Reverse logistics in Malaysia: The Contingent role of institutional pressure

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Abstract

- Reverse logistics is important in green supply chain management initiatives
- This study decomposes reverse logistics into five commonly adopted disposition options to examine the effects on measures of environmental performance, profitability, and sales growth.
- This study investigates the moderating role of regulatory and ownership pressure on the relationship.
- Collecting survey data, regression models test a series of hypothesized relationships.
- Results suggest that under the presence of institutional pressure, use of disposition options results in increased levels of performance in some cases.
- Legislative frameworks regarding extended producer responsibility are recommended in order to motivate the implementation of reverse logistics product disposition activities.

Introduction

- Globalization and the advancement of information infrastructures have raised concerns about environmental and human health issues caused by mismanagement of electrical and electronic equipment (EEE) waste.
- The consumption rates of EEE have increased, leading to the need for manufacturers to take responsibility for collecting and properly disposing of products.
- Malaysia, like other industrialized countries, has witnessed the growth of environmentally conscious practices, with EEE accounting for a significant value in manufacturing exports.
- The introduction of governmental policies and guidelines, such as the "Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia," aims to control the transboundary movement of e-waste and promote lifecycle stewardship.
- Reverse logistics plays a crucial role in the recoverability of product returns and the proper disposition.

Theoretical framework and hypotheses development

- The article proposes 2 hypotheses
  - 1. The disposition options of reverse logistics are positively correlated with measures of performance.
  - 2. Institutional pressures moderates the relationship between disposition options and performance measures.

Hypothesis 1. Employment of reverse logistics product disposition options [(i) repair, (ii) recondition, (iii) remanufacture, (iv) recycle, and (v) disposal] is positively related to measures of performance [(i) environmental performance, (ii) profitability, and (iii) sales growth].

Hypothesis 2. Institutional pressures [(i) regulatory pressure, and (ii) ownership pressure] moderate the relationship between employment of each reverse logistics disposition option and measures of performance [(i) environmental performance, (ii) profitability, and (iii) sales growth].

Research framework

- The framework of the above two assumptions is as follows::
  - Product disposition affects Business performance;
  - Institutional pressure will moderate the relationship between the above two

