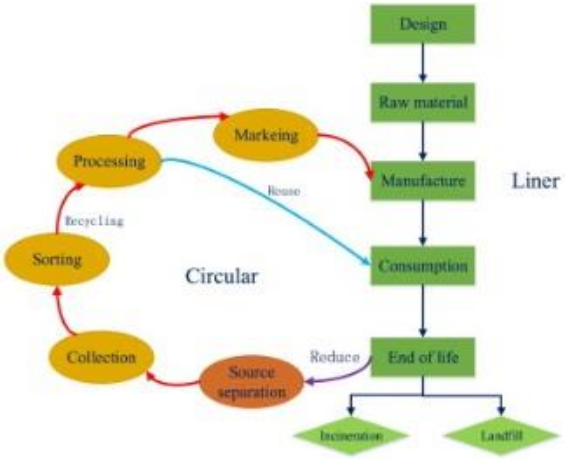

Figure 3 linear relationship between the flow of raw materials and cyclical

Figure 3 can be learned from the online resources of the periodic flow , you can explore from a manufacturing point of view and two logistics .

(1) Manufacturing surface

(2) Logistics plane

If companies want to logistics, must integrate these two parts, and strengthen personnel training , enhance the speed and efficiency of information transfer . Executives are leading all decisions , so executives subjective awareness about green logistics is an important basis for implementation.

2.3.4 Green logistics model

To implement enterprise logistics, industrial characteristics of enterprises, implementation of the objectives , policy development , etc. are from , these reasons will affect the business model imported .

Green Logistics program has many players, and these players exist in the supply chain , the supply chain is divided into upstream, midstream, downstream three different levels .Participants will be different levels in different activity, such as the upper layer (raw material suppliers, parts suppliers) will be selected raw materials , renewable raw materials and recycling (Van Hoek, 1999). Information Table 1.

Green Logistics focuses on the value of the production process of waste recycling, has been manufacturing and use of raw materials in the product recovery , the products have been sold in the production process may impact on the environment is minimized , or product fixes are included in the green Category logistics. As shown in Figure 4

Table 1 Green Logistics and the program participants

	upstream	midstream	Downstream
Players	Raw material supplies Parts supplies	Main suppliers Manufacturers	Wholesalers Importers/distributions Retailers
Green activities	Materials selections Re-use of material	(Design for) dis-assembly Scrap, shred Transportation	Packaging Returns handling Returns shipment
Relation performance measures	Emission rates and energy efficiency per material % of virgin material	Volume of goods dis-assembled per hour Degree of utilization transport equipment	Amount of “air” in package Volume selected for recycling

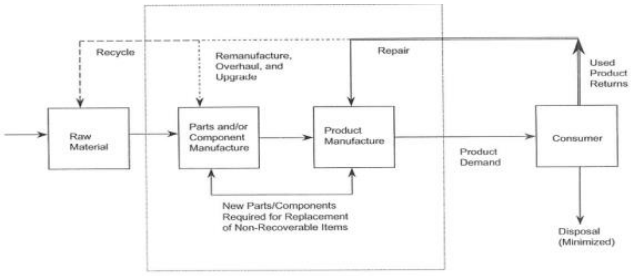

Figure 4 Green Logistics value of recycling

Implementation of green logistics , in addition to have an impact on the overall supply chain , also contributed to the emergence of enterprise integration case . Table 2 note to achieve a good recovery and management efficiency, we must make the internal integration .

Figure 5 is intended to convey the enterprise in the implementation of green logistics , it is necessary to find the reasons that may affect the external Green Logistics ,then set a policy decision on how to act , and then from the inside vertical integration of upstream and downstream levels , and ultimately to showing the effectiveness of green logistics .

