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**ENVIRONMENTAL TECHNOLOGICAL INNOVATION  
IMPLEMENTATION AND MARKET DEMAND IN MALAYSIAN  
MANUFACTURING INDUSTRY**



**By**  
**MUHAMMAD FAKHRUL YUSUF**

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Universiti Utara Malaysia

**Thesis Submitted to  
School of Technology Management and Logistics,  
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in Fulfillment of the Requirement for the Degree of Doctor of Philosophy**



**Kolej Perniagaan**  
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Pemeriksa Luar  
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: **Assoc. Prof. Dr. Mohd Nizam Ab Rahman**

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*(Internal Examiner)*

: **Dr. Norani Nordin**

Tandatangan  
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Tarikh: **1 Ogos 2017**  
*(Date)*

Nama Pelajar  
(Name of Student)

: Muhammad Fakhru Yusuf

---

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---

Nama Penyelia/Penyelia-penyelia  
(Name of Supervisor/Supervisors)

Prof. Madya Dr. Hasbullah Haji Ashari

---



Tandatangan

Nama Penyelia/Penyelia-penyelia  
(Name of Supervisor/Supervisors)

Prof. Madya Dr. Mohd Rizal Razalli

---



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## ABSTRACT

Sustainable development is an international agenda accepted by all stakeholders, namely policy-makers, industry practitioners and the communities, to resolve current and future development problems. The interdependence relationship between economy, social and environment is an important pillar of sustainable development. Environmental technological innovation (ET-innovation) is the key factor that connects those three pillars. Hence, this study's original contribution to knowledge was the evaluation of the extent of market demand effects on ET-innovation implementation from the perspective of the demand-based view. This study also proposed market orientation as the mediator on the above relationship while the moderating effect of environmental turbulence and managerial ties were also determined. The investigation was done within the scope of the manufacturing industry in Malaysia. The single cross-sectional web-based survey was used to collect the data while the analysis was executed using PLS-SEM. The response rate for the study was 5.6 percent with 186 usable data. Interestingly, the result shows that customer demand has an insignificant direct relationship with ET-innovation, whereas only competitor pressure has direct relationships with ET-innovation implementation as hypothesised. Furthermore, the effect of market orientation as a mediating factor can only be found on the eco-process innovation implementation, while no interaction effects have been found for both environmental turbulence and managerial ties as moderating factors. In conclusion, despite several limitations, this study has proposed and validated a model to better explain ET-innovation implementation in the Malaysian manufacturing industry. This study has also compiled empirical evidence for new and existing theoretical propositions surrounding ET-innovation and environmental innovation. Several practical implications have been derived to further assist stakeholders in implementing ET-innovation. It is hoped that the inputs that originated in this study form the basis for future scholarly research. Recommendations are also outlined in this study.

**Keywords:** environmental technological innovation, demand-based view, market orientation, sustainable development, environmental innovation

## ABSTRAK

Pembangunan lestari adalah agenda antarabangsa yang diterima oleh semua pihak yang berkepentingan iaitu pembuat dasar, pengamal industri dan masyarakat untuk menyelesaikan masalah pembangunan semasa dan pada masa hadapan. Hubungan saling bergantung antara ekonomi, sosial dan alam sekitar merupakan tunggak yang penting dalam pembangunan lestari. Inovasi teknologi alam sekitar (*ET-innovation*) adalah faktor utama yang menghubungkan ketiga-tiga tunggak pembangunan lestari tersebut. Oleh itu, sumbangan sebenar kajian ini dalam ilmu pengetahuan adalah untuk menilai sejauh mana kesan permintaan pasaran terhadap pelaksanaan *ET-innovation* dari perspektif pandangan berasaskan permintaan (*demand-based view*). Kajian ini turut mencadangkan orientasi pasaran (*market orientation*) sebagai faktor perantara dalam hubungan di atas, manakala kesan pengantaraan pergolakan persekitaran (*environmental turbulence*) dan pertalian pengurusan (*managerial ties*) juga ditentukan. Penyelidikan dibuat dalam skop industri pembuatan di Malaysia. Tinjauan keratan rentas tunggal berasaskan sesawang (web) digunakan untuk mengumpul data, manakala analisis dilakukan dengan menggunakan PLS-SEM. Kadar maklum balas kajian adalah sebanyak 5.6 peratus dengan 186 data boleh digunakan. Menariknya, keputusan kajian menunjukkan bahawa hubungan langsung permintaan pelanggan dengan *ET-innovation* adalah tidak signifikan, sedangkan hanya tekanan pesaing mempunyai hubungan langsung dengan pelaksanaan *ET-innovation* sebagaimana hipotesis asal. Tambahan pula, kesan orientasi pasaran sebagai faktor perantara hanya boleh didapati pada pelaksanaan inovasi proses alam sekitar (*eco-process innovation*), manakala tiada kesan interaksi didapati pada pergolakan alam sekitar dan hubungan pengurusan sebagai faktor perantara. Kesimpulannya, walaupun terdapat beberapa kekangan, kajian ini telah mencadangkan sebuah model yang terbukti boleh menerangkan *ET-innovation* dengan lebih jelas dalam industri pembuatan di Malaysia. Kajian ini juga telah mengumpul bukti empirik untuk cadangan teori baharu dan teori sedia ada yang berkaitan dengan *ET-innovation* dan inovasi alam sekitar (*environmental innovation*). Beberapa implikasi praktikal telah diperolehi untuk membantu pihak-pihak berkepentingan ke arah pelaksanaan *ET-innovation*. Diharapkan agar input daripada kajian ini dapat membentuk asas penyelidikan ilmiah pada masa hadapan. Beberapa cadangan juga digariskan dalam kajian ini.