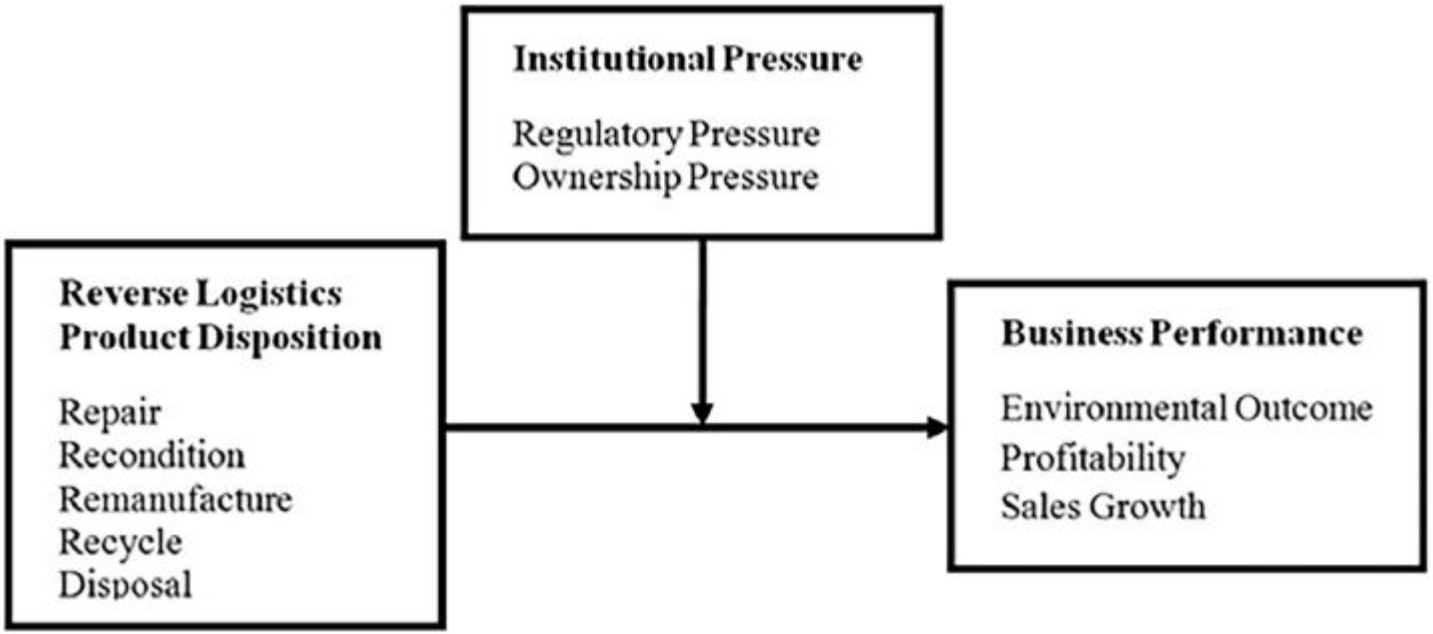


Fig. 1. Research framework.

Research method

- Questionnaire development
  - 70 items questionnaire, 5-point Likert-type scale
  - 34 items: regarding the extent to which reverse logistics product disposition options were used in their organization
  - 23 items: to assess regarding performance
  - 13 items: to assess perceived regulatory and ownership pressures
- Control variable
  - firm size in terms of number of employees
- Data collection and sample characteristics
  - 89 responses from 177 organizations of Malaysian EEE manufacturing firms w/ ISO14001
  - Considering the smallest observed full-model R-square value of.357, alpha value of 0.05 and 14 predictors,
  - Post-hoc power analysis indicates that the sample size of 89 yields a power of 0.997

Measure assessment and descriptive statistics

- Validity analysis of questionnaire
  - The alpha of each item is > 0.7, to exclude

Table 1
Summary of reliability analysis and descriptive statistics.

Variables	No. of items	Cronbach's alpha	Mean (μ)	Standard deviation (σ)
Reverse logistics product disposition:				
Repair	5	0.899	3.46	1.05
Recondition	8	0.959	2.77	1.19
Remanufacture	8	0.969	2.42	1.17
Recycle	9	0.897	2.71	1.04
Disposal	4	0.896	3.87	1.01
Business performance				
Environment outcome	8	0.903	3.88	0.80
Profitability	8	0.920	3.10	0.94
Sales growth	7	0.922	3.01	1.07
Institutional pressure				
Regulatory pressure	8	0.904	3.80	0.77
Ownership pressure	6	0.873	3.00	0.95

Correlation analysis

- two-tailed Pearson's product-moment correlation analysis was used to verify the direction and strength of association between constructs.
- From the table below, institutional pressure is positively related to all measures of performance

Table 2
Pearson's Product-Moment Correlation Analysis.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Repair	1									
(2) Recondition	0.545***	1								
(3) Remanufacture	0.479***	0.704***	1							
(4) Recycle	0.373**	0.346**	0.494***	1						
(5) Disposal	0.306†	0.287*	0.188	0.296**	1					
(6) Environmental Outcome	0.041	0.174	0.183	0.260*	0.271*	1				
(7) Profitability	0.417***	0.398***	0.401***	0.437***	0.113	0.430***	1			
(8) Sales Growth	0.079	0.249*	0.458***	0.160	0.024	0.313**	0.487***	1		
(9) Regulatory Pressure	0.241*	0.169	0.133	0.175	0.440***	0.348**	0.458***	0.318**	1	
(10) Ownership Pressure	0.183†	0.315**	0.338**	0.360**	0.103	0.330**	0.462***	0.476***	0.440***	1

Significant levels (2-tailed)

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
† $p < 0.10$

Regression analysis

Four-step hierarchical regression analyses were applied for testing the direct and moderating relationships.

