

Applicability of Industrial Ecology Strategies for the Corporate Environmental Management: Selected Cases of the Eastern and Northern Zones of Tanzania

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Abstract

Corporate utilization of industrial ecology principles is essential to safeguard ecosystems' integrity, human health and economical sustainability. This study used purposive sampling with informants being workers from the strategic, tactical and control functions of corporate environmental management levels. Data collection involved survey of 50 Corporates in Dar es Salaam and Arusha cities as well as Moshi and Morogoro municipal councils with 71 respondents. Data collected include exploration of environmental management functions performed at various corporate environmental management levels. Corporate environmental management functions performed were identified. Moreover, results showed presence of unclear definition of responsibilities between workers working at the strategic, tactical and control levels of corporate environmental management. This indicates similar situation with corporate organizations located in other countries as per the literature surveyed in the study. The study recommended corporate environmental management policy making process to clearly define responsibilities of the corporate organization employees basing on their working level. This will achieve corporate environmental management efforts towards environmental performances of the processes, products and services. Furthermore, this study observed that small organizations don't have sections specifically for handling environmental issues. Therefore, further research is recommended to explore how these small organizations manage to integrate environmental aspects in the designed products, processes and services.

Key words: Corporate Organization, environmental management, industrial ecology, Tanzania.

1.0 Introduction

In recent years, applicability of industrial ecology strategies is vitally important for sustainable developments (Berkel et al. 2009; Fiksel, 2002; Korhonen, 2004). Moreover, the increased industrial production in the efforts to meet customer needs have increased environmental problems including land degradation, destruction of aquatic habitats and global climatic change (Tuomisto and Mattos, 2011; Katima et al. 2000). Several studies have reported substantial benefits achieved from the effective implementation of industrial ecology strategies for sustainable environmental management globally, including recovery of volatile metals from electric furnace dusts which is used in civil works (Quijorna, 2011), non-renewable fossil fuel and green house gas emission savings through biotechnology (Hermann, 2007), resource use savings via industrial symbiosis (Chertow and Lombardi, 2005), energy and green house gas savings with the use of industrial wastes as feedstock material for industrial productions (Elkington, 1998).

According to Lee and Rhee (2007); Paradzayi and Ruther (2004); Todd (2009); Biswas and Gering (1987); Wallace (2006) implementation of industrial ecology strategies will be achieved by considering environmental issues in the corporate decisions and by workers participation in the decision making at the strategic, tactical and control levels of the corporate environmental management. Furthermore, Khan and Rathwell (1991) argued that urban transport organizations have managed to maintain air quality and reduced greenhouse gas emissions through involvement of workers working at strategic, tactical and control levels of corporate environmental management in the decision making. Despite of the benefits achieved, through implementation of industrial ecology strategies with workers participation in the environmental management decision making, yet no study conducted to explore the extent to which corporate employees participate in decision making including Tanzania. To date, large number of corporate organizations in the world including Tanzania have introduced environmental

management units due to complexity and inter-related nature of environmental issues (Fergusson and Langford 2006; URT 2004; Temba 2008) in which environmental concerns are included in the corporate organizations' strategic plan. Magashi (2011); Kundi and Ngereja (2003) contended that, the government of Tanzania has paid great efforts to ensure sustainable environmental management, but still is facing various problems including lack of corporate environmental policy that constitute strategies and plans for pollution management and control, inadequate awareness on environmental policy and inadequate finance for implementation of cleaner technologies. Therefore, the main objectives of this study are (1) To identify the three levels of corporate environmental management and (2) To determine the extent to which employees participate in the corporate environmental management decision making process the case of Tanzania.

2.0 Methodology

This study identified various environmental management functions performed by the corporate environmental management levels in Tanzania through hypothesis testing. It was claimed that, there are no significant differences between various corporate environmental management functions performed in the corporate environmental management levels. These hypotheses were tested using analysis of variance test and means for estimating causal relationships within and between constructs by confirmatory factor analysis. The study involved fifty (50) corporate organizations from Morogoro and Moshi municipal councils as well as Dar es Salaam and Arusha cities of Tanzania. A cross-sectional research design that allows collection of data at one point in time was employed (Babbie 1990). Primary data was collected using self administered questionnaires and interviews while secondary data was collected through documentary reviews. The survey involved purposive sampling with informants being experts working at the corporate environmental management levels strategic, tactical and control. Analysis of the collected data was done with computer software excel, Amos7 and Statistical Package for Social Sciences (SPSS). Moreover, AMOS7 software was used to provide a confirmatory test for the stated environmental management functions performed at the strategic, tactical and control levels to be functions. The target population for this study comprised of workers working at the strategic, tactical and control levels of corporate environmental management. In the corporate self administered questionnaires were distributed to atleast two (2) workers working at each of the corporate environmental management levels. Out of 130 questionnaires distributed to various corporates only 71 questionnaires were filled in and used for the analysis of which the response rate was 54.6%.