Table 2. The implementation phase of the Green Logistics

AUTHOR	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
SRIVASTAVA(2006)	Collection		Inspection/Sorting	Re-processing	Location/Distribution
BLACKBURN(2004)	Product-acquisition	Reverse-logistics	Inspection/Disposition	Remanufacture/Refurbish	Marketing
WHITE(2003)	Acquisition		Assessment/Disassembly	Re-processing	
GUIDE JR(2002)	Product-acquisition	Reverse-logistics	Inspection/Disposition	Recondition	Distribution/Sales
DENNIS(2002)	Retrieval	Transportation		Disposition	
FLEISCHMANN(2000)	Collection		Inspection/Separation	Re-processing/Disposition	Re- distribution

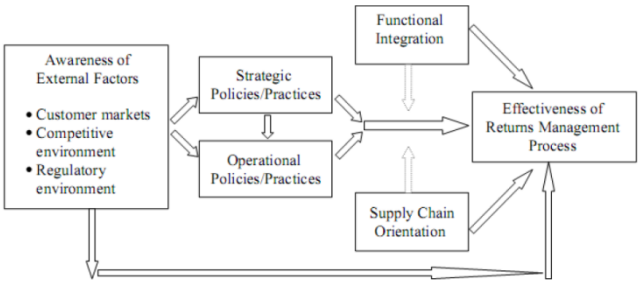

Figure 5 Integrated action to implement green logistics business strategy

2.4 Cost -benefit analysis

2.4.1 Cost-Benefit Analysis Overview

Cost-benefit analysis (CBA) can be used as analytical tools to assist in decision-making , government, private non-profit organizations as well as the use of either.

Decision for public affairs , its consideration of a plan or policy on all the members of society arising from all the benefits and costs , also known as social cost-benefit analysis(SCBA).

2.4.2 Cost-benefit analysis Milestones

Table 3 Cost-benefit analysis milestones

Year	Event
1808	Treasury Secretary Albert Gallatin recommend compare the cost-effectiveness of water resources related to the project
1902	Bureau of Land Management requirements for irrigation project economic analysis
1936	Flood Control Act requires flood control plan benefits must exceed costs
1946	Establishment of the Federal Commission river cost-effectiveness of the Commission
1950	The Committee made the cost-effectiveness of the cost-benefit analysis rivers report, which referred to " Green Book ."
1952	Bureau of the Budget should be encouraged to budget cost-benefit analysis as a reference
1955	Harvard University plans to set up water
1960	Resources for the Future Research institutions using the cost -benefit analysis of water resources
1970s-80s	Cost-benefit analysis of the application be extended to public finance
1990	President Reagan's Executive Order No. 12291

In addition to applying cost-benefit analysis to assess foreign investment in the public sector ,but when private enterprise making major policy decisions change will be carried out cost-benefit assessment .The cost-benefit assessment and focus on " implementation and does not implement " compare of the decision , rather compare " before and after the implementation of the implementation " .

3. BUILD COST-BENEFIT ASSESSMENT MODEL FOR SOLID WASTE

3.1 research material

The case study will be based on company data .Discussion case status company sludge treatment costs , put forward three hypothetical scenarios .Sludge treatment equipment cost comparison between the four scenarios ,and added zero waste concept of green logistics in the leather binding process last .Analysis and zero waste policy after import for business impact and enterprise integration case .

Case studies are divided into three sources :(1) Document collection (2) File History (3) in-depth interviews

3.2 Research framework

In this study, three kinds of sludge treatment scenarios, in which case the cost of the company's operations generated and benefits and other possible effects. In addition to exploring in the literature as well as industry data collection, analysis of the status of the case but also the actual company data. Analysis of the current status of foreign enterprises , and the actual status as calculated on the basis of the simulation program. Then the final two simulated scenarios with each other compared with the actual status, to arrive at the ratio of costs and benefits of each situation and determine the best solution.

3.3 Model Design

This study focused on sludge treatment equipment produced by the company leather case process. Treatment of sludge generated as a case currently , some proportion of untreated sludge drying and then by outsourcing vendors via a device in the factory for processing.

