RELATIONSHIP BETWEEN GREEN PRODUCT DESIGN, REVERSE LOGISTICS PRODUCT DISPOSITION AND BUSINESS PERFORMANCE AMONG ELECTRICAL AND ELECTRONIC MANUFACTURING FIRMS

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By

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ABSTRACT

This thesis is derived from the concept of reverse supply chain management and focuses on environmental and economic perspectives of reverse logistics product disposition. The current business environment accentuates the need for recoverable products, and manufacturers are encouraged to design products that facilitate multiple recovery capabilities. Returns with higher residual value deserve attention because business benefits from reverse logistics potentially improve firms' performance by extending the useful life of products which had underperformed earlier than expected. The product's structure and composition challenge reverse logistics implementation and these necessitate quantitative research on anteceding factors, particularly green product design and resource commitment, on reverse logistics product disposition. The study also examined the successive influence of reverse logistics product disposition on business performance and investigated whether institutional pressures moderate capability-performance relationships. A mail survey was administered to 177 ISO14001 certified E&E manufacturers in Malaysia and 89 usable responses were empirically tested. The research findings revealed that green product design (design for disassembly and design for environment) and resource commitment were antecedents of reverse logistics product disposition. Consequently, repair, remanufacture and recycling contributed to business performance (profitability and sales growth). By maintaining environmental compliance and shareholder interest, hierarchical regression analyses revealed that institutional pressures exerted significant moderating influence to warrant desirable outcome from reverse logistics activities, that is, repair, recondition, remanufacture, recycle and disposal. If firms have interest on reverse logistics implementation, disassemblability takes precedent over recyclability of products. When risk of penalties from regulatory violation is present, firms are motivated to generate benefits via extended producer responsibility. This study provided insights into antecedents and outcome of reverse logistics and acknowledged the moderating influence of institutional pressure, particularly, coercive and ownership pressure. Instead of analysing green product design and reverse logistics as components of green supply chain management, the relationship between both components was investigated. Limitations and suggestions for future research are discussed.

Keyword: Green product design, Reverse logistics, Business performance, Green supply chain management, Electrical and electronic equipment

ABSTRAK

Konsep pengurusan rangkaian bekalan berbalik merupakan fokus dalam kajian tesis ini. Di samping itu, tesis ini menumpukan kepada produk diposisi logistik berbalik daripada perspektif persekitaran dan ekonomi. Persekitaran perniagaan semasa amat menitikberatkan perolehan semula produk. Pengeluar digalakkan untuk mereka bentuk produk yang dapat memberikan kemudahan dalam pelbagai bentuk kaedah pemulihan. Produk dengan nilai baki yang tinggi patut diberi perhatian. Ini kerana produk ini dapat memberi manfaat logistik berbalik yang seterusnya mampu mempertingkatkan prestasi firma melalui pelanjutan jangka hayat sesuatu produk yang sebelum ini mempunyai mutu yang rendah. Struktur serta komposisi produk memberi kelebihan kepada pelaksanaan logistik berbalik. Faktor-faktor ini mendorong kepada keperluan untuk melaksanakan kajian kuantitatif terhadap pengaruh anteseden seperti rekaan produk hijau dan komitmen sumber terhadap produk disposisi logistik berbalik. Oleh itu, kajian ini menganalisis pengaruh turutan produk disposisi logistik berbalik terhadap prestasi perniagaan. Di samping itu, kajian ini menyelidik sama ada wujudnya tekanan institusi berpengaruh secara moderator terhadap perhubungan kapabiliti-prestasi. Kaji selidik melibatkan 177 buah syarikat pembuatan E&E yang beroperasi di Malaysia serta memiliki pengesahan sijil ISO 14001. Sebanyak 89 maklum balas yang diguna pakai serta diuji secara empirikal. Dapatan kajian menunjukkan rekaan produk hijau (rekaan untuk penyahpasangan dan rekaan untuk alam sekitar) dan komitmen sumber merupakan anteseden-anteseden kepada produk disposisi logistik berbalik. Seterusnya, pembaikan, pembuatan semula dan kitar semula menyumbang kepada prestasi perniagaan dalam aspek keuntungan dan peningkatan jualan. Berdasarkan analisis regresi hierarki, peraturan persekitaran yang dipatuhi dan mengekalkan kepentingan pemilik pula menunjukkan tekanan institusi memberi pengaruh moderator yang signifikan dalam menjamin kesan yang memuaskan daripada aktiviti logistik berbalik. Ini seperti pembaikan, pemulihan, pembuatan semula, kitar semula dan pelupusan. Sekiranya firma berminat terhadap implimentasi logistik berbalik, kebolehupayaan penyahpasangan produk didahulukan berbanding kebolehupayan kitaran semula. Kewujudan risiko penalti akibat peraturan yang tidak dipatuhi, akan mendorong firma untuk menjana manfaat melalui tanggungjawab lanjutan pengeluar. Kajian ini mendapati anteseden-anteseden serta kesan logistik berbalik dan memperakui tekanan institusi sebagai pengaruh moderator. Ini terutamanya melibatkan tekanan perundangan dan pemilikan. Selain menganalisis rekaan produk hijau dan logistik berbalik sebagai komponen pengurusan rantaian bekalan hijau, hubung kait kedua-dua komponen telah dikenal pasti. Selain itu, had-had dan saranan untuk kajian masa hadapan turut dibincangkan.

