



# Developing an assessment framework for managing sustainability programs

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# Background and motivation

- Green supply chain management
  - ▣ Integrating environmental thinking into supply chain management including
    - Product design
    - Material sourcing and selection
    - Manufacturing processes
    - Delivery of the final product to the customers



# Research objective

- Triple bottom line (TBL)
  1. Social development
  2. Environmental protection
  3. Economic development

Waste printed circuit boards



Recycling  
extract

Reuse  
remanufacturing



Clusters	Dimensions	Sub-dimensions	Author(s)	Main Issues
Social Development	Competence Trust	Human Capital Development	Heikkurinen et al. (2013); Chen et al. (2009)	investing in human capital accumulation necessary for enhancing core competencies and building a sustainable development
		Talent Attraction and Retention	Nankervis (2013); Ciliberti et al. (2008)	producers or focal firms in supply chain paying attention to working conditions, wage level and payment conditions, health and safety issues, and training and education
		Knowledge Management	Franz (2010); Liao et al. (2010)	managing all cognitions and abilities, knowledge creation, and knowledge exchange
	Goodwill Trust	Corporate Citizenship/ Philanthropy	Evans and Davis (2014); Pies et al. (2014); Lee and Kim (2009)	proactively responding to society's expectations and needs, and contributing resources to the community based upon the goodwill of enterprises
		External Trust	Tang and Li (2009); Liu et al. (2008)	developing goodwill trust through socially responsible acts and transferring socially responsible behaviors to suppliers
	Contractual Trust		Heffernan (2004); Madu and Kuei (2004)	focusing on conformance to international standards, government regulations, and contract specifications using community-centric approach