1. Accounted for the effect of the control variable, firm size.
2. Tested Hypothesis 1 by assessing the direct relationships between each reverse logistics product disposition option and measure of performance.
3. Incorporated institutional pressures as direct predictors of performance
4. Examined the inclusion of interaction terms (Sharma et al.,1981).

Regression analysis

- 6 regression models were developed to consider all 3 measures of performance (outcome variables) in addition to the 2 moderating variables.
- As shown in Tables 3 and 4, the variance accounted for in the model continued to increase during Step 3 and Step 4
- significant F statistics verify that this increase is significant (Ho, 2006).
- Subsequently, the interaction terms were explored further by plotting the predictors (reverse logistics product disposition options) against high and low predicted values for the moderating variables (Frazier et al., 2004).

Regression analysis

- Firm size did not contribute significant variance in predicting performance in the full model.

Regression analysis

Table 3
Hierarchical regression analysis: Contingent role of regulatory pressure.

Reverse logistics product disposition	Business performance of reverse logistics											
	Environmental outcome				Profitability				Sales growth			
	Step 1	*Step 2*	*Step 3*	*Step 4*	*Step 1*	*Step 2*	*Step 3*	*Step 4*	*Step 1*	*Step 2*	*Step 3*	*Step 4*
Control variable												
Small firms	−0.087	−0.044	0.063	0.197	0.147	0.137	0.306*	0.580***	−0.041	0.025	0.147	−0.157
Medium firms	−0.080	−0.073	−0.009	0.232	0.130	0.053	0.154	0.384**	0.125	0.033	0.106	−0.121
Large firms	0.000	0.012	0.038	0.236	0.273	0.311†	0.352*	0.620***	0.289	0.351*	0.380*	0.096
Independent variable												
Repair		−0.182	−0.230	3.266**		0.217†	0.141	2.080**		−0.135	−0.190	−0.349
Recondition		0.093	0.116	−3.313*		0.211	0.247†	−4.786***		−0.058	−0.032	4.889***
Remanufacture		0.080	0.078	0.282		0.081	0.078	2.206**		0.647***	0.645***	-2.965***
Recycle		0.200	0.178	−0.850		0.280*	0.244*	−0.983		−0.062	−0.088	1.643*
Disposal		0.212	0.110	0.461		−0.129	−0.291**	1.368*		−0.057	−0.174	−1.682**
Regulatory pressure			0.302*	0.652			0.479***	0.777*			0.345**	0.754*
Interaction term												
Repair*regulatory				−4.754**				−2.702*				0.372
Recondition*regulatory				4.423*				6.276***				−6.055***
Remanufacture*regulatory				−0.378				−2.610**				4.366***
Recycle*regulatory				1.131				1.373†				−2.046*
Disposal*Regulatory				−0.375				−2.234**				2.006*
R^2	0.009	0.140	0.206	0.396	0.031	0.355	0.520	0.630	0.081	0.342	0.428	0.611
F Change	0.218	2.013†	5.347*	3.784**	0.767	6.627***	22.28***	3.569**	2.084	5.244***	9.734**	5.668***
F	0.218	1.345	1.869†	2.810**	0.767	4.543***	7.816***	7.292***	2.084	4.292***	5.402***	6.744***
Durbin-Watson	1.909				1.724				1.983			

Significant levels:

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
† $p < 0.10$

Regression analysis

Table 4
Hierarchical regression analysis: Contingent role of ownership pressure.