**Kata kunci:** inovasi teknologi alam sekitar, pandangan berasaskan permintaan, orientasi pasaran, pembangunan lestari, inovasi alam sekitar

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## LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AIC	Akaike's Information Criterion
AIC <sub>3</sub>	Modified AIC with Factor 3
AIC <sub>4</sub>	Modified AIC with Factor 4
AIM	Malaysian Innovation Agency ( <i>Agensi Inovasi Malaysia</i> )
ASEIC	ASEM SMEs Eco-innovation Center
ASEM	Asia-Europe Meeting
AVE	Average Variance Extracted
BCSDM	Business Council for Sustainable Development in Malaysia
BIC	Bayesian Information Criteria
CAIC	Consistent AIC
CB-SEM	Covariance Based - Structural Equation Modelling
CO <sub>2</sub>	Carbon Dioxide
CR	Composite Reliability
Eco-	Environmental
Eco-process Innovation	Environmental Process Innovation
Eco-product Innovation	Environmental Product Innovation
EMS	Environmental Management System
EN	Entropy Statistic (Normed)
ENGO	Environmentally Oriented NGO
ENPD	Environmental New Product Development
ENSEARCH	Environmental Management and Research Association of Malaysia
EPU	Economic Planning Unit
ET-innovation	Environmental Technological Innovation
FIMIX-PLS	Finite Mixture PLS
FMM	Federation of Malaysian Manufacturers
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GIS	Geographical Information System
GLC	Government Linked Company
GoF	Goodness-of-Fit Index
GreenTech Malaysia	Malaysia Green Technology Corporation

GTFS	Green Technology Funding Scheme
HTMT	Heterotrait-Monotrait Ratio of Correlations
IPMA	Importance-Performance Matrix Analysis
ISO	International Organization for Standardization
KeTTHA	Ministry of Energy, Green Technology, and Water ( <i>Kementerian Tenaga, Teknologi Hijau dan Air</i> )
LnL	Log Likelihood
MaGIC	Malaysian Global Innovation and Creativity Centre
MASTIC	Malaysian Science and Technology Information Centre
MATRADE	Malaysia External Trade Development Corporation
MDL <sub>5</sub>	Minimum Description Length with Factor 5
MGA	Multi-Group Analysis
MICCI	Malaysian International Chamber of Commerce & Industry
MOSTI	Ministry of Science, Technology, and Innovation ( <i>Kementerian Sains, Teknologi and Inovasi</i> )
NFI	Normal Fit Index
NRBV	Natural-resource-based View
OECD	Organisation for Economic Co-operation and Development
PLC	Product Life Cycle
PLS-GAS	Genetic Algorithm Segmentation in PLS-SEM
PLS-IRRS	Iterative Reweighted Regressions Segmentation Method
PLS-MGA	PLS-Multi Group Analysis
PLS-POS	PLS-SEM Prediction-Oriented Segmentation Approach
PLS-SEM	Partial Least Squares – Structural Equation Modelling
R&D	Research and Development
RBV	Resource-based View
REBUS-PLS	Response-Based Procedure For Detecting Unit Segments
SME	Small Medium Enterprise
SRMR	Standardized Root Mean Residual
TIM	Texas Instruments Malaysia Sdn Bhd
UN	United Nations
UNFCCC-COP 15	United Nations Framework Convention on Climate Change - Conference of the Parties 15
VIF	Variance Inflation Factor
WCED	World Commission on Environment and Development

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# CHAPTER ONE

## INTRODUCTION

This chapter begins with the background of the study, the problem statement, the research objectives and the research questions. Subsequent sections discuss the significance of this study, the scope and the limitations of this study, and also the definition of terms. Finally, the chapter concludes with the organisation of the report and the summary of the chapter.

### 1.1 Background of the Study

The background of this study first gives a big picture overview of the sustainable development concept in the world and in Malaysia. It will then narrow down to describe the environmental technological innovation (ET-innovation) concept within the sustainable development. Finally, it ends with a brief explanation of the current situation on market demand and the ET-innovation in Malaysian manufacturing industry as the focus of this study.

#### 1.1.1 Sustainable Development

The Honorary U Thant (Secretary-General of the United Nations, 1969) has stated that the arms race, the environment deterioration, the population explosion, and economic development stagnation are major long-term problems of the new world (Meadows, Meadows, Randers, & Behrens, 1972, p. 17). Sustainable development is an important agenda to resolve most of these critical modern man problems. Sustainable development is a process of developing land, businesses,

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## APPENDICES



## Appendix A: PLS-SEM Algorithm Setting

<b>Data file Settings</b>	
<b>Data file</b>	Data3 1.0 [186 records]
<b>Missing value marker</b>	none
<b>Data Setup Settings</b>	
<b>Algorithm to handle missing data</b>	Mean Replacement
<b>Weighting Vector</b>	-
<b>PLS Algorithm Settings</b>	
<b>Data metric</b>	Mean 0, Var 1
<b>Initial Weights</b>	1.0
<b>Max. number of iterations</b>	300
<b>Stop criterion</b>	5
<b>Use Lohmoeller settings?</b>	No
<b>Weighting scheme</b>	Path
<b>Construct Outer Weighting Mode Settings</b>	
<b>Business Ties</b>	Automatic
<b>Competitive Intensity</b>	Automatic
<b>Competitor Pressure</b>	Automatic
<b>Customer Demand</b>	Automatic
<b>Eco-process Innovation Implementation</b>	Automatic
<b>Eco-product Innovation Implementation</b>	Automatic
<b>Market Orientation</b>	Automatic
<b>Market Turbulence</b>	Automatic
<b>Political Ties</b>	Automatic
<b>Technological Turbulence</b>	Automatic
<b>University Ties</b>	Automatic