3.0 Results and Discussion

The analysis results revealed, the varimax rotated loadings and Cronbach's alpha greater than 0.6 and 0.7 adequate for data analysis. The findings for the extent of participation in decision making at all three levels of corporate environmental management are presented as follows;

3.1 Corporate Environmental Management Levels

Corporate environmental management performs three functions including strategic, tactical and control (Figure 1). Out of 71 respondents, 11 (15.5%) were working at the corporate strategic environmental management, 29 (40.8%) were working at the corporate tactical environmental management, 26 (36.6%) were working at the corporate control environmental management. Fewer respondents were working at the strategic level because this is responsible for decision making process and more respondents are found on the tactical level because it is responsible for the implementation of the corporate top management decisions. These results are inline with Mohamed (2009) and Theyel (2000) arguing the environmental success of conscious business practice by corporate environmental management to be achieved by giving environmental decisions based on strategic, tactical and control levels of corporate environmental management.

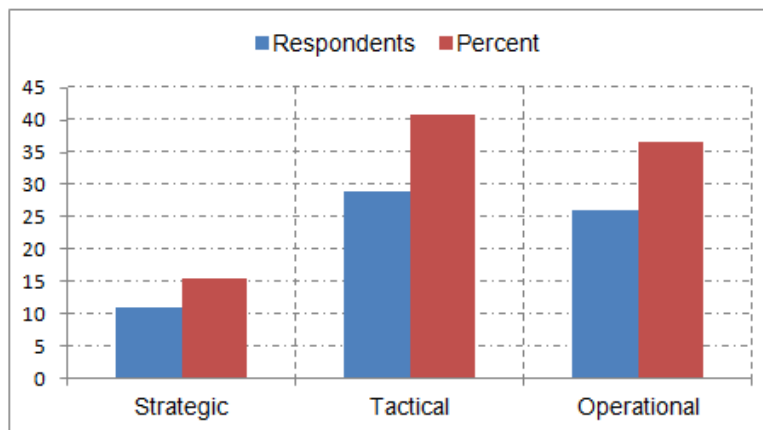


Figure 1. Corporate Environmental Management Levels

3.2 Participation in the Environmental Management Decision making Process

The extent to which corporate organization employees participate in environmental management decision making is relatively adequate (Tables 1, 2 & 3).

3.2.1 Strategic Environmental Management Functions

The extent to which employees participate in the strategic environmental management functions are presented in Table 1.

Table 1. Extent of Participation in Strategic Environmental Management Functions

Strategic	Level of participation					N*	M*	STD*	L*	R*	
	1	2	3	4	5						
Formulation of environmental policy	5	7	19	24	14	69	3.5	1.15	0.68	1	
Approval of environmental objectives	7	11	30	16	5	69	3.0	1.05	0.72	3	
Develop strategic environmental plans	5	14	20	24	7	70	3.2	1.10	0.70	2	
Approve integration of environmental factor, designs	9	13	13	27	8	70	3.2	1.24	0.68	2	
Approve development of innovative EIS	11	17	27	14	1	70	2.7	1.02	0.71	4	
Grand Mean							3.1				

Five point likert scale:

1 = not at all, 2 = very low, 3 = low, 4 = to some extent, 5 = to great extent

M* mean score, R* rank, STD* standard deviation, L* loading value, N* Respondents

From the results, the extent of respondents participation in strategic environmental management functions including formulation of corporate environmental policy, approval of corporate environmental objectives, development of strategic environmental management plans, approve guidelines for integration of environmental factors into product and process designs is low (mean scores are slightly above the threshold limit of 3.0). Moreover, respondents participation in the development of the innovative environmental information system is very low (mean score below the threshold limit of 3.0). Therefore, the extent to which respondents participate in the strategic environmental management functions is adequate (grand mean 3.12).

3.2.2 Tactical Environmental Management Functions

Table 2 presents distribution of respondents showing the extent of participation in the tactical environmental management functions of the selected corporate organizations.