3.4 Build evaluation model derivation

3.4.1 The total cost of sludge treatment plant

First, calculate the company's 2015 annual investment in case the total cost of leather sludge into the formula (3.1) as follows :

$$T_{Ci} = G_i + C_i + H_i + E_i + P_i + D_i \quad (3.1)$$

i represent different options i = 1, 2, …, n

TCi：total cost；Gi：Sludge equipment purchase cost steam consumption；Ci：Sludge removal costs；Hi：Human sludge equipment operating costs；Ei：Sludge equipment power consumption costs；Pi：Space purchase the package cost；Di：Sludge equipment depreciation amortization costs

The total number of square feet of leather resulting total cost TC and 2015 annual cases of the company divided by the formula (3.1), resulting in sludge disposal costs per square foot of leather, as shown in equation (3.2) as shown

$$TC\ i\ /\ OP_i = SC_i \quad (3.2)$$

In equation (3.2)

TCi：The total cost of sludge treatment leather；OPi：The number of square feet of leather output；SCi：The cost per square foot of leather produced sludge treatment.

3.4.2 Scenario analysis

Case company's actual situation, wet sludge treatment equipment production capacity to handle all of the plant to produce leather. Therefore, this study assumes situational Case of the company increased plant sludge treatment equipment, so that the capacity is sufficient to handle the wet sludge generated from the entire plant.

Suppose each program follows the actual operating conditions of the variable, hypothetical situations may vary depending on the estimated cost of the additional equipment and improve: Equipment depreciation amortization costs ,Human operating costs ,Cost of electricity ,Steam costs ,Place the new equipment with the cost of land ,and so on. The estimated cost of the final sludge generated by reducing the amount of removal costs ,space bag costs ,etc. Finally, after adjustment benefit assessment models such as equation (3.3) as shown

$$TC_i = G_i + C_i + H_i + E_i + P_i + D_i + L_i \quad (3.3)$$

The Hypothetical Situations leather total number of square feet and the resulting total cost TC 2015 annual cases of company division, draw situation sludge disposal costs per square foot of leather, formula (3.4) as shown:

$$TC\ i\ /\ OP_i = SC_i \quad (3.4)$$

3.4.3 Cost and Benefit Analysis

Based on the above scenarios assume that the program, the total cost of the program can be obtained between calculated after all costs spent proportion occupied. In this study, the proportion of the costs and benefits of sludge treatment equipment in addition to exploring hypothetical situations, and hope for comparison, add purchase units into land costs and other factors. Once the sludge or solid waste without treatment, directly by the outsourcing vendors removal, may result in environmental costs and additional land costs, storage accumulation resulting impact on business and other factors to consider as the future

4. PRACTICE AND DISCUSSION ON VERIFICATION

4.1 Sludge treatment technology and equipment

4.1.1 Sludge Treatment Technology

At present the domestic leather industry sludge generated in the manufacturing process, can be roughly divided from the wastewater treatment plant was precipitated out of water containing up to 97%. After the pressure and moisture content of 65-70% mud treatment of wet sludge, and after drying the moisture content of less than 40% of dry sludge.

When heated at a constant temperature water sludge is dried, the weight curve can be divided into three periods. As shown in Figure 6.

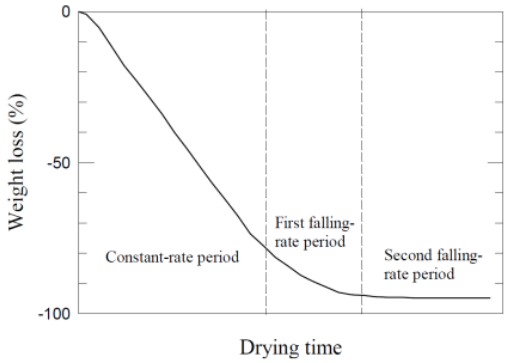

Figure 6 Sludge drying time curve

Currently existing sludge drying techniques include: steam heating, radiant heat drying, freeze-drying

In addition to the above methods of radiation (sun) drying the rest are drying machines. Mechanical drying method in accordance with the heat medium and the sludge-contact manner to be divided into categories:

(1) Direct Heating (2) Indirect Heating

Case's current practice is to use six lines out of wet sludge into the sludge drying equipment steam, external purchase vapors wet sludge is dried, and then compressed into sludge cake using machine load space bag, removal performed by outside vendors.

4.1.2 Case sludge drying equipment company

In case the company cleaned and soaked in the process, the sewage flowing into the water over time due to the physical characteristics of the sludge is deposited on the

bottom of the mixture of the solid waste. The sludge must be periodically withdrawn to maintain the depth of the sedimentation tank, sludge settling to avoid the excessive increase in the load of sewage treatment section.