## Appendix B: SmartPLS 3 Setting with Bootstrapping

<b>Data file Settings</b>	
<b>Data file</b>	Data3 1.0 [186 records]
<b>Missing value marker</b>	none
<b>Data Setup Settings</b>	
<b>Algorithm to handle missing data</b>	Mean Replacement
<b>Weighting Vector</b>	-
<b>PLS Algorithm Settings</b>	
<b>Data metric</b>	Mean 0, Var 1
<b>Initial Weights</b>	1.0
<b>Max. number of iterations</b>	300
<b>Stop criterion</b>	5
<b>Use Lohmoeller settings?</b>	No
<b>Weighting scheme</b>	Path
<b>Bootstrapping Settings</b>	
<b>Complexity</b>	Complete Bootstrapping
<b>Confidence interval method</b>	Bias-Corrected and Accelerated (BCa) Bootstrap
<b>Parallel processing</b>	No
<b>Samples</b>	1000
<b>Sign changes</b>	No Sign Changes
<b>Significance level</b>	0.05
<b>Test type</b>	Two Tailed
<b>Construct Outer Weighting Mode Settings</b>	
<b>Business Ties</b>	Automatic
<b>Competitive Intensity</b>	Automatic
<b>Competitor Pressure</b>	Automatic
<b>Customer Demand</b>	Automatic
<b>Eco-process Innovation Implementation</b>	Automatic
<b>Eco-product Innovation Implementation</b>	Automatic
<b>Market Orientation</b>	Automatic
<b>Market Turbulence</b>	Automatic
<b>Political Ties</b>	Automatic
<b>Technological Turbulence</b>	Automatic
<b>University Ties</b>	Automatic

## Appendix C: SmartPLS 3 – FIMIX-PLS Setting

<b>Data file Settings</b>	
<b>Data file</b>	Data3 1.0 [186 records]
<b>Missing value marker</b>	none
<b>Data Setup Settings</b>	
<b>Algorithm to handle missing data</b>	Mean Replacement
<b>Weighting Vector</b>	-
<b>PLS Algorithm Settings</b>	
<b>Data metric</b>	Mean 0, Var 1
<b>Initial Weights</b>	1.0
<b>Max. number of iterations</b>	300
<b>Stop criterion</b>	7
<b>Use Lohmoeller settings?</b>	No
<b>Weighting scheme</b>	Path
<b>Finite Mixture (FIMIX) Segmentation Settings</b>	
<b>Estimate Regression Intercept</b>	No
<b>Maximum iterations</b>	5000
<b>Number of repetitions</b>	10
<b>Number of segments</b>	2
<b>Stop criterion</b>	10
<b>Use unstandardized latent variable scores</b>	No
<b>Construct Outer Weighting Mode Settings</b>	
<b>Business Ties</b>	Automatic
<b>Competitive Intensity</b>	Automatic
<b>Competitor Pressure</b>	Automatic
<b>Customer Demand</b>	Automatic
<b>Eco-process Innovation Implementation</b>	Automatic
<b>Eco-product Innovation Implementation</b>	Automatic
<b>Market Orientation</b>	Automatic
<b>Market Orientation-\Business Ties/-Eco-process Innovation Implementation</b>	Automatic
<b>Market Orientation-\Business Ties/-Eco-product Innovation Implementation</b>	Automatic
<b>Market Orientation-\Competitive Intensity/-Eco-process Innovation Implementation</b>	Automatic
<b>Market Orientation-\Competitive Intensity/-Eco-product Innovation Implementation</b>	Automatic
<b>Market Orientation-\Market Turbulence/-Eco-process Innovation Implementation</b>	Automatic
<b>Market Orientation-\Market Turbulence/-Eco-product Innovation Implementation</b>	Automatic

Appendix C (Continued)

<b>Market Orientation-\Political Ties/-Eco-process Innovation Implementation</b>	Automatic
<b>Market Orientation-\Political Ties/-Eco-product Innovation Implementation</b>	Automatic
<b>Market Orientation-\Technological Turbulence/-Eco-process Innovation Implementation</b>	Automatic
<b>Market Orientation-\Technological Turbulence/-Eco-product Innovation Implementation</b>	Automatic
<b>Market Orientation-\University Ties/-Eco-process Innovation Implementation</b>	Automatic
<b>Market Orientation-\University Ties/-Eco-product Innovation Implementation</b>	Automatic
<b>Market Turbulence</b>	Automatic
<b>Political Ties</b>	Automatic
<b>Technological Turbulence</b>	Automatic
<b>University Ties</b>	Automatic



**UUM**  
Universiti Utara Malaysia

# **SURVEY QUESTIONNAIRE DOCTORAL RESEARCH**

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**Environmental Technological Innovation Implementation  
and Market Demand: Accessing Mediating and Moderating  
Factors of Market Orientation, Environmental Turbulence  
and Managerial Ties**



**Universiti Utara Malaysia  
06010 UUM Sintok  
Kedah Darul Aman, Malaysia**

**Muhammad Fakhru Yusof  
Doctoral Researcher**

**School of Technology Management &  
Logistic  
College of Business**

**Email: [m.fakhrul@gmail.com](mailto:m.fakhrul@gmail.com)  
Phone: +6016-2380780**

## Appendix D (Continued)



Pusat Pengajian Pengurusan  
Teknologi dan Logistik  
SCHOOL OF TECHNOLOGY MANAGEMENT AND LOGISTICS  
Universiti Utara Malaysia



Dear Sir/Madam,

I am currently a PhD candidate studying Technology Management at Universiti Utara Malaysia. As part of my dissertation, I am seeking to understand the relationship between Market Demand and Environmental Technological Innovation\* Implementation.

My research title is Environmental Technological Innovation Implementation and Market Demand: Accessing Mediating and Moderating Factors of Market Orientation, Environmental Turbulence and Managerial Ties.

This study will help fellow practitioners, academicians and policy makers to better understand the chemistry of the relationship in the implementation of Environmental Technological Innovation within a firm. Malaysian Green Technology Corporation as attached recommendation letter also has endorsed this study.

The research requires participation of the middle management level (Manager & above) or top-management level (General Manager & above) to complete the enclosed questionnaire.

Please Note:

Your participation in this study is completely voluntary. There are no foreseeable risks associated with this project. Your survey responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential. If you have questions at any time about the survey or the procedures, you may contact me by email at the email address specified below.

Your participation in answering the questionnaire is very much significant and appreciated to ensure the success of the study.

Thank you for your participation.