Table 2. Extent of Participation in Tactical Environmental Management Functions

Tactical (Functions)	Level of participation					N*	M*	STD*	L*	R*	
	1	2	3	4	5						
Implementation of agreed environmental policy	0	3	10	32	26	71	4.1	0.82	0.57	1	
Implement environmental objectives and targets	0	4	17	30	20	71	3.9	0.87	0.71	2	
Implement environmental plans and programs	2	7	19	21	21	70	3.7	1.09	0.63	3	
Process integration of environmental factors into designs	3	6	16	27	19	71	3.7	1.08	0.90	3	
Operationalization of EIS	7	15	17	17	15	71	3.3	1.28	0.64	4	
Grand Mean							3.1				

Five point likert scale:

1 = not at all, 2 = very low, 3 = low, 4 = to some extent, 5 = to great extent

M* mean score, R* rank, STD* standard deviation, L* loading value, N* Respondents

The results, revealed adequate participation in tactical environmental management (mean scores are slightly above the threshold limit of 3.0). This include; implementation of the corporate environmental objectives, implementation of the approved environmental plans and programmes, process for integration of environmental factors into product and process designs and operationalization of environmental information system (Table 2). While respondents' participation in the implementation of agreed environmental policy is to some extent (mean score of 4.1). Therefore, the extent of participation in tactical environmental management issues is adequate. The results are similar to Khan and Rathwell (1991) arguing that urban transport organizations have managed to maintain air quality and reduced greenhouse gas emissions through decisions made by workers from the strategic, tactical and control levels of corporate organizations' environmental management.

3.2.3 Control Environmental Management

Corporate organizations' compliance with the environmental standards is assured by employees' participation in the control function of the environmental management (Table 3).

Table 3. Extent of Participation on Control Environmental Management

Control Functions	Level of Participation					N	M*	STD*	L*	R*	
	1	2	3	4	5						
Monitoring operations to comply with environmental policy	2	6	6	30	27	71	4.0	1.03	0.66	1	
Auditing evaluation of objectives and targets appraisal	9	8	22	21	11	71	3.2	1.22	0.782	4	
Supervise review implementation of environmental plans and targets	3	12	13	20	22	71	3.4	1.12	0.809	3	
Supervise integration of environmental factors into product designs	1	12	19	28	11	71	3.5	1.00	0.710	2	
Supervise production of environmental reports	14	17	18	8	14	71	2.9	1.39	0.764	5	
Grand Mean							3.4				
Five point likert scale:											
1 = not at all, 2 = very low, 3 = low, 4 = to some extent, 5 = to great extent											

M* mean score, R* rank, STD* standard deviation, L* loading value, N* Respondents

The findings show that there is adequate (grand mean slightly above threshold limit of 3.0) extent of participation in control environmental management functions performed by corporate environmental management. From the study, the extent of respondent's participation in auditing and evaluation of environmental objectives, supervise and review implementation of environmental management plans, supervise integration of environmental factors into product and process designs is low (the mean scores are slightly above the threshold limit of 3.0). While, respondents participation in the monitoring of corporate operations to comply with the environmental policy is to some extent (the mean score is 4.0). Furthermore, respondents' participation in the supervision of production of environmental reports, documentation and communication to employees and public is very low with the mean score of 2.9. These results imply that, respondents' participation in the control environmental management functions is adequate.

3.3 Structural Equation Modeling

Factor analysis is a common statistical method used to find maximum likelihood to multimodal situation for a small set of unobserved variables which can account for the covariance among a larger set of observed variables (Bozdogan, 2000). The variables were confirmed to be functions by confirmatory factor analysis using AMOS 7 software. Table 4 presents confirmatory analysis results for the strategic, tactical and control functions of corporate environmental management.

Table 4. Confirmatory Factor Analysis (CFA)¹

Factor	Constructs (Function)	Loading (λ)	SMC ² (R ²)	CR ³
Strategic	Formulation of Environmental ⁴ policy (<i>FCE</i>)	0.84	0.545	-
	Approval of environmental objectives and targets (<i>ACEO</i>)	0.81	0.590	8.08
	Develop strategic environmental plans and programmes (<i>DSEPlans</i>)	0.81	0.756	8.18
	Approve guidelines for integration of environmental factors into designs (<i>AGIEDesign</i>)	0.86	0.707	8.86
	Approve development of innovative EIS ⁵ (<i>ADIEIS</i>)	0.83	0.541	8.45
Tactical	Implementation of agreed environmental policy (<i>IAEP</i>)	0.76	0.486	-
	Implementation of environmental objectives and targets (<i>ICEO</i>)	0.70	0.579	5.80
	Implementation of environmental plans and programmes (<i>IAEP</i>)	0.78	0.601	6.46
	Integration of environmental factors into product and process designs (<i>IED</i>)	0.76	0.493	6.33
	Operationalization of EIS (<i>OEIS</i>)	0.70	0.580	5.76
Control	Monitoring of operations to comply with environmental policy (<i>MOP</i>)	0.74	0.691	-
	Auditing and evaluation of objectives and targets appraisal (<i>AO</i>)	0.84	0.734	6.97
	Supervise and review implementation of environmental plans and programmes (<i>SEP</i>)	0.87	0.662	7.22
	Supervise integration of environmental factors into designs (<i>SIPD</i>)	0.77	0.656	6.33
	Supervise production of environmental reports, documentation (<i>SEP</i>)	0.74	0.700	6.07

