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Reverse Processing Series System Integration with Cleaner Production Processes in Iraqi Industrial Companies

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This study aims to test the integral relationship between Cleaner Production (CP) processes and chain processes. The study adopted the issue of cleaner production processes as an explanatory variable, as well as the process of the reverse processing chain as a responsive variable. The study is in the field of production management and operations in four veins and proposes to answer the following question: Are the cleaner production and back-up processes integrated in the company under consideration? A key hypothesis has been formulated to be tested in the company in order to diagnose the complementary relationship between CP and reverse processing chain processes. To achieve a deeper understanding of that relationship the researcher has adopted a questionnaire methodology. The study reached a number of conclusions including the existence of a significant complementary correlation between cleaner production processes and reverse processing chain processes. As well this research provides an important proposal, namely that the company under consideration should adopt cleaner production and back-chain operations. This is better because one is complementary to the other and preserves the natural environment.

Key words: *CP (Cleaner Production), Processes Chain (supply chain), 3R Series (Chain)*

Introduction

Over the past years there has been a tremendous development in the technology of the productive industries. That was caused by the irrational use of resources and energy which had negative impacts on the environment by emitting harmful emissions and disposing of

hazardous liquids and solids into the waterways. On the other hand, limited resources and enormous change in the environment, as well as a growing environmental awareness of clients, have become pressure factors on the management of industrial organisations. They were forces to take these challenges seriously and adopt modern means and systems that would preserve the environment and reduce excessive resource use. Many researches and studies have confirmed that cleaner production processes, reverse processing and integration play an important and pivotal role in the success of industrial companies to maintain their competitive position. The Iraqi industrial companies adopted the concepts of modern production and keep up with leading companies by improving their products and production processes. The adoption of cleaner production processes and a series of reverse processing reduced the toxic effects on the environment and the use of resources and energy.

The Study Methodology

The Problem Is

1. What are the cleaner production processes and what interest did the researched company have in terms of adoption for these operations?
2. What are the processes of the reverse processing chain and what is their commitment to these processes?
3. Are the cleaner production processes and the reverse processing chain integrated in the company?

The Importance of the Study

1. The importance of this study stems from the importance of integration between cleaner production processes and the reverse supply chain in industrial companies.
2. Research is also gaining importance through the trend of companies towards the application of modern methods, in the field of operations management, which contributes to achieving environmental protection and enabling the company to survive and grow in the market.
3. The vital importance of this study' variables is as a contemporary approach, consistent with the requirements of the work of contemporary companies, as well as the possibility of the company researched to keep up with the ongoing changes in the field of modern approaches to production processes.

Objectives of the Study

This study seeks to achieve the following objectives.

1. Provide a theoretical and field study about cleaner production processes and series in the reverse processing chain.
2. Identify the percentage of interest and commitment to cleaner production processes and the reverse processing chain.
3. Identify the extent of integration between cleaner production and the reverse processing chain.
4. Present some actions and practical solutions based on the field results. Provide a clear vision of the integration between CP processes and the reverse processing chain in the environment. Support the company researched to protect the natural environment from the negative effects of industrial waste.

Hypotheses of the Study

H1 - The commitment of the company varies significantly in terms of their adoption of cleaner production processes.
H2 - The commitment of the company to the reverse processing chain operations varies significantly.
H3 - There is a significant correlation between the integration of cleaner production processes and reverse processing chain.

The Place of Study

The study was undertaken at the Baghdad Electric Industries Company, which includes three factories:
1. Refrigerant factory
2. Welding wire factory
3. Air Conditioning Equipment Factory

Statistical Analysis

The researcher used the SPSS program to obtain statistical results using these tools:
1. Duplicates, percentages, arithmetic media, standard deviations and response rate to describe, search the diagnostic variables. Commitment Ratio = Mean / Scale Degrees * 100.
2. C-Kendall's Tau correlation coefficient was used to determine the nature of the integral correlation relationship between variables and their explanatory power.

Theoretical Background

1. Cleaner Production. A comprehensive and integrated strategy that protects the environment from all residues of the production processes, minimises risks to the environment and humans

and modifies production process equipment and devices in line with the achievement of the goal of continuous improvement of productivity (Van Berkel, et al., 2000). The elimination of hazards resulted from cleaner production residues and emissions to the environment (Heid, et al., 2003). Almaz (2004) stated that cleaner production is an ongoing application of an integrated strategy of production processes and preventive services to protect the environment from productive waste through efficient use of resources. Naturally in order to reduce waste and emissions and human exposure to health risks, the main objective of a strategy of cleaner production is to reduce the use of hazardous materials by replacing those substances with less dangerous materials in the production procedures (Government of Africa, 2004).