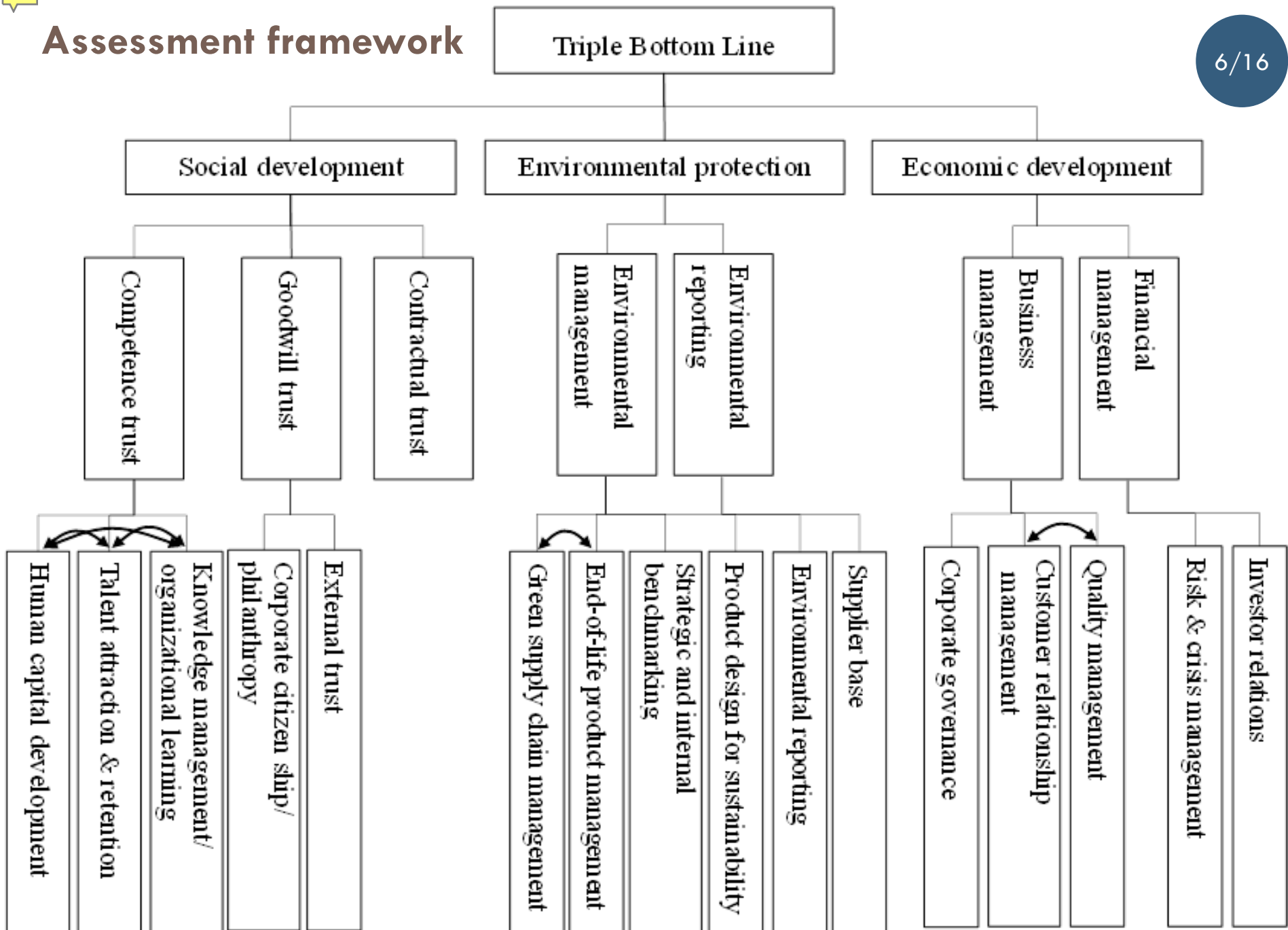


Clusters	Dimensions	Sub-dimensions	Author(s)	Main Issues
Environmental Protection	Environmental Management	Green Supply Chain Management	Govindan et al. (2014); Mitra and Datta (2014); Srivastava (2008)	an important inter- and intra-organizational set of environmental practices useful for logistics management
		End-of-life Product Management	Ji et al. (2014); Ravi et al. (2008)	prolonging the life of the product, minimizing wastes of materials, and conserving the landfills
		Strategic and Internal Benchmarking	Kuei and Madu (2009) ; Madu (2006)	creating a continuous and systematic process of measuring product, service, and process performance as well as management practices against the best performers in any industry
		Product Design for Sustainability	Knight and Jenkins (2009); Coley and Lemon (2008)	adopting sustainable design and eco efficiency concepts/techniques along new product development processes
	Environmental Reporting	Environmental Reporting	Brown et al. (2009); Moneva and Cuellar (2009)	reporting a wide array of metrics of environmental quality; focusing on non-financial reports such as sustainability report, environmental statement, and SA8000 (social accountability standard) report
		Supplier Base	Hsu and Hu (2009)	producers paying attention to strategic supplier selection, suppliers' endorsement, and supply chain structure



Clusters	Dimensions	Sub-dimensions	Author(s)	Main Issues
Economic Development	Business Management	Corporate Governance	Wei and Kong (2014); Windsor (2009); Vermeulen (2008)	governance modes including single firm approach, joint product sector approach, and cross sectoral approach; minimizing negative impacts; maximizing positive impacts
		Customer Relationship Management	Batenburg and Versendaal (2007); Madu and Kuei (2004)	achieving customer satisfaction through deployment of knowledge and information about the customer across the different functional units and the supply chain network of the company
		Quality Management	Kaynak and Hartley (2008); McAdam et al. (2008)	two challenges for introducing QM in a supply chain setting: (1) applying and integrating TQM, and (2) realigning organizational structures and cultures to realize the full benefits of supply chain integration
	Financial Management	Risk and Crisis Management	Siano et al. (2010); Hoti, et al. (2007)	producers paying attention to environmental and social risks, economic risks, and disruption
		Investor Relations	Lee and Kim (2009); Lehavey and Sloan (2008)	experiencing a relatively healthy economic environment; having institutionalized dialogue with investors and stakeholder

# Assessment framework



# ANP Methodology

- Step1 : Preparing pairwise comparison matrices based on the proposed ANP model
- Step2 : Collecting data by employing fuzzy scales, instead of Saaty's crisp nine-point scale
- Step3 : Finding the defuzzified values and converting these group values to a single value
- Step4 : Obtaining the local weights for each pairwise comparison matrix
- Step5 : Using the SuperDecisions software to obtain the global weights for each survey item



# Empirical Assessment

- **Ten** experts from a company in the electronics industry in Taiwan were contacted to test the model
- Linguistic term:
  - 1: item  $i$  and item  $j$  are of equal importance,
  - 3: item  $i$  is weakly more important than item  $j$ ,
  - 5: item  $i$  is strongly more important than item  $j$ ,
  - 7: item  $i$  is very strongly more important than item  $j$ ,
  - 9: item  $i$  is absolutely more important than item  $j$ , and
  - 2, 4, 6, 8: intermediate values between the two adjacent judgments.