Muhammad Fakhrol Yusuf  
PhD Candidate  
Universiti Utara Malaysia  
06010 Sintok,  
Kedah, Malaysia  
016-2380780  
m.fakhrol@gmail.com

*\*Environmental technological innovation (ET-innovation) also known as technological environmental innovation, technological eco-innovation and green technological innovation. Eco-product innovation and eco-process innovation are subsets of ET-innovation and ET-innovation is part of green innovation. Green technology is the output of ET-innovation.*

## Appendix D (Continued)



Pusat Pengajian Pengurusan  
Teknologi dan Logistik  
SCHOOL OF TECHNOLOGY MANAGEMENT AND LOGISTICS  
Universiti Utara Malaysia



Ref No. : MGTC/GG/GTFS/423  
Date : February 10, 2016

### To Whom It May Concern

Dear Sir/Madam,

### Re: Recommendation Letter to Conduct Research for GTFS Project.


We write in support for En Muhammad Fakhru Yusof, a Ph.D. student, at University Utara Malaysia who is seeking assistance in conducting his research in Environmental Technological Innovation relationship with Market Demand.

The target respondents for the research are companies that implement eco product or eco process innovation in their respective industry. We believe the result of the research will benefit the policy makers, international firms, business owners, academics and environmental interested parties.

We, therefore hope that you provide the necessary assistance and utmost cooperation to En Muhammad Fakhru Yusof in conducting his research. If you should require further information, please do not hesitate to contact Kamaradzaman Mohd Bakri at 603-8921 0901.

Thank you.

Yours faithfully,

  
SYED AHMAD SYED MUSTAFA  
Vice President, Green Growth

MALAYSIAN GREEN TECHNOLOGY CORPORATION (462237-T)

No.2, Jalan 9/10, Persiaran Usahawan, Seksyen 9, 43650 Bandar Baru Bangi, Selangor Darul Ehsan  
Tel: 03 8921 0800 Fax: 03 8921 0801/03 8921 0802 Email: info@greentechmalaysia.my  
www.greentechmalaysia.my



## Appendix D (Continued)



Pusat Pengajian Pengurusan  
Teknologi dan Logistik  
SCHOOL OF TECHNOLOGY MANAGEMENT AND LOGISTICS  
Universiti Utara Malaysia



This survey is divided into **6 sections**. Respond to each question with whatever knowledge you have. There are no right or wrong answers. Be honest and realistic in your assessment.

**For information: In case you have more than one plant, please choose only one primary plant to base on your answers on all questions contain here**

### SECTION 1

1. **What is the main industry of your company?**

- |                                                              |                                                         |
|--------------------------------------------------------------|---------------------------------------------------------|
| <input type="checkbox"/> Electrical & electronics            | <input type="checkbox"/> Machinery & equipment industry |
| <input type="checkbox"/> Petrochemicals industry             | <input type="checkbox"/> Aerospace                      |
| <input type="checkbox"/> Textile and apparels                | <input type="checkbox"/> Automotive industry            |
| <input type="checkbox"/> Furniture & wood-based              | <input type="checkbox"/> Rubber products                |
| <input type="checkbox"/> Shipbuilding & ship repair industry | <input type="checkbox"/> Basic metal products           |
| <input type="checkbox"/> Non metallic mineral industry       | <input type="checkbox"/> Food & sustainable resources   |
| <input type="checkbox"/> Pharmaceutical                      | <input type="checkbox"/> Medical devices                |
| <input type="checkbox"/> Engineering support                 | <input type="checkbox"/> Chemicals                      |
| <input type="checkbox"/> Jewelry                             | <input type="checkbox"/> Publishing & printing          |
| <input type="checkbox"/> Concrete products                   | <input type="checkbox"/> Other, please specify _____    |

2. **Please indicate who own your company:**

- |                                         |                                                        |
|-----------------------------------------|--------------------------------------------------------|
| <input type="checkbox"/> Publicly owned | <input type="checkbox"/> Privately owned               |
| <input type="checkbox"/> State owned    | <input type="checkbox"/> Foreign ownership             |
| <input type="checkbox"/> Federal owned  | <input type="checkbox"/> Mixed ownership/Joint Venture |

3. **How long has your company established? \_\_\_\_\_ years**

4. **No of employees in the organisation: \_\_\_\_\_**

5. **How many years have you been working with the company: \_\_\_\_\_ years**

6. **Please indicate your job title: \_\_\_\_\_**

## Appendix D (Continued)



Pusat Pengajian Pengurusan  
Teknologi dan Logistik  
SCHOOL OF TECHNOLOGY MANAGEMENT AND LOGISTICS  
Universiti Utara Malaysia



### 7. How would you describe your company implementation of eco-product innovation?

- Original concept (never existed in/outside of Malaysia)
- Originated from an existing concept in Malaysia
- Originated from an existing concept from outside of Malaysia
- Other (please specify) \_\_\_\_\_

*Note: Eco-product (green product) innovation implementation involves the development of new or improved products or services that inflicts no or less negative impact on the environment than a conventional product through different stages of the product's physical life cycle (manufacturing process, product use, and disposal)*

### 8. How would you describe your company implementation of eco-process innovation?

- Original concept (never existed in/outside of Malaysia)
- Originated from an existing concept in Malaysia
- Originated from an existing concept from outside of Malaysia
- Other (please specify) \_\_\_\_\_

*Note: Eco-process innovation implementation is the introduction of an improvement to existing production processes or the addition of new processes with the aim of producing environmentally friendly products capable of meeting eco-targets, such as energy savings, pollution prevention, waste recycling, no toxicity, low energy consumption, recycle, reuse and remanufacture material and use of cleaner technology to make savings and prevent pollution*

## Appendix D (Continued)



### SECTION 2

For SECTION 2, based on the following statement, please TICK (✓) your answers as scales below.