Reverse logistics product disposition	Business performance of reverse logistics											
	Environmental outcome				Profitability				Sales growth			
	Step 1	*Step 2*	*Step 3*	*Step 4*	*Step 1*	*Step 2*	*Step 3*	*Step 4*	*Step 1*	*Step 2*	*Step 3*	*Step 4*
Control variable												
Small firms	−0.087	−0.044	−0.033	−0.062	0.147	0.137	0.148	0.156	−0.041	0.025	0.040	0.048
Medium firms	−0.080	−0.073	−0.105	−0.265	0.130	0.053	0.019	−0.124	0.125	0.033	−0.012	−0.095
Large firms	0.000	0.012	−0.033	−0.089	0.273	0.311†	0.262	0.183	0.289	0.351*	0.287†	0.250
Independent variable												
Repair		−0.182	−0.170	−0.561		0.217†	0.230†	0.308		−0.135	−0.118	0.222
Recondition		0.093	0.043	2.135**		0.211	0.156	1.685**		−0.058	−0.128	0.932
Remanufacture		0.080	0.057	−2.085**		0.081	0.056	−2.210***		0.647***	0.616***	−0.879
Recycle		0.200	0.121	0.736†		0.280*	0.193	0.391		−0.062	−0.173	0.051
Disposal		0.212	0.227†	0.601		−0.129	−0.113	0.177		−0.057	−0.037	0.376
Ownership pressure			0.272*	0.908			0.294**	0.561			0.380***	1.203*
Interaction Term												
Repair*ownership				0.656				−0.151				-0.617
Recondition*ownership				−2.809**				−1.977*				-1.402†
Remanufacture*ownership				2.821**				3.040***				2.041*
Recycle*ownership				−0.868				−0.275				−0.296
Disposal*Ownership				−0.726				−0.563				−0.691
R^2	0.009	0.140	0.198	0.357	0.031	0.355	0.423	0.574	0.081	0.342	0.456	0.548
F Change	0.218	2.013†	4.708*	2.962*	0.767	6.627***	7.657**	4.242**	2.084	5.244***	13.62***	2.434*
F	0.218	1.345	1.786†	2.379*	0.767	4.543***	5.297***	5.769***	2.084	4.292***	6.057***	5.193***
Durbin-Watson	2.088				1.796				1.714			

Significant levels:

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
† $p < 0.10$

Analysis of interactions

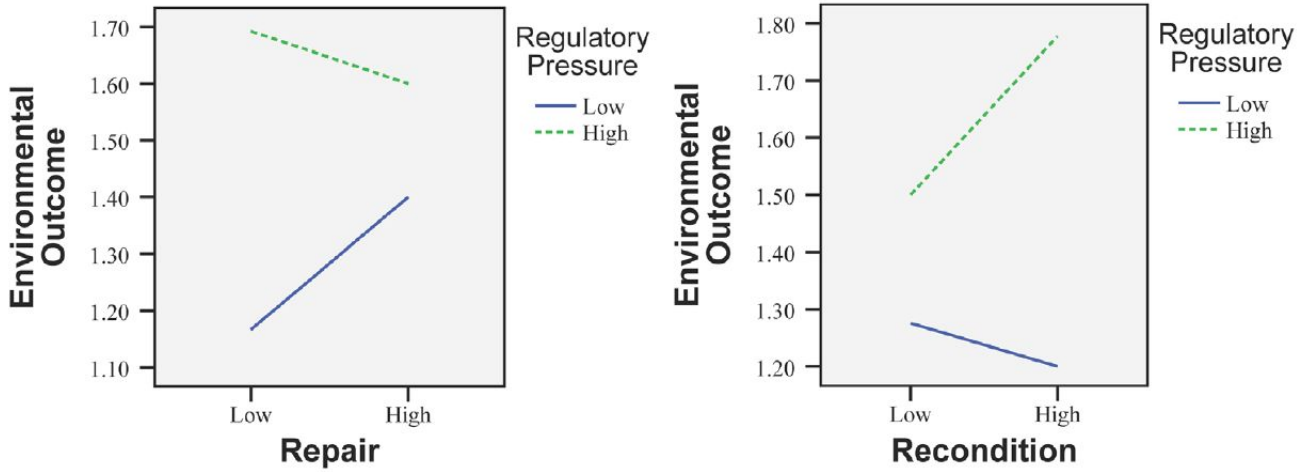


Fig. 2. Plot of significant interactions: moderating influence of regulatory pressure on relationship between (i) repair and (ii) recondition and environmental performance.

