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# **Supplier selection in Electrical & Electronic industry from a sustainable point of view**

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## OUTLINE

- INTRODUCTION
- OBJECTIVES
- RESEARCH METHODOLOGY
- CASE STUDY
- RESULTS AND DISCUSSION
- CONCLUSION



## INTRODUCTION...

# Sustainable supply chain management

- A supply chain network (SCN) refers to a number of entities such as: the raw material suppliers, basic parts manufacturing unit, component suppliers, inventory service providers, assemblers, distributors, retailers, and customers.
- Due to the growth of knowledge about sustainability, sustainable supply chain management (SSCM) should be considered in all of aspects including economic, environmental, and social merits.
- The selection of supplier is an important decision making problem in SSCM and is the key to successful SSCM.

## INTRODUCTION...

### The importance of sustainable supplier selection

- Increases and varieties of customer demands.
- Competition in global market place.
- manufacturing industries and service providers have global sourcing for their business activities around the world
- Integrate the sustainable aspects into supplier selection.
- Choosing the appropriate mathematical method for supplier evaluation and selection.
- Identify the efficient and inefficient suppliers.



# RESEARCH METHODOLOGY.....

## How to find an appropriate method

- Supplier selection is a multi criteria decision making problem which includes a great deal of evaluation factors and multiple criteria need to be taken in to account for selection process.
- Choosing data envelopment analysis as a multi criteria decision making method for supplier selection problem

# RESEARCH METHODOLOGY.....

## Data envelopment analysis

- a mathematical programming method for assessing the relative efficiency of homogenous decision making units (DMU) with multiple inputs and outputs proposed by Charnes, Cooper, and Rhodes
- a non-parametric method that lets efficiency be measured without having specific weights for inputs and outputs or specify the form of the production function.
- the performance of a supplier is calculated using the ratio of weighted outputs to weighted inputs.



# RESEARCH METHODOLOGY.....

## Data envelopment analysis

$$\text{Max} Z_k = \sum_{r=1}^s u_r y_{rk}$$

st :

$$\sum_{i=1}^m v_i x_{ik} = 1$$

$$\sum_{r=1}^s u_r y_{rj} - \sum_{i=1}^m v_i x_{ij} \leq 0 \quad (j=1, 2, \dots, n)$$

$$u_r, v_i \geq \varepsilon$$

Where:  $k$  is the unit being evaluated;  $s$  represents the number of outputs;  $m$  represents the number of inputs;  $y_{rj}$  is the amount of output  $r$  provided by unit  $j$ ;  $x_{ij}$  is the amount of input  $i$  used by unit  $j$ ;  $u_r$  and  $v_i$  are the weights given to output  $r$  and input  $i$  respectively

## CASE STUDY .....

- This model was applied in electronic & electrical industry in Malaysian company considering 6 criteria(3 inputs, 3 outputs) for supplier evaluation and selection.
- The appropriate criteria were derived from related literature.
- After verifying a group of criteria considering companies' goals, three criteria including cost, quality, and delivery are considered as economic aspect, environmental certificates and green purchasing for environmental, and the rights & interest of employee for social aspects.



## Table 1: Supplier selection researches in electronic industry

Researchers	Evaluation and Selection Factors/Application
Kuo et al., 2010	Quality (reject rate, management commitment to quality, process improvement, warranties and claim policies, quality assurance); Cost (price performance value, compliance with sectoral cost behavior, transportation cost); Delivery (order fulfill rate, lead time, order frequency); Service (responsiveness, stock management, willingness, design capability); Environment (EUP, ODC, RoHS, ISO 14001, WEEE); Corporate social responsibility (the interests and rights of employee, the rights of stakeholder, information disclosure, respect for the policy)/Digital cameras manufacturer
Tseng and Chiu, 2010	Value-adding practices to a firm to ensure the profitability of supplier, Relationship, Delivery reliability, Quality, Satisfy customer needs, Flexibility, Service, Communication, Management, Green design, Environmental certificates, Green production plan, Cleaner production, Green purchasing, Life cycle assessment, Environmental management system, R& D capability, Innovation/ a printed circuit board manufacturer
Yeh and Chuang, 2010)	Production cost, Production time, Transportation cost, Transportation time, Average product quality, Green principles (green image, product recycling, green design, green supply chain management, pollution treatment cost, environment performance assessment)/ Electronic industry

# RESULTS and DISCUSSION...

Table 2: The data for inputs and outputs

Supplier No.	Inputs			Outputs		
	Cost	Quality	Delivery	Environmental certificates	Green purchasing	the interests and rights of employee
1	0.3289	0.5555	0.75	0.9223	0.5723	0.7223
2	0.4552	0.619	0.5	0.9644	0.4832	0.8644
3	0.3783	0.789	0.75	0.9993	0.7693	0.8993
4	0.5633	0.9751	1	0.9923	0.5041	0.9923
5	0.8821	0.539	0.1	0.9642	0.3475	0.9642
6	0.952	0.7344	0.2	0.9728	0.8925	0.9728
7	0.6323	0.321	0.5	0.9342	0.5223	0.9342
8	0.2793	0.299	0.25	0.8662	0.9918	0.8662
9	0.4536	0.498	0.1	0.9384	0.6723	0.7384



# RESULTS and DISCUSSION...

Table 3: Efficient and inefficient suppliers

Supplier Name	Input-Oriented CRS Efficiency	Optimal Multiplier					
		Cost	Quality	Delivery	Environmental certificates	Green purchasing	the interests and rights of employee
1	0.90419	3.04044	0.00000	0.00000	0.98037	0.00000	0.00000
2	0.68314	2.19684	0.00000	0.00000	0.70835	0.00000	0.00000
3	0.85175	2.64340	0.00000	0.00000	0.85235	0.00000	0.00000
4	0.56801	1.77525	0.00000	0.00000	0.57242	0.00000	0.00000
5	1.00000	0.54652	0.00000	5.17915	0.00000	0.00000	1.03713
6	0.79568	0.00000	0.78349	2.12301	0.00000	0.28680	0.55480
7	1.00000	0.01374	3.08821	0.00000	0.00000	0.00000	1.07043
8	1.00000	0.00000	3.34448	0.00000	0.00000	0.00900	1.14416
9	1.00000	0.00000	1.66696	1.69856	1.06564	0.00000	0.00000

## CONCLUSION

- Considering social aspects in supplier selection improve the performance of SCM to achieve competitive advantages.
- DEA can handle multiple input and output models. This paper applies DEA as a tactical decision-making tool in purchasing decisions and compares the overall supplier performances and presents the application through a case study for a manufacturing firm.
- Identify the efficient and inefficient suppliers.





**Thanks**