1	2	3	4	5	6	7
<b>Strongly disagree</b>	Disagree	Somewhat disagree	<b>Neither agree nor disagree</b>	Somewhat agree	Agree	<b>Strongly agree</b>

*"In last 3 years, relative to your competitors, please rate your firm on a scale of 1 to 7 on the following questions:"*

1      2      3      4      5      6      7

9. Our company often emphasizes developing new eco-products through new technologies to simplify their packaging

10. Our company often emphasizes developing new eco-products through new technologies to simplify their construction

11. Our company often emphasizes developing new eco-products through new technologies to easily *recycle* their components

*Note: Recycle in this case, can be done by third party company or collected by your company for recycling activity*

12. Our company often emphasizes developing new eco-products through new technologies to easily *decompose* their materials

*Note: Decompose reflects to materials that can be tossed onto the ground and can become food for plants and animals and nutrients for soil*

13. Our company often emphasizes developing new eco-products through new technologies to use *natural materials*

*Note: A natural material that comes from plants, animals, or the ground including minerals and the metals that can be extracted from them without further modification*







## Appendix D (Continued)



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36. If a major competitor were to launch an intensive campaign targeted at our customers/business clients, we would implement a response immediately

### SECTION 5

For SECTION 5, state your responses based on the following scales, please TICK (✓) your answers.

1	2	3	4	5	6	7
<b>Strongly disagree</b>	Disagree	Somewhat disagree	<b>Neither agree nor disagree</b>	Somewhat agree	Agree	<b>Strongly agree</b>

	1	2	3	4	5	6	7
37. The technology in this industry is changing rapidly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Technological changes provide substantial opportunities in this industry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. A large number of new product ideas have been made possible through <i>technological breakthroughs</i> in this industry <i>Note: Technological breakthrough happens when radical technological innovations are produced, challenging the old or outdated paradigm and system and gradually replacing it</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. It is very difficult to forecast where the technology in this area will be in the next few years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. In our kind of business, customers'/business clients' product preferences change constantly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. Our customers/business clients tend to look for new products all the time.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43. We are witnessing demand for our products from new customers/business clients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



## Appendix D (Continued)



Pusat Pengajian Pengurusan  
Teknologi dan Logistik  
SCHOOL OF TECHNOLOGY MANAGEMENT AND LOGISTICS  
Universiti Utara Malaysia



- |                                                                                                                             |                          |                          |                          |                          |                          |                          |                          |
|-----------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 55. Official in supporting organisations such as tax bureaus, state banks, commercial administration bureaus and the like   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 56. University researchers for R&D activities and formal consulting work<br><i>Note: R&amp;D = Research and Development</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 57. University researchers for training and transfer of personnel                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 58. University researchers for commercialisation related to intellectual property rights                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Thank you for your participation, if you need summary of the result, please attach your name card or fill up the information below. Thank you again.**

Name: \_\_\_\_\_

Name of organisation: \_\_\_\_\_

Address: \_\_\_\_\_

Email: \_\_\_\_\_



## Appendix E: Invitation Email



fakhrul m <m.fakhrul@gmail.com>

### Universiti Utara Malaysia Doctoral Research Survey Invitation

1 message

m.fakhrul@gmail.com <m.fakhrul@gmail.com>  
To: "m.fakhrul" <m.fakhrul@gmail.com>

Mon, Apr 18, 2016 at 11:03 PM



Pusat Pengajian Pengurusan  
Teknologi dan Logistik  
SCHOOL OF TECHNOLOGY MANAGEMENT AND LOGISTICS  
Universiti Utara Malaysia



Dear ,

I am Muhammad Fakhru Yusof, currently a PhD candidate studying Technology Management at Universiti Utara Malaysia. As part of my dissertation, I am seeking to understand the relationship between Market Demand and Environmental Technological Innovation Implementation.

This study will help fellow practitioners, academicians and policy makers to better understand the chemistry of the relationship in the implementation of Environmental Technological Innovation within a firm. This study also has been endorsed by the Malaysian Green Technology Corporation as attached recommendation letter ([http://www.questionpro.com/qp\\_userimages/sub-3/2686924/CCI20022016.pdf](http://www.questionpro.com/qp_userimages/sub-3/2686924/CCI20022016.pdf)).

Please help by giving your feedback in our survey. We really appreciate your reply. All responses will remain confidential and secure. Thank you in advance for your valuable insights. Please click on this link to complete the survey:

<http://www.questionpro.com/t/CTdhFZThg2o>

Please contact email below for further clarification

Thank you.

Muhammad Fakhru Yusof  
PhD Candidate  
Universiti Utara Malaysia  
06010 Sintok,

Kedah, Malaysia  
016-2380780  
[m.fakhrul@gmail.com](mailto:m.fakhrul@gmail.com)



# UUM

Universiti Pengurusan Terkemuka



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Universiti Utara Malaysia |  
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## Appendix G: Second Reminder Email



fakhrul m <m.fakhrul@gmail.com>

### University Research Survey - Special Reminder

1 message

for record <m.fakhrul@gmail.com>  
To: "m.fakhrul" <m.fakhrul@gmail.com>

Mon, Apr 18, 2016 at 11:04 PM



Dear ,

As mention in my first email, I am Muhammad Fakhru Yusuf, currently a PhD candidate studying Technology Management at Universiti Utara Malaysia.

My research focuses on Environmental Technological Innovation Implementation relationship with Market Demand within manufacturing industry in Malaysia.

Please assist me in completing this survey as it will also help fellow practitioners, academicians and policy makers to better understand the effect of Environmental Technological Innovation within a firm.

I greatly appreciate your feedback in our survey. Please click on this link to complete the survey:

<http://www.questionpro.com/t/CTdhFZThg2z>

Please contact email below for further clarification.

Thank you.

Muhammad Fakhru Yusuf  
PhD Candidate  
Universiti Utara Malaysia  
06010 Sintok,  
Kedah, Malaysia

016-2380780  
[m.fakhrul@gmail.com](mailto:m.fakhrul@gmail.com)



UUM  
Universiti Utara Malaysia



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**Reminder for involvement in Research Survey for Universiti Utara Malaysia**

1 message

for record <m.fakhrul@gmail.com>  
To: "m.fakhrul" <m.fakhrul@gmail.com>

Mon, Apr 18, 2016 at 11:05 PM



Dear ,

As stated earlier, I am Muhammad Fakhru Yusuf, a UUM doctorate candidate doing research on Environmental Technological Innovation Implementation.