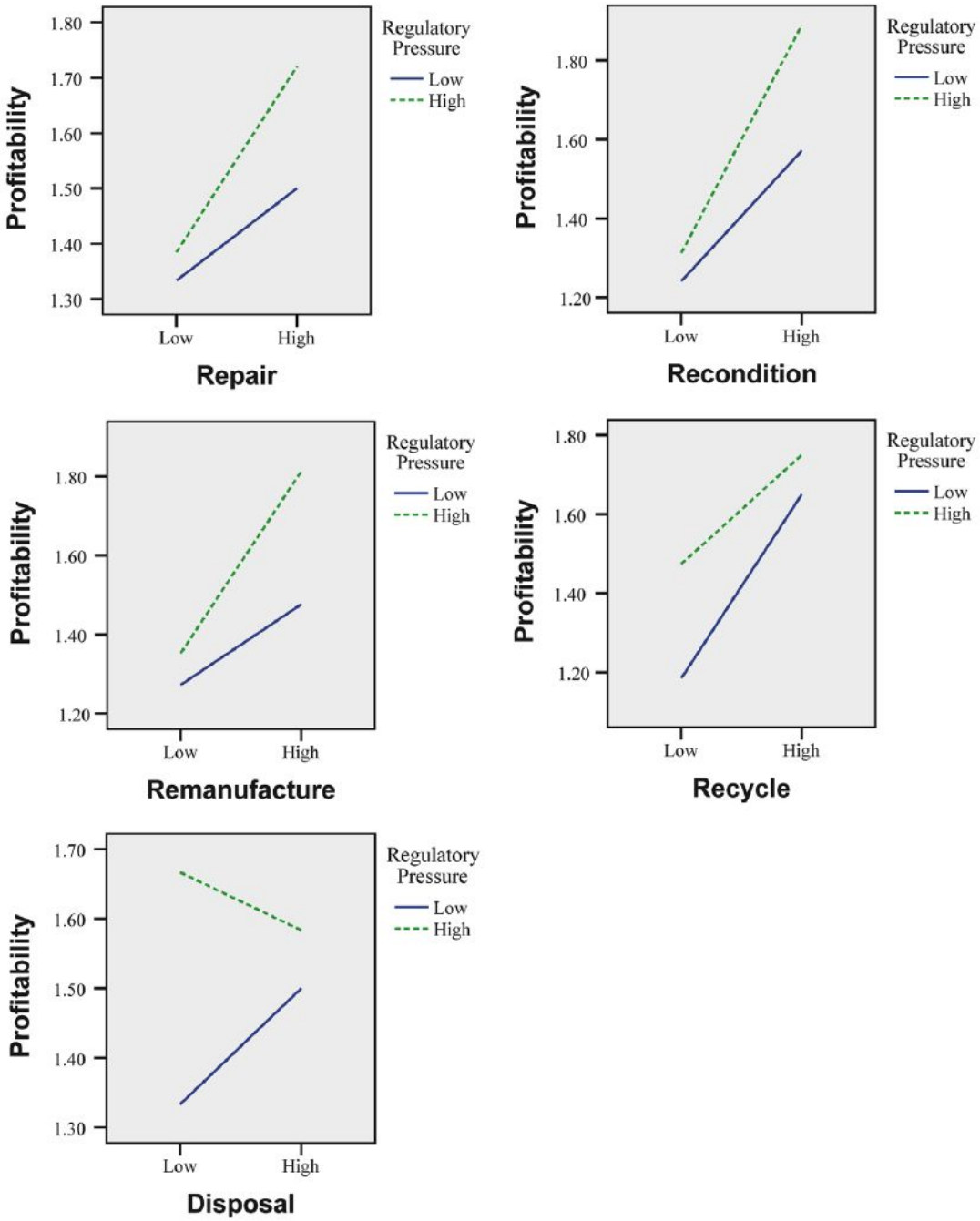


Fig. 3. Plot of significant interactions: moderating influence of regulatory pressure on relationship between (i) repair, (ii) recondition, (iii) remanufacture, (iv) recycle, and (v) disposal on profitability.