4.2 Cost-effectiveness and situational analysis

4.2.1 2015 actual operating conditions Case

Case Company in January 2015 - December 2015 financial statements between pursuant, plant various cost items and the proportion shown in Table 4-1, and the items that can be substituted into the formula. Tc = 53,364,680；The total number of outputs leather Ft OP = 16,400,000；The average cost per square foot of leather sludge treatment SC = 3.25 (dollar)

Context 1. Actual operating conditions and depreciation

In this study to compare the difference between the new purchase the equipment before and after, it is assumed that in the context booth 1 will mention the cost of the old equipment D1 fiscal 2015 included cases companies operating status, and analyzed to include the cost of equipment depreciation and calculate Context 1.

The total cost of Tc 1 = 58,114,680；The total number of outputs leather Ft OP = 16,400,000；Both, after dividing an average cost per square foot of leather sludge treatment SC1 = 3.54(dollar)

Context 2. Purchase the equipment, increased costs and sludge reduction

The hypothesis in the context of 2 cases in 2015, the company added a plant sludge treatment equipment, increases in the cost of equipment depreciation considering various cost, electric cost, human operating cost, steam cost. Because the final output of sludge reduction and reduce the cost of removal costs and space bag purchase costs. The final calculation of situations leather sludge context 2

Total cost Tc2 = 46,041,564；The total number of outputs leather Ft OP = 16,400,000；Both, after dividing an average cost per square foot of leather sludge treatment SC2 = 2.81(dollar)

Context 3. The cost of land included placing equipment

Case Company assume additional machines to reduce the amount of sludge produced, thus achieving sludge reduction purposes, to reduce sludge removal costs in the context of 2, but the actual situation, the case is not sufficient to place the company's factory space and new the machine with the pipeline, it is assumed that in the context of 3 cases of companies to increase the cost of land in the year 2015 in order to obtain additional space for new machines and vapor line, dummy purchase an area just can be placed on the 15 floor, all other costs are in use context 2 the cost of the project, the final calculation of situations of leather sludge context 3：The total cost of Tc 3 = 48,291,564；The total number of outputs leather Ft OP = 16,400,000；Both, after dividing an average cost per square foot of leather sludge treatment SC 3 = 2.94(dollar)

4.3 Situation and Suggestion Scheme Comparison

At any situation, removal costs are the highest proportion, but by increasing the sludge drying equipment, thus reducing the water content of the sludge to reduce weight, to reduce the cost of removal.

Authors believe that in addition to the cost of equipment, land cost is bound to a second crucial element in the case when considering the introduction of new machines, on the principle of zero waste theory, the cost of land can also be seen as a part of environmental costs.

Therefore, this study suggests that the introduction of new equipment 3,4 context of the case in terms of the company is effective reduction of sludge program.

The company selected by the decline in the case of wet blue leather processing, the removal of a substantial proportion of the cost to occupy about 68% is still the highest, but in principle sludge reduction, the amount of removal costs have been greatly reduced, but production is not significant difference between the final dried sludge production decreased by nearly 65%, so this study suggests that the use of wet blue leather, leather processing industry is the actual operation of the more viable option.

5. CONCLUSION

After results of this study assumed that comparison, indeed after you increase the amount of sludge reduction target significant performance has helped, on the one hand can reduce the cost of removal as income, on the other hand, it can be said cost savings piling, land, hidden environmental factors, population explosion, the more valuable natural resources in modern society, high cost of land in the future is inevitable, how to protect the precious land resources and take advantage of, definitely upgrade a major focus of the subject enterprise competitiveness.

In this paper, in addition to cases of internal company data via the fixed costs of recording, there may be other differences in the future than the variable costs have (1) removal costs (2) the value of the land (3) environmental policy factor.

Based on the above, the direction of the leather industry in the future sludge treatment should be to reduce, secure, zero pollution forward, this study expect tomorrow if unable to reach a zero-waste manufacturing process, the ability to find a method of drying the treated sludge reuse, the solid waste re-utilization carried back to the environment, it is the most important goal of future sludge of development.

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