Please help me by answering the survey as it will also have an impact on understanding Environmental Technological Innovation within manufacturing industry in Malaysia for fellow practitioners, policy makers and academics. Please click on this link to complete the survey:

<http://www.questionpro.com/t/CTdhFZThg20>

I greatly appreciate your feedback and thank you in advance for your time.

All responses will remain confidential and secure. Please contact email below for further clarification.

Best regards.

Muhammad Fakhru Yusuf  
PhD Candidate  
Universiti Utara Malaysia  
06010 Sintok,  
Kedah, Malaysia  
016-2380780  
[m.fakhrul@gmail.com](mailto:m.fakhrul@gmail.com)



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Appendix I: Table of Mean, Kurtosis and Skewness for Indicators

Indicators	Mean	Std. Dev.	Kurtosis	Skewness	Indicators	Mean	Std. Dev.	Kurtosis	Skewness
09	4.9	1.494	-0.214	-0.600	34	5.25	1.25	0.520	-0.708
10	5.04	1.442	-0.020	-0.690	35	5.38	1.119	0.210	-0.575
11	5.03	1.47	-0.076	-0.655	36	5.24	1.208	0.570	-0.718
12	4.74	1.503	-0.234	-0.526	37	5.22	1.424	-0.084	-0.658
13	4.9	1.55	-0.098	-0.594	38	5.38	1.26	0.077	-0.638
14	5.51	1.304	0.648	-0.944	39	5.28	1.293	-0.157	-0.595
15	5.39	1.403	0.427	-0.858	40	4.85	1.346	-0.318	-0.324
16	5.39	1.368	0.021	-0.753	41	4.72	1.395	-0.533	-0.348
17	5.58	1.238	0.520	-0.840	42	4.88	1.467	-0.682	-0.365
18	5.41	1.28	0.465	-0.799	43	5.26	1.148	0.881	-0.780
19	5.32	1.308	-0.005	-0.577	44	5.02	1.369	-0.246	-0.502
20	4.74	1.613	-0.588	-0.471	45	5.04	1.389	-0.291	-0.423
21	4.43	1.538	-0.554	-0.336	46	4.87	1.561	-0.779	-0.395
22	5.31	1.375	0.166	-0.792	47	4.83	1.455	-0.308	-0.355
23	5.23	1.362	0.203	-0.777	48	5.62	1.355	0.219	-0.911
24	5.04	1.481	-0.300	-0.569	49	4.82	1.521	0.187	-0.759
25	4.88	1.534	-0.316	-0.480	50	4.95	1.458	0.291	-0.762
26	4.97	1.559	-0.243	-0.629	51	4.11	1.604	-0.531	-0.392
27	5.45	1.356	0.998	-1.048	52	4.37	1.566	-0.330	-0.557
28	5.29	1.316	0.355	-0.766	53	3.78	1.761	-0.964	-0.217
29	5.37	1.238	0.400	-0.789	54	4.15	1.65	-0.508	-0.550
30	5.36	1.232	0.242	-0.664	55	4.15	1.656	-0.614	-0.393
31	5.33	1.166	0.326	-0.636	56	4.02	1.793	-0.901	-0.366
32	5.13	1.216	0.404	-0.552	57	3.75	1.76	-0.981	-0.180
33	5.28	1.181	0.435	-0.730	58	3.73	1.793	-1.009	0.067