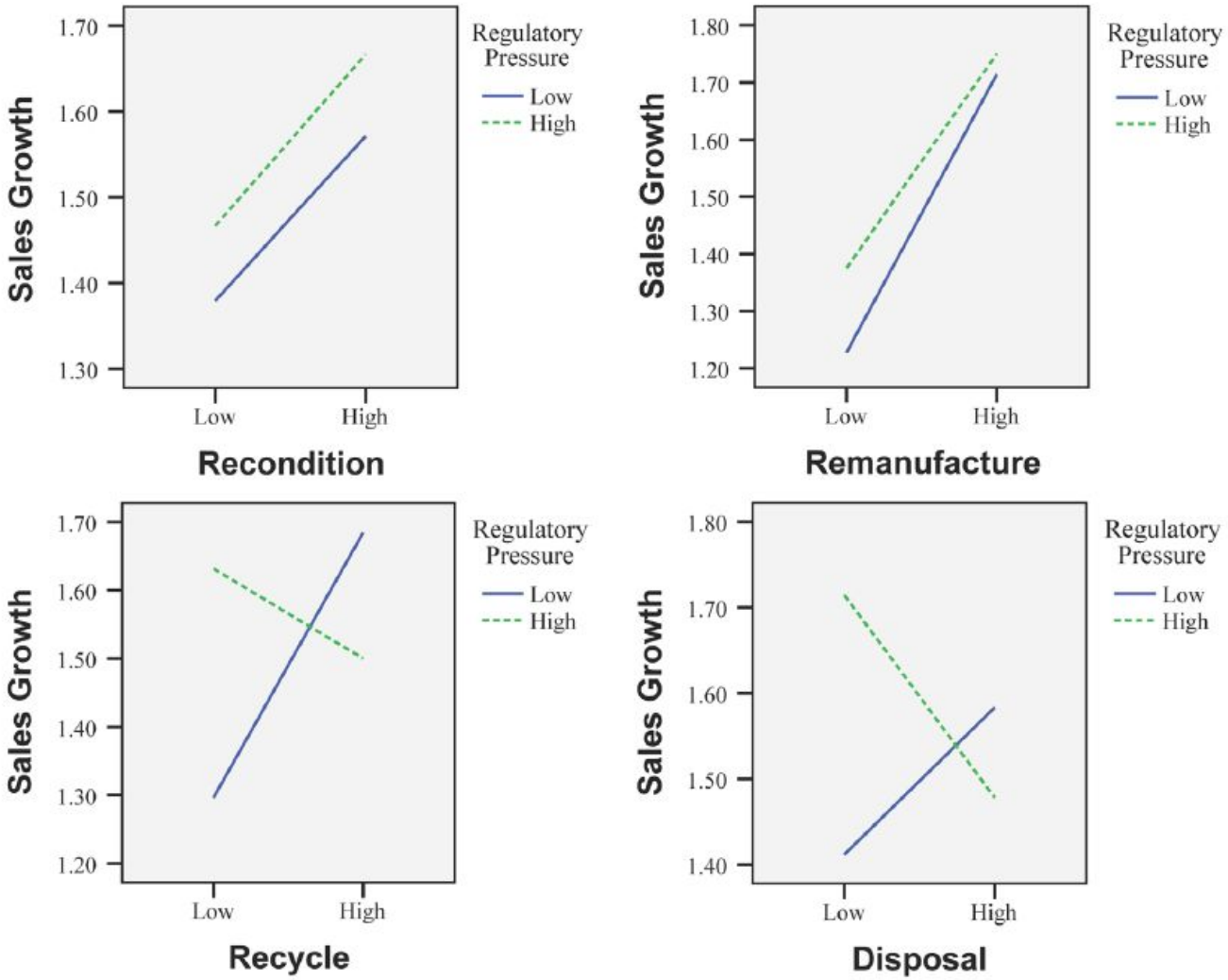


Fig. 4. Plot of significant interactions: Moderating influence of regulatory pressure on relationship between (i) recondition, (ii) remanufacture, (iii) recycle, and (iv) disposal on sales growth.