2. Benefits of CP. There were a number of benefits identified for organisations to use CP. These are:

a. Achieving financial returns: Cleaner production generates financial savings, prompting business organisations to adopt CP technology in its practices to conserve its natural resources by rationalising consumption of resources, which will have economic and environmental benefits as a result.

b. Preventing environmental damage and preventing pollution: One of the benefits of cleaner production is disposal of waste and emissions caused by the production processes because of the threat to the environment and health by rationalising the use of natural resources.

c. Reducing risks to workers and society: Many business organisations consider these hazardous of industrial processes towards human and the environment are one of the most important motives for adopting cleaner production technology, necessitating policy and strategic decision-making for alternatives to preserve both human health and natural environment.

d. Those who agreed on the need to classify each type of feedback according to the stage in which the return process takes place. They are manufacturing feedback, distribution feedback and customer feedbacks. This study agrees with this classification. It classifies feedback according to the stage in which the return process occurs; in addition this category includes most of the opinions of researchers.

3. Cleaner production processes. The most important cleaner production processes are:

a. Developing production processes.

b. Replacement of materials

c. Development and replacement of equipment.

d. Good management.

e. Waste recycling (Chen, Huiyu, 2010; Maduro, et al., 2004; Peterson, Andrew J., 2005).

4. The concept of the reverse supply chain and its importance. The process of the reverse processing chain is known through the recycling and disposal of waste, management of hazardous materials, replacement and reuse of materials and disposal.

One of them is widely gone (Dhanda, et al., 2005; Chaabane, 2011). In the same context (Kocabasoglu, et al., 2007) stated that a cost effective flow planning, implementation and control process for raw materials for inventory management, finished products and related information (Mahmadi, et al., 2013; Arum, et al., 2003).The reverse processing chain is used for reverse flow management of products through a process whereby recyclable or recycled products are received recycled and then reused or disposed of by consumers (Bai, hua, 2009; Elmas, et al., 2001). The reverse processing chain means the reverse flow of products to the point of origin for reuse in the assembly process. Or the products are recycled in processes or recycled in production processes as raw materials as well as waste disposal (Ferrer, et al., 2000; V. Daniel, et al., 2002; Alain, et al., 2016). They play a key role in the company's activities. This motivates them to use these chains due to central instructions issued as well as due to growing awareness and consumer pressure (Agamuthu P., et al., 2011; Kenneth, et al.,2015; Rao, et al., 2013). Reverse processing chains are the processes of dealing with background flows through the use of damaged products, reprocessing and disposal at the lowest cost to achieve the company's economic advantages and preserve the environment. The importance of the reverse supply chain is as a building tool that helps companies survive, grow and achieve sustainable competitive advantage, if it can reduce costs through its activities and thus increase. The magnitude of its revenue and the importance of reverse processing chains are just as important as the processing chain management. The company’s energy and resource management as well as its environmental protection, demonstrates the importance of reverse processing chains through optimal resource and energy management to reduce use of resources and energy in a manner that does not cause any harm to the natural environment (Ruisheng, et al., 2015; Sivakumaran, 2015; Anojkumar L., et al., 2014). Companies through reverse processing chains aim to mitigate costs to increasing profits as well as addressing environmental problems or recovering the value of the product at the lowest possible cost (Doonan, J., et al., 2005); Field, J., et al., 2007).

5. Reverse supply chain operations. The following processes of reverse processing chain can be addressed so as to be adopted by a group of writers, as well as in tune with the productive process in the company researched through several meetings with its managers, engineers and technicians.

a. Recycling: Recycling in the reverse processing chain is returning products or materials into the production processes, so it can again be utilised through some physical treatments or with the addition of some chemicals or biochemical (Chen, Huiyu, 2010). Recycling is an essential part of environmental protection policies.

b. Reuse: Reuse means the reuse of products or some of their components after their expiration or after the damaged part is reused. As well as the use of waste through a change in structure or some other parts in order to attenuate the costs of buying materials or other products. There are several factors that will prompt companies to reuse namely: the use of their products; the pursuit of reducing the negative environmental impact; maintaining safe human health and maximising the economic benefits.