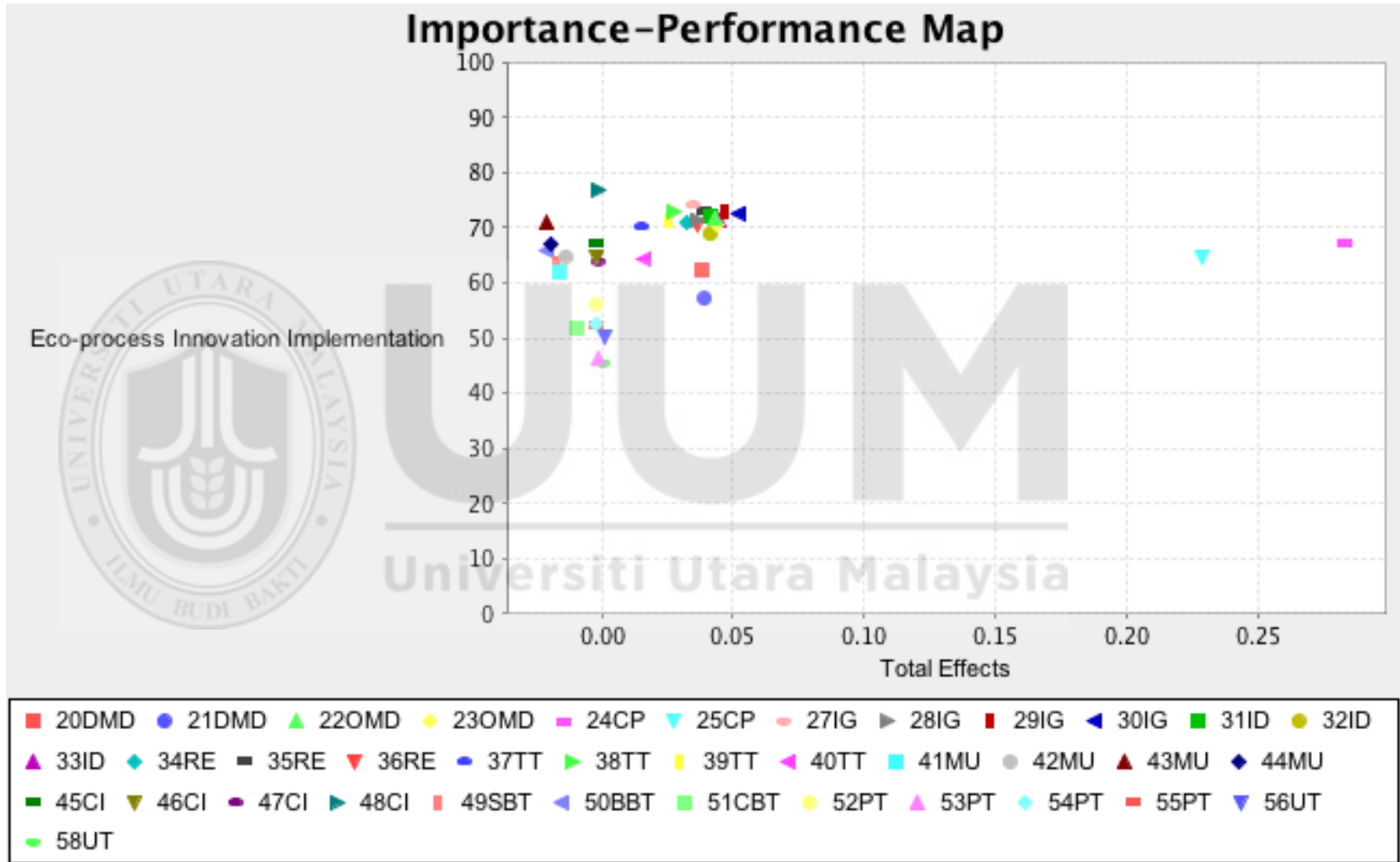
	<b>Business Ties</b>	<b>Competitive Intensity</b>	<b>Competitor Pressure</b>	<b>Customer Demand</b>	<b>Eco-process Innovation Implementation</b>	<b>Eco-product Innovation Implementation</b>	<b>Market Orientation</b>	<b>Market Turbulence</b>	<b>Political Ties</b>	<b>Technological Turbulence</b>	<b>University Ties</b>
<b>Business Ties</b>	0.865										
<b>Competitive Intensity</b>	0.230	0.791									
<b>Competitor Pressure</b>	0.224	0.067	0.952								
<b>Customer Demand</b>	0.206	0.170	0.741	0.875							
<b>Eco-process Innovation Implementation</b>	0.133	0.146	0.591	0.485	0.876						
<b>Eco-product Innovation Implementation</b>	0.200	0.168	0.737	0.624	0.737	0.788					
<b>Market Orientation</b>	0.277	0.313	0.561	0.507	0.560	0.526	0.801				
<b>Market Turbulence</b>	0.466	0.409	0.372	0.405	0.264	0.348	0.557	0.821			
<b>Political Ties</b>	0.589	0.130	0.211	0.224	0.104	0.178	0.243	0.463	0.882		
<b>Technological Turbulence</b>	0.256	0.401	0.347	0.423	0.361	0.402	0.497	0.576	0.192	0.815	
<b>University Ties</b>	0.368	-0.025	0.153	0.188	0.077	0.167	0.132	0.324	0.667	0.181	0.958

	<b>Business Ties</b>	<b>Competitive Intensity</b>	<b>Competitor Pressure</b>	<b>Customer Demand</b>	<b>Eco-process Innovation Implementation</b>	<b>Eco-product Innovation Implementation</b>	<b>Market Orientation</b>	<b>Market Turbulence</b>	<b>Political Ties</b>	<b>Technological Turbulence</b>	<b>University Ties</b>
<b>Business Ties</b>											
<b>Competitive Intensity</b>	0.291										
<b>Competitor Pressure</b>	0.249	0.079									
<b>Customer Demand</b>	0.244	0.192	0.823								
<b>Eco-process Innovation Implementation</b>	0.153	0.187	0.648	0.538							
<b>Eco-product Innovation Implementation</b>	0.224	0.192	0.810	0.693	0.813						
<b>Market Orientation</b>	0.294	0.366	0.595	0.551	0.600	0.559					
<b>Market Turbulence</b>	0.560	0.522	0.416	0.456	0.295	0.398	0.621				
<b>Political Ties</b>	0.732	0.178	0.227	0.235	0.108	0.191	0.260	0.522			
<b>Technological Turbulence</b>	0.284	0.508	0.381	0.477	0.398	0.440	0.546	0.685	0.207		
<b>University Ties</b>	0.471	0.127	0.167	0.211	0.077	0.181	0.144	0.365	0.740	0.200	

	Business Ties	Competitive Intensity	Competitor Pressure	Customer Demand	Eco-process Innovation Implementation	Eco-product Innovation Implementation	Market Orientation	Market Turbulence	Political Ties	Technological Turbulence	University Ties
<b>09EP</b>	0.263	0.159	0.558	0.454	0.574	<b>0.775</b>	0.466	0.365	0.295	0.349	0.123
<b>10EP</b>	0.146	0.166	0.657	0.502	0.637	<b>0.846</b>	0.428	0.316	0.132	0.470	0.114
<b>11EP</b>	0.124	0.092	0.512	0.487	0.520	<b>0.767</b>	0.304	0.228	0.106	0.209	0.095
<b>12EP</b>	0.110	0.155	0.568	0.529	0.508	<b>0.779</b>	0.349	0.269	0.183	0.268	0.164
<b>13EP</b>	0.135	0.035	0.497	0.466	0.443	<b>0.687</b>	0.360	0.333	0.099	0.198	0.222
<b>14EP</b>	0.171	0.108	0.581	0.501	0.635	<b>0.825</b>	0.485	0.241	0.112	0.309	0.130
<b>15EP</b>	0.152	0.186	0.663	0.504	0.703	<b>0.824</b>	0.480	0.189	0.066	0.361	0.095
<b>16EPs</b>	0.128	0.121	0.487	0.383	<b>0.845</b>	0.608	0.513	0.279	0.122	0.337	0.095
<b>17EPs</b>	0.122	-0.023	0.520	0.439	<b>0.855</b>	0.622	0.475	0.181	0.090	0.203	0.106
<b>18EPs</b>	0.114	0.196	0.529	0.428	<b>0.906</b>	0.681	0.491	0.223	0.076	0.394	0.027
<b>19EPs</b>	0.104	0.209	0.532	0.449	<b>0.896</b>	0.669	0.483	0.241	0.077	0.325	0.046
<b>20DMD</b>	0.182	0.146	0.603	<b>0.862</b>	0.392	0.479	0.427	0.296	0.187	0.328	0.180
<b>21DMD</b>	0.128	0.089	0.625	<b>0.845</b>	0.379	0.501	0.465	0.388	0.253	0.302	0.228
<b>22OMD</b>	0.189	0.204	0.638	<b>0.909</b>	0.450	0.594	0.439	0.337	0.156	0.387	0.128
<b>23OMD</b>	0.217	0.151	0.720	<b>0.883</b>	0.470	0.596	0.444	0.392	0.194	0.452	0.133
<b>24CP</b>	0.239	0.085	<b>0.962</b>	0.717	0.639	0.754	0.580	0.344	0.174	0.353	0.143
<b>25CP</b>	0.183	0.037	<b>0.941</b>	0.693	0.469	0.640	0.477	0.366	0.234	0.302	0.148