Determinants	social development	environmental protection	economic development
Social development	1	[1/7, 1/5]	[1/6, 1/4]
environmental protection	[5, 7]	1	[4, 6]
economic development	[4, 6]	[1/6, 1/4]	1

# Empirical Assessment

## □ Expert #1 - linguistic terms

Determinants	social development	environmental protection	economic development
Social development	1	$[1/7, 1/5]$	$[1/6, 1/4]$
environmental protection	$[5,7]$	1	$[4,6]$
economic development	$[4,6]$	$[1/6, 1/4]$	1

## □ Expert #1 - defuzzified value

Determinants	social development	environmental protection	economic development
Social development	1	$6^{-1}$	$5^{-1}$
environmental protection	6	1	5
economic development	5	$5^{-1}$	1

# Empirical Assessment

- **Ten** experts from a company in the electronics industry in Taiwan were contacted to test the model
- ten experts independently assessed the survey items

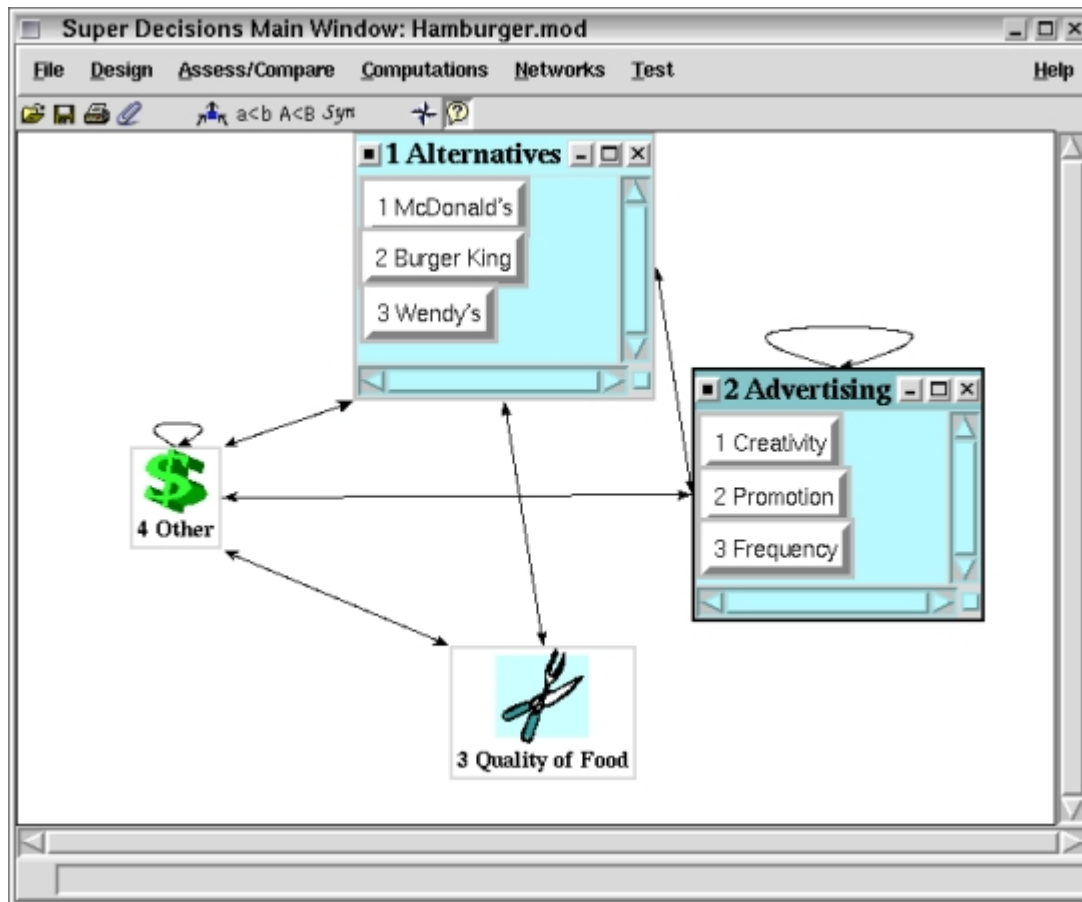
Determinants	social development	environmental protection	economic development
social development	1	6 <sup>-1</sup> , 6, 6.5 <sup>-1</sup> , 2.5 <sup>-1</sup> , 6, 8 <sup>-1</sup> , 2, 7 <sup>-1</sup> , 7 <sup>-1</sup> , 6	5 <sup>-1</sup> , 4, 2.5, 3.5, 8.5, 1, 2 <sup>-1</sup> , 4, 7 <sup>-1</sup> , 5 <sup>-1</sup>
environmental protection	6, 6 <sup>-1</sup> , 6.5, 2.5, 6 <sup>-1</sup> , 8, 2 <sup>-1</sup> , 7, 7, 6 <sup>-1</sup>	1	5, 5, 7.5, 4.5, 8.5, 1, 1, 5.5, 1, 6 <sup>-1</sup>
economic development	5, 4 <sup>-1</sup> , 2.5 <sup>-1</sup> , 3.5 <sup>-1</sup> , 8.5 <sup>-1</sup> , 1 <sup>-1</sup> , 2, 4 <sup>-1</sup> , 7, 5	5 <sup>-1</sup> , 5 <sup>-1</sup> , 7.5 <sup>-1</sup> , 4.5 <sup>-1</sup> , 8.5 <sup>-1</sup> , 1 <sup>-1</sup> , 1 <sup>-1</sup> , 5.5 <sup>-1</sup> , 1 <sup>-1</sup> , 6	1