Figure 1. Recycling of waste products (3R)

c. Refurbishment: Under this process the focus can be on raising the reputation during dismantling and refurbishment. Inspections and replacement of damaged parts are carried out for the purpose of mitigating production costs. They are carried out through the renewal of products, components and materials that are returned in the production stage as non-conforming raw materials. An increase in primary materials as well as the waste products in the production processes are made under this process. Repairs or maintenance services are ongoing and repairs are either at the consumer site or when the product is sent to the repair site. The formation of pollutants can be resisted by developing devices and equipment (Staniskis J., K., et al., 2005).

d. Redistribution or sale: This refers to: the return of damaged products through distribution channels; products not sold by the seller or distributor; as well as products that do not meet the aspirations. The customer redistribution or sale of products includes all activities related to backflow and to the products in the processing chain such as tables, containers, boxes and envelopes that can be used more than once and from which companies can achieve great economic benefits from repeated use. It also

helps to preserve the environment through reuse. If the company plans to sell recycled products they have to target a specific market and customers so they can win potential customers who cannot afford the prices of new products thereby making significant profits from the resale of these products (Andreas N., & Dag. N., 2019; Suresh Prasad, S., K., Sharma, 2014).

Statistical Analysis (The Applied Side of the Study)

The statistical analysis presents the trends from the respondents' responses about the study variables and tests the hypotheses.

This includes a description of the nature of the research variables as perceived by the respondents in the company then an investigation. Therefore, the researcher used the program SPSS to discover the frequency, percentages, standard deviations and response ratios in measuring study variables to identify the individuals' responses to variables.

The purpose of this paragraph is to measure the cleaner production variable (X1-X10) through four processes namely: development of the production process; replacement of materials; equipment development and replacement; and good housekeeping. The parameters of the reverse processing chain (X11-X22) were measured through four processes: recycling; reuse; refurbishment; and redistribution or sale. There were 12 questions to measure this variable as shown in Table 1.

Table 1: Describe the variables

	Dimensions of the study	variable	Scale degree			Mean	Standard devas ion	Commitment ratio
			agree	neutral	not agree			
Cleaner Production (CP) Operations	Developing production processes	**X1**	**44**	**50**	**6**	**2.31**	**0.61**	**77**
		X2	**60**	**40**	**0**	**2.60**	**0.50**	**87**
	Replacement of materials	**X3**	**30**	**64**	**6**	**2.20**	**0.55**	**73**
		X4	**61**	**33**	**6**	**2.53**	**0.63**	**84**
	Development and replacement of equipment	**X5**	**34**	**60**	**6**	**2.27**	**0.58**	**76**
		X6	**57**	**43**	**0**	**2.57**	**0.50**	**86**
	Good management	**X7**	**58**	**36**	**6**	**2.50**	**0.63**	**83**
		X8	**57**	**40**	**3**	**2.53**	**0.57**	**84**
	Waste recycling	**X9**	**61**	**36**	**3**	**2.57**	**0.57**	**86**
		X10	**17**	**70**	**13**	**2.03**	**0.56**	**68**
	General average		**47.9**	**47.2**	**4.9**	**2.41**	**0.57**	**80**
Supply Chain operations	Recycling	**X11**	**54**	**46**	**0**	**2.53**	**0.51**	**84**
		X12	**34**	**50**	**16**	**2.03**	**0.72**	**68**
		X13	**61**	**33**	**3**	**2.60**	**0.56**	**87**
	Ruse	**X14**	**54**	**40**	**6**	**2.50**	**0.63**	**83**
		X15	**14**	**70**	**16**	**1.93**	**0.52**	**64**
		X16	**58**	**36**	**6**	**2.50**	**0.63**	**83**
	Refurbishment	**X17**	**61**	**33**	**3**	**2.57**	**0.57**	**86**
		X18	**57**	**33**	**10**	**2.40**	**0.72**	**80**
		X19	**28**	**36**	**36**	**1.90**	**0.80**	**63**
	Redistribution	**X20**	**50**	**44**	**6**	**2.43**	**0.63**	**81**
		X21	**23**	**57**	**20**	**2.03**	**0.67**	**68**
		X22	**10**	**64**	**26**	**1.83**	**0.59**	**61**
	General average		**42.5**	**45.2**	**12.3**	**2.27**	**0.63**	**76**

Table 2: Integration correlation results at the macro level

Variable(1) / Variable(2)	Cleaner production operations
Supply chain operations	0.25*

P<=0.05 N=30

Discussion and Results

Testing the first and second hypotheses. Table 1 shows the following: a. The results in Table 1 show that the respondents from the company about the cleaner production processes (X1-X10) tended towards agreement with an overall rate of 47.9%. The ratio was reinforced by the arithmetic average of 2.41, which is higher than the hypothetical mean of the scale of 2. This confirms an agreement of the individuals surveyed with a standard deviation of 0.57 and a general commitment rate of 80%. The general ratio of disagreement was 4.9 and the neutral was 47.2, The main section that contributed to this result are X2, X7 and X9. "Our company seeks to change production techniques when high energy consumption rates are used by our experienced employees with the skills that enable them to make decisions regarding their pollutants and our company strives to recycle waste of its production operations in order to secure the benefit of them". This was the most homogeneous and consistent section and obtained the highest commitment ratio of 87, 86 and 86 respectively and the highest mean 2.60, 2.57 and 3.57 and the minimum standard deviation of 0.50, 0.50 and 0.57) respectively. This indicates that the company has the ability to develop the production process and also has the ability to train and inform employees about environmental risks. As well as improving the control role on the production process and return of the product or materials that can be treated by adding some chemicals or through some physical treatments on site.