	Business Ties	Competitive Intensity	Competitor Pressure	Customer Demand	Eco-process Innovation Implementation	Eco-product Innovation Implementation	Market Orientation	Market Turbulence	Political Ties	Technological Turbulence	University Ties
<b>27IG</b>	0.231	0.213	0.376	0.400	0.367	0.347	<b>0.760</b>	0.540	0.287	0.351	0.150
<b>28IG</b>	0.228	0.290	0.391	0.450	0.382	0.374	<b>0.743</b>	0.463	0.201	0.320	0.120
<b>29IG</b>	0.216	0.183	0.533	0.473	0.500	0.471	<b>0.847</b>	0.461	0.202	0.334	0.096
<b>30IG</b>	0.201	0.240	0.588	0.419	0.588	0.527	<b>0.834</b>	0.422	0.146	0.437	0.034
<b>31ID</b>	0.222	0.313	0.431	0.423	0.459	0.424	<b>0.804</b>	0.382	0.143	0.430	0.073
<b>32ID</b>	0.230	0.297	0.424	0.414	0.444	0.437	<b>0.828</b>	0.546	0.245	0.437	0.217
<b>33ID</b>	0.188	0.242	0.481	0.382	0.489	0.480	<b>0.816</b>	0.372	0.167	0.441	0.148
<b>34RE</b>	0.279	0.306	0.341	0.316	0.364	0.329	<b>0.768</b>	0.488	0.234	0.487	0.069
<b>35RE</b>	0.204	0.121	0.432	0.360	0.456	0.379	<b>0.806</b>	0.405	0.202	0.367	0.098
<b>36RE</b>	0.253	0.341	0.415	0.407	0.357	0.372	<b>0.797</b>	0.437	0.159	0.391	0.072
<b>37TT</b>	0.163	0.369	0.191	0.309	0.176	0.243	0.326	0.412	0.085	<b>0.818</b>	0.124
<b>38TT</b>	0.272	0.225	0.373	0.415	0.366	0.403	0.481	0.497	0.144	<b>0.886</b>	0.153
<b>39TT</b>	0.260	0.380	0.310	0.381	0.349	0.373	0.489	0.586	0.229	<b>0.926</b>	0.183
<b>40TT</b>	0.082	0.405	0.198	0.234	0.224	0.236	0.253	0.332	0.144	<b>0.590</b>	0.117
<b>41MU</b>	0.355	0.497	0.230	0.281	0.180	0.264	0.386	<b>0.779</b>	0.343	0.564	0.234
<b>42MU</b>	0.349	0.392	0.237	0.283	0.168	0.221	0.387	<b>0.790</b>	0.320	0.446	0.187
<b>43MU</b>	0.379	0.210	0.374	0.388	0.287	0.311	0.564	<b>0.850</b>	0.400	0.486	0.278
<b>44MU</b>	0.440	0.307	0.347	0.356	0.209	0.328	0.461	<b>0.863</b>	0.441	0.412	0.340

	Business Ties	Competitive Intensity	Competitor Pressure	Customer Demand	Eco-process Innovation Implementation	Eco-product Innovation Implementation	Market Orientation	Market Turbulence	Political Ties	Technological Turbulence	University Ties
<b>45CI</b>	0.115	<b>0.794</b>	0.095	0.166	0.102	0.182	0.253	0.235	-0.009	0.366	-0.051
<b>46CI</b>	0.163	<b>0.854</b>	0.061	0.143	0.136	0.132	0.240	0.375	0.113	0.387	0.000
<b>47CI</b>	0.264	<b>0.711</b>	0.019	0.134	0.117	0.111	0.274	0.453	0.255	0.268	0.100
<b>48CI</b>	0.211	<b>0.797</b>	0.019	0.079	0.107	0.090	0.222	0.235	0.075	0.208	-0.141
<b>49SBT</b>	<b>0.937</b>	0.221	0.207	0.187	0.130	0.174	0.276	0.442	0.513	0.273	0.303
<b>50BBT</b>	<b>0.947</b>	0.218	0.224	0.182	0.147	0.209	0.291	0.414	0.456	0.223	0.273
<b>51CBT</b>	<b>0.686</b>	0.147	0.134	0.181	0.035	0.117	0.095	0.368	0.698	0.156	0.495
<b>52PT</b>	0.606	0.146	0.169	0.175	0.099	0.157	0.276	0.473	<b>0.846</b>	0.201	0.517
<b>53PT</b>	0.435	0.097	0.120	0.107	0.026	0.096	0.143	0.382	<b>0.844</b>	0.112	0.611
<b>54PT</b>	0.484	0.084	0.202	0.202	0.117	0.161	0.202	0.370	<b>0.925</b>	0.160	0.585
<b>55PT</b>	0.527	0.126	0.221	0.261	0.093	0.185	0.208	0.409	<b>0.911</b>	0.181	0.657
<b>56UT</b>	0.367	-0.050	0.154	0.182	0.098	0.184	0.130	0.302	0.639	0.192	<b>0.978</b>
<b>58UT</b>	0.334	0.018	0.135	0.180	0.034	0.122	0.122	0.327	0.647	0.145	<b>0.937</b>



(Numbers in the coding is the question no.)