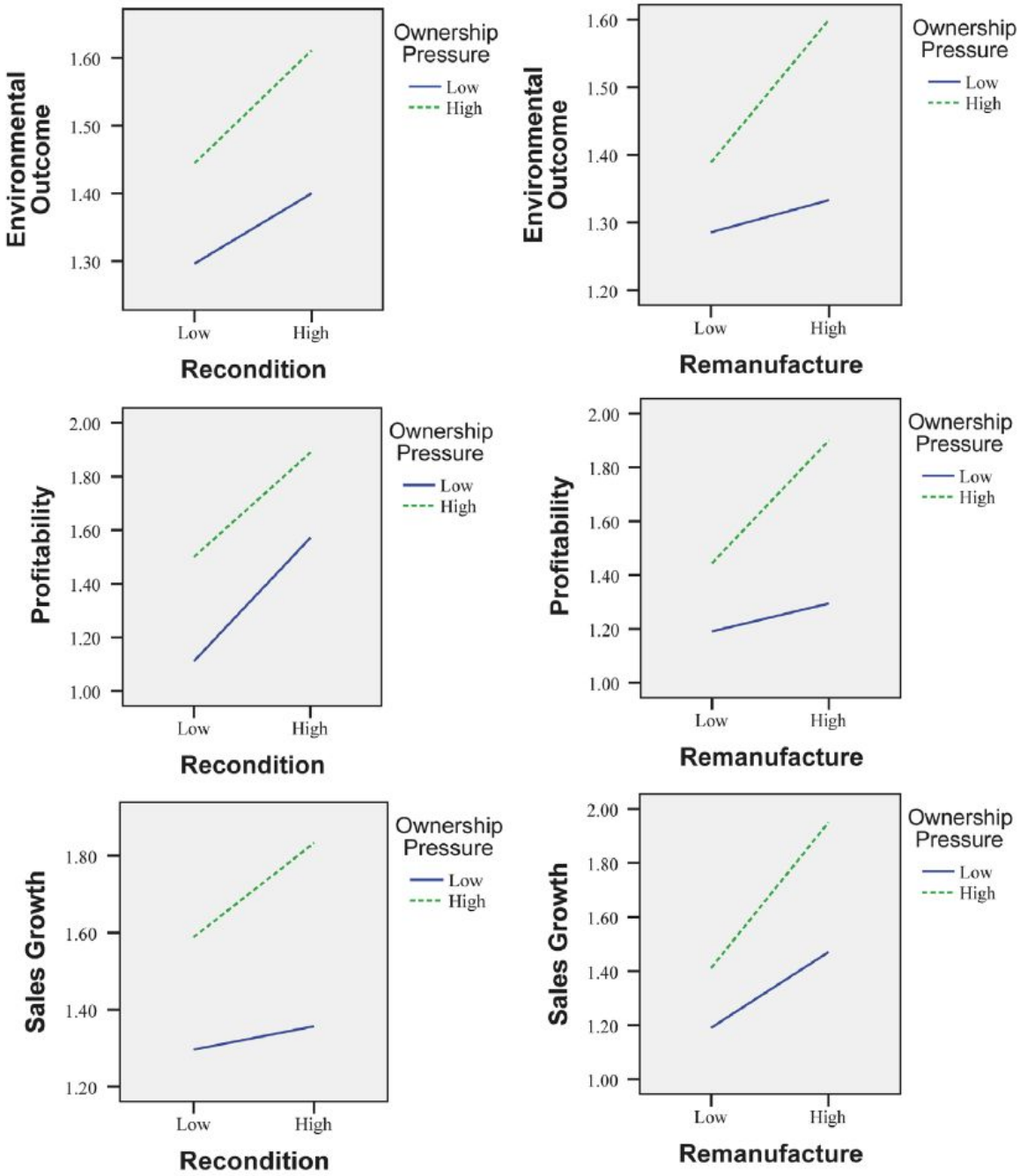


Fig. 5. Plot of significant interactions: Moderating influence of ownership pressure on relationship between recondition and remanufacture with environmental performance, profitability, and sales growth.