The lowest rate of agreement 17% shows that the company does not have modern methods in operational waste recycling. This represents a weakness for the company and shows a reluctance of people to adopt modern methods. In this context, especially since these modern methods have become a competitive priority, there was the lowest commitment to cleaner production 68%, the lowest agreement 17%, less arithmetic mean 2.03 and standard deviation 0.56. Based on the results of the analysis of CP processes, the first study hypothesis is accepted.

Processes of the reverse processing chain (X11 – X22). Table 1 also shows the following:
- Respondents responses in the surveyed company had a general average of 76%, the mean was 2.27, standard deviation 0.63 and agreement rate 42.5%. This indicates the consistency of the respondents' opinions towards the section of the reverse processing chain operations.
- X13 - X17. "The management of our company is economically profitable by recovering its products for recycling" and "Our management focuses on raising the quality of our used products through refurbishing". This was the section that contributed to the enrichment of these operations by the commitment rate of87% and 86% respectively. It had the highest mean 2.60 and 2.57 respectively, and a standard deviation of 0.56and 0.57. This indicates that the company is achieving profits through recycling and is increasing the quality of products that are renewed again.

•X22. "Our company preserves the environment by reusing products such as loading tables, containers, boxes and envelopes. This is among the least harmonious and homogeneous sections. The respondents had the lowest agreement rate 10%, the arithmetic mean of 3, standard deviation of 0.59 and the lowest commitment rate of 61%. This indicates that the company is not interested in re-use of the tables to carry products, containers and boxes in order to preserve the environment. The results of the analysis of the reverse processing chain operations accept the second hypothesis of this study.

Testing the third hypothesis. To test the third hypothesis of the study, that states there is a significant correlation between integration of cleaner production processes and reverse processing chain processes in the company Kendall's' Tau-c, statistical treatment was used.

Table 2 indicates a weak positive correlation between CP processes and reverse processing chain. The correlation coefficient was 25% and this is an indicator of the weak relationship between cleaner production processes and the reverse processing chain in the company. This shows that no matter how interested the company is about cleaner production processes and activating it in all its operations, it will not lead to the realisation of the reverse processing chain operations. This reflects the reality of the situation of the company. It is at the beginning of its interest in the application of cleaner production technology and has little experience in this area, which is reflected on the weak relationship with the processes of the reverse processing chain. It will appear more clearly as the company's experience matures. This result was in line with the results of some sections that contributed to this analysis in the initial diagnosis of workers through the results of the respondent's agreement and commitment ratios, as well as the results of the mean and standard deviation in Table 1. Therefore we can accept the third hypothesis.

Conclusions

The study reached the following conclusions:
a. CP processes contribute to delivering products that are acceptable to consumers.
b. That there is a difference in commitment and attention to cleaner production processes.
c. That there is a difference in commitment and attention to reverse supply chain operations.
d. That the company is still in the beginning stage of its interests in the application of cleaner production technology and the immaturity of its experience in this area is reflected in the weak relationship with the reverse processing chain operations.

REFERENCES

Agamuthu P., Chenayah S., Hamid F. S., And Victor D., 2011 , "3R Related Polices For Sustainable Waste Management In Malaysia," Proceeding Conferences Of Innovation and Sustainability Transitions in Asia, Kuala Lumpur, Malaysia.

Alain Fercoq, Samir Lamouri, Valentina Carbone, 2016,"Lean/Green integration focused on waste reduction" Journal of Cleaner Production, Vol.137, pp.567-578.

Almaz, A. Asipjanov, 2004,"Development of cleaner production strategies for the kyrgy 2 Republic. A thesis submitted in partial fulfilment of the requirement for the degree of Master of Engineering, Asian institute of Technology school of Environment, Thailand.

Arum, Kumar and Kwan, Tan, Albert, (2003),"Improving the performance of a computer company in supporting its reverse logistics operations in the Asia-pacific region", International journal of physical distribution and logistics management.