The confirmatory factors analysis results (Table 4) showed good correlation for the functions within the three constructs (strategic, tactical and control). Moreover, they lacked good correlation when compared between construct functions which disqualify some of the functions despite good results shown by ANOVA. When tested at loading factor ($\lambda = 0.82$) for correlation between strategic and control constructs; formulation of corporate environmental policy ($\lambda = 0.84$), approval of guidelines for integration of environmental factors into process and product designs ($\lambda = 0.86$) and approve development of innovative EIS ($\lambda = 0.83$) are confirmed to be strategic functions. When tested at loading factor ($\lambda = 0.77$) for correlation between tactical and control constructs only implementation of approve environmental plans and programmes ($\lambda = 0.78$) was confirmed to be tactical function since their loading factors are less than 0.77. While when tested at loading factor ($\lambda = 0.82$) for correlation between strategic and control; auditing and evaluation of objectives and targets appraisal ($\lambda = 0.84$) and supervise and review implementation of environmental management plans and programmes ($\lambda =$

¹ Chi – square = 200.96 and degrees of freedom = 87

² SMC = Squared Multiple Correlation

³ CR = Composite Reliability

⁴ Corporate environmental

⁵ EIS = environmental information system

0.87) are confirmed to be control functions (Figure 1).

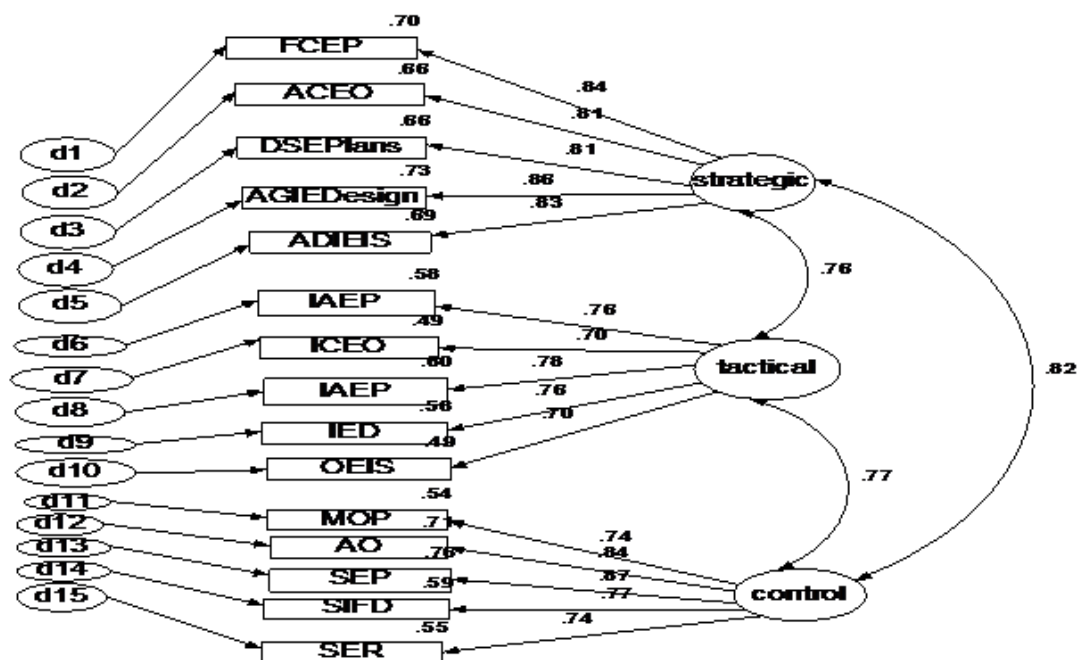


Figure 1. Confirmatory Factor Analysis for the Strategic, Tactical and Control constructs

4.0 Conclusion

Applicability of industrial ecology strategies for corporate environment management in Tanzania has been explored. In which adequate participation of employees in the corporate organization environmental management decision making was observed. Despite the distinctions of the functions performed at each level, it was found that there was not clear description of responsibilities for workers working at strategic, tactical and control levels. This has reduced workers attitude and lack of focus towards environmental improvement of corporate products or services. With the fact, this paper found that corporate environmental management policy making process must clearly define responsibilities of the corporate employees based on their working level. The study also observed small organizations not to have sections mainly for handling environmental issues. Therefore, further research is recommended to assess how these small organizations manage to integrate environmental aspects in the designed products, processes and services for sustainable development.

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