

A Guidance System for Selecting an Appropriate Eco-Design Checklist in the Early Stages of Product Development

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Agenda



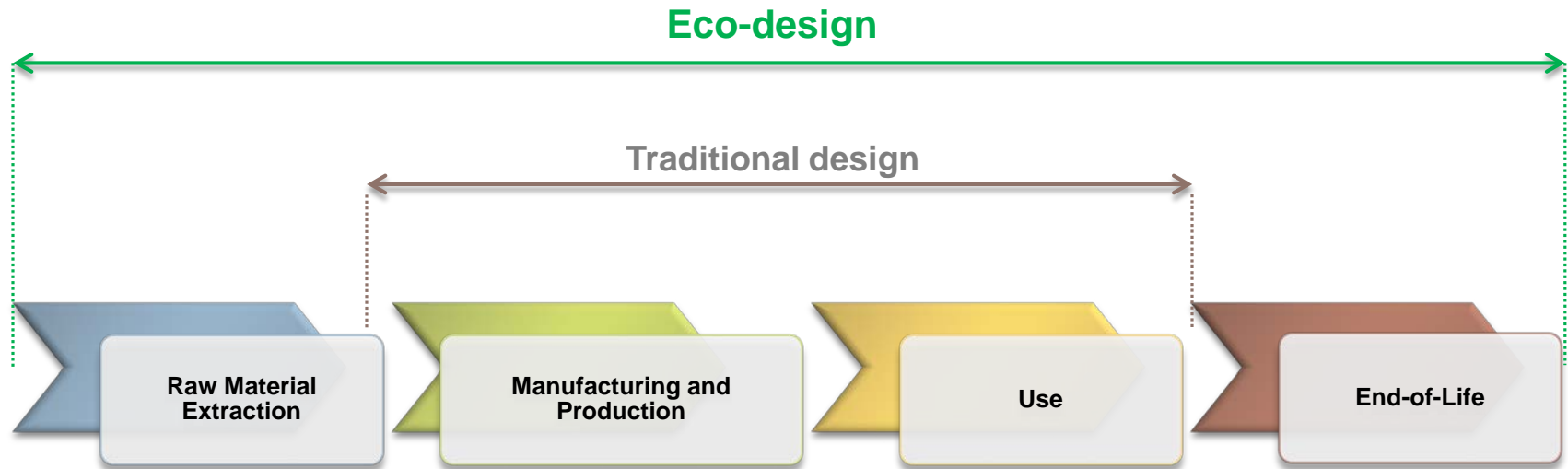
I.	Background
II.	Objectives of Research
III.	Problem Statement
IV.	Research Approach
V.	Case Study
VI.	Discussion

Background



Background

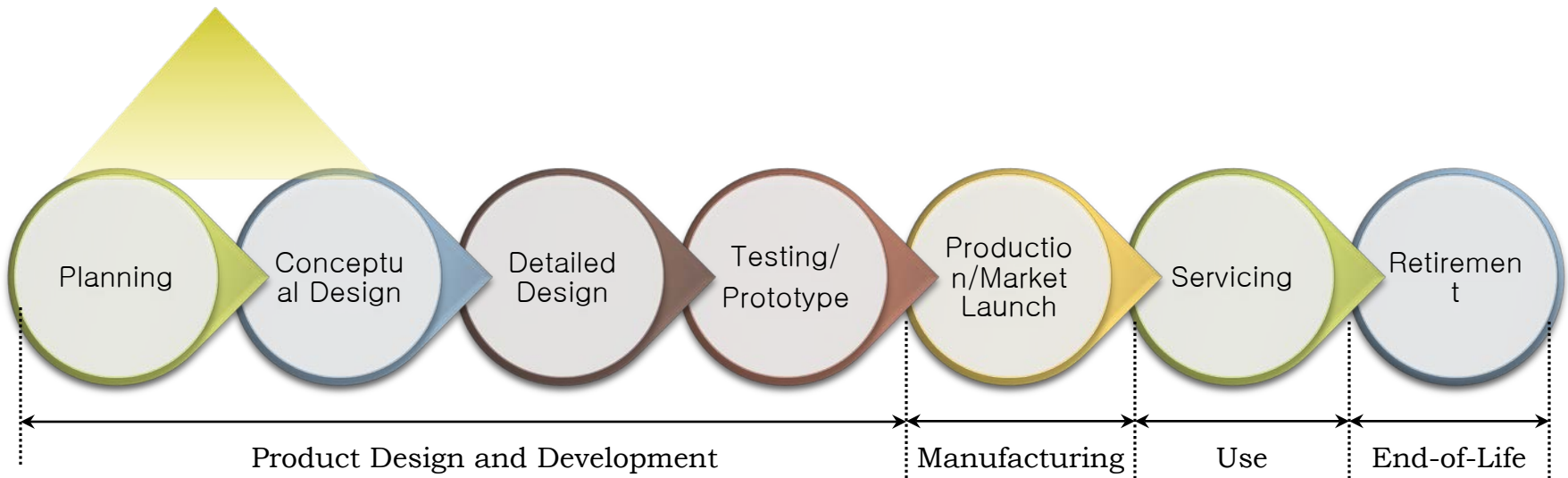
- ▶ Traditional design vs. Eco-design (DFE)



- ▶ Life Cycle Thinking is the core of Eco-design

Problem Statement

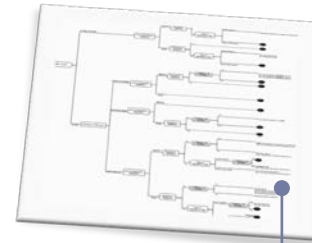
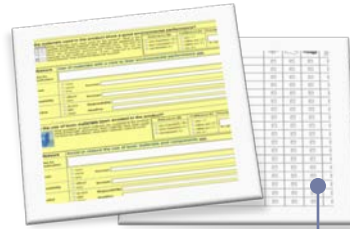
- ▶ A plenty of eco-design tools for addressing the environmental impacts of products are existed
- ▶ Majority of the eco-design tools are applied in **later stages** of product design and development process
- ▶ Environmental impacts of products must be incorporated at **the early stages** of new product design and development



Objectives of Research

- ▶ Develop a structured **taxonomy** of existing **Eco-design tools**
 - ▶ Identify eco-design tools that can be applied at **the early stages** of product design and development process
 - ▶ Identify **essential features** of existing **Eco-design checklists**
 - ▶ Propose an **Eco-design checklist selection guide** to help
-
- ▶ ⁶product designers

Research Approach