Kata kunci: Reka bentuk hijau, Logistik berbalik, Prestasi perniagaan, Pengurusan rantaian bekalan hijau, Produk elektrik dan elektronik

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LIST OF ABBREVIATIONS

Abbreviation	Description of Abbreviation
CLSC	Closed Loop Supply Chain
DfD	Design for Disassembly
DfE	Design for Environment
DfR	Design for Recycling
DOE	Department of Environment
EEE	Electric and Electronic Equipments
EMS	Environmental Management System
EPR	Extended Producer Responsibility
FMM	Federation of Malaysian Manufacturers
FSC	Forward Supply Chain
GSCM	Green Supply Chain Management
GPD	Green Product Design
HRA	Hierarchical Regression Analysis
ISO 14001	International Standard for Environmental Management System
KMO	Kaiser-Meyer-Olkin
LCA	Life Cycle Assessment
MCAR	Missing Completely at Random
MRA	Multiple Regression Analysis
MSA	Measure of Sampling Adequacy
OEM	Original Equipment Manufacturer
PLC	Product Life Cycle
PRM	Product Recovery Management
R&D	Research and Development

RBV	Resource Based View
RC	Resource Commitment
RL	Reverse Logistics
RLPD	Reverse Logistics Product Disposition
RSC	Reverse Supply Chain
SIRIM	Standards and Industrial Research Institute of Malaysia
WEEE	Waste of Electrical and Electronic Equipment

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

In the midst of growing concern towards environmental issues, product return deserved greater attention since government regulations and international trade standards have introduced stricter requirements on the management of electrical and electronic waste (e-waste). Reverse logistics developed from the concept of extended producer responsibility and this business activity focused on the challenging task of recovering value from end-of-use or end-of-life products. The presence of hazardous substances in e-waste threats environmental and human health and this circumstance steered the trend of after use product handling. Due to shrinking industry clockspeed, rate of equipment obsoletion is higher as new and improved technologies consistently replace products at current marketplace Fernández and Kekäle (2005) and this have led to the rapid saturation of landfill (Ayres, Ferrer, & Van Leynseele, 1997).

As the environmental and financial impact of waste burgeons, members of European Union, Japan, South Korea and other countries have introduced legislations related to producers' responsibilities to elevate pollution prevention activities. Therefore, manufacturers have begun to invest in sustainable product to take advantage of new market opportunity and benefit from reduced consumption of resources (Mollenkopf & Closs, 2005; Rock & Angel, 2007). Manufacturers ought to improve sustainability

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