Discussion

- The results are summarized in the table below
  - Yes are significant and support the hypothesis
  - — are not significant and do not support the hypothesis
  - (Yes) are significant and support the hypothesized negative relationship

Table 5
Summary of results.

Reverse logistics product disposition	Environmental outcome		Profitability		Sales growth	
	Regulatory pressure	*Ownership pressure*	*Regulatory pressure*	*Ownership pressure*	*Regulatory pressure*	*Ownership pressure*
Repair	Yes	-	Yes	-	-	-
Recondition	Yes	Yes	Yes	Yes	Yes	Yes
Remanufacture	-	Yes	Yes	Yes	Yes	Yes
Recycle	-	-	Yes	-	(Yes)	-
Disposal	-	-	Yes	-	(Yes)	-

Note: 'Yes' means interaction term is significant and hypothesis is supported; '-' means interaction term is not significant and hypothesis is not supported; '(Yes)' means interaction term is significant and the hypothesized relationship is supported at negative direction.

Limitations and suggestion for future research

- The research focused solely on ISO14001 certified electrical and electronic equipment manufacturers, potentially limiting its applicability to other industries or varied environmental management systems.
- It overlooked other reverse logistics aspects, like IT capabilities, innovation, product management, and institutional pressures like normative and mimetic pressures.
- The findings, based on survey data, might face biases or be constrained by the participants' viewpoints. A deeper dive using case studies or interviews might provide richer insights.
- While the study hinted at knowledge diffusion from major manufacturers in developed countries aiding sustainable supply chains, this wasn't deeply examined.
- Future research could delve into leading firms' influence on supplier regulation compliance.

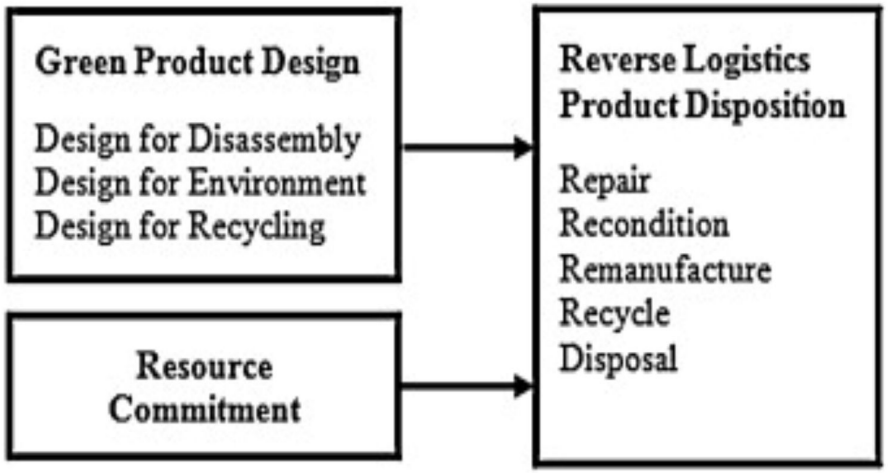
Dr. Kuan Siew Khor's Research

2016 Reverse logistics in Malaysia: The Contingent role of institutional pressure

2015 Remanufactured products purchase intentions and behaviour: Evidence from Malaysia

2015 Bridging the Gap of Green IT/IS and Sustainable Consumption

2013 Reverse logistics in Malaysia: Investigating the effect of green product design and resource commitment



Population -8 Billion/2022
Consumption -Environmental Awareness

United Nation -CSR/1999 > ESG/2004 > SDGs/2015
Country,Goverment -Legislation, Regulatory

Global Enterprise - Profitability
Local Company - Sales Growth

Manufacture
Distribution

- Reverse Logistics
- Disposition Option