	Dimensions	Sub-dimensions	Local Rank	Global Rank
Social Development	Competence Trust	Human Capital Development	3	16
		Talent Attraction and Retention	2	12
		Knowledge Management and Organizational Learning	1	15
	Goodwill Trust	Corporate Citizenship/Philanthropy	2	13
		External Trust	1	4
	Contractual Trust			5
Environmental Protection	Environmental Management	Green Supply Chain Management	2	2
		End-of-life Product Management	4	11
		Strategic and Internal Benchmarking	3	3
		Product Design for Sustainability	1	1
	Environmental Reporting	Environmental Reporting	2	8
		Supplier Base	1	6
Economic Development	Business Management	Corporate Governance	3	14
		Customer Relationship Management	2	8
		Quality Management (QM)	1	10
	Financial Management	Risk and Crisis Management	1	7
		Investor Relations	2	17

# Data analysis

- SuperDecision – a decision support system software



# Relative importance of survey items

13/16

Environment reporting	0.057
Risk & crisis management	0.060
Supplier base	0.067
Contractual trust	0.068
External trust	0.074
Strategic and internal benchmarking	0.081
Green supply chain management	0.109
Product design for sustainability	0.126

# Evaluate green performance

14/16

	Global Weight	Company A	Company B	Company C
Human Capital Development	0.024	4.50	6.84	5.83
Talent Attraction and Retention	0.045	6.19	5.69	6.55
Knowledge Management and Organizational Learning	0.028	4.26	5.75	5.37
Corporate Citizenship/Philanthropy	0.043	2.61	4.28	3.81
...	...	...	...	...
Contractual Trust	0.068	5.30	7.43	5.50
Environmental Reporting	0.057	2.62	5.43	5.71
Supplier Base	0.067	5.33	6.41	6.21
Corporate Governance	0.03	3.19	6.69	6.28
Quality Management (QM)	0.056	6.25	7.61	7.19
Risk and Crisis Management	0.06	5.08	6.76	6.21
Investor Relations	0.02	5.09	6.67	5.73
Desirability Index		4.87	6.45	6.2

# Conclusion (1/2)

- Multinational enterprises aspiring to achieve the TBL confront the following two challenges:
  - 1) understanding and improving the structure of sustainable systems, and.
  - 2) making the right decision by using the right decision-making tool
- The proposed approach can assist decision-makers in managing three of the most critical issues facing modern firms: social development, environmental protection, and economic development.



- There are several contributions:
  - 1) the use of the fuzzy-ANP can help people who are knowledgeable about the problem at hand to deal with imprecise human judgments
  - 2) our approach integrates stakeholders' perceptions (the Dow Jones Sustainability Indexes) on the focal TBL issues, and is specific to the industry of concern
  - 3) a benchmarking process can be used to evaluate the green performance of firms based on the TBL.
  - 4) a general framework and research procedures offer good guidance with regard to effectively managing sustainable organizations and the supply networks

THANK YOU

Q&A