Andreas N., and Dag. N.,2019,"SupplyChain Incentive Alignment: The Gap between Perceived Importance and Actual Practice", Operation and Supply Chain Management (OSCM):Vol.12,No.3,pp:129-142.

Anojkumar L., Ilangkumaran M., Kirubakaran B., Arulmuruga L., Mohamed Hassan S., Lokesh S. ,2014,"**A** Novel Method For Material Selection In Industrial Applications**"**, International Research Journal of Engineering and Technology, Vol.3,No.11, pp.439-443.

Bai, hua, 2009, Reveres supply chain coordination and design for profitable returns an example of link cartridge. Thesis submitted to the faculty of the Worcester Polytechnic Institute in partial fulfilment of the requirements for the degree of Master of Science in manufacturing engineering.

Chaabane, Amin.,(2011),"Multi-Criteria methods for designing and evaluating sustainable supply chains ,Doctor Thesis, Ecole De , Technologie superieure university Du Quebec.

Chen, Huiyu., (2010), Green supply chain management for a Chinese auto manufacture , Masters' Thesis in industrial Engineering and management ,university of Gavle, China.

Dhanda, K. K. and Peters, A. A., (2005), Reverse logistic in the computer industry, International journal of computer systems and signals, Vol.6, No.2.

Doonan, J., Lanoie, P., Laplante, B., 2005, Determinants of Environmental Performance in the Canadian Pulp and Paper Industry: An Assessment From Inside the Industry. Ecol. Econ., Vol.55, No, 1, pp.73-84.

Elmas, Guldem and Erdogmus, Ferzi., (2001),"The importance of reverse

Ferrer, G. and D.C. Whybark (2000) From Garbage to Goods: Successfully Manufacturing Systems and Skills, Business Horizons, Vol.43, No ,6

Field J., and Sroufe R., 2007, The Use of Recycled Materials in Manufacturing: Implications for Supply Chain Management and Operations Strategy, International Journal of Production Journal of Environment Pollution and Human Health, Vol.45, No18-19, pp. 4439-4463.

Heid, E. staff Mestl, Kristin Aunan, Jinghua Fang, 2003, Cleaner production as climate investment-integrated assessment in Taiyuan city" Journal of cleaner production, Received, 6 March 2003 .

Kenneth Peprah, Samuel Twumasi Amoah, Godwin Thomas Wedam Achana, 2015, Assessing 3Rs Model in Relation to Municipal Solid Waste Management in Ghana, Department Of Environment and Resource Studies, University For Development Studies, World Environment, Ghana,Vol.5, No.3,pp.112-120.

Kocabasoglu, C. Drahinskl, C .and Klassen, R.D, 2007, Linking forward and reverse supply chain investments: the role of business uncertainty, Journal of operations management, Vol. 25.

Maduro, Marisa paula de brito, (2004),Managing reverse logistic, Thesis to obtain a degree of doctor from the Erasmus university, Rotterdam.

Mahmadi, H., Fazlollahtabar. Hand Mahdavi, I, 2013, Optimizing a reverse supply chain including transportation, operation, maintenance and remanufacturing costs", International Journal of applied operational research, Vol. 3, No.2.

Peterson, Andrew J., (2005), An examination of reverse logistic factors impacting the pallet program, Thesis department of the air force, Air University, Ohio.

Rao, L. N., and Prabhakar, G. , 2013 , Waste Minimization in the Chemical Process Industries-A Review Journal of Chemical, Biological and Physical Sciences, an International Peer Review E-3 Journal of Sciences, Vol. 3, No. 2, pp.1594-1601.

Ruisheng Ng, Jonathan Sze Choong Low, Bin Song, 2015, Integrating and Implementing Lean and Green Practices Based on Proposition of Carbon-Value Efficiency Metric, Journal of Cleaner Production.,Vol. 95, pp.242-255.

Sivakumaran, 2015,Principles of Waste Management Techniques, Published On Research Gate.

Staniskis J. K., Stasiskiene Z., 2005, Industrial Waste Minimization- Experience From Lithuania Waste Manage. Res., Vol. 23, No.4. pp.282-290.

Suresh Prasad, S.K. Sharma, 2014 , Studies Linking Lean Manufacturing Methodology With Green Manufacturing Journal Of Energy Research And Environmental Technology, Vol.1, No. 1; pp.34-37.

The Government of the republic of south Africa, 2004, An international and regional workshops.

Van Berkel, C.W.M, 2000, Cleaner Production a profitable road for sustainable development of Australian industry, Journals of clean air, Vol. 33, no4.

V. Daniel R., Guide Jr. and Van Wassenhove, 2002, The Reverse Supply Chain, Harvard Business Review, February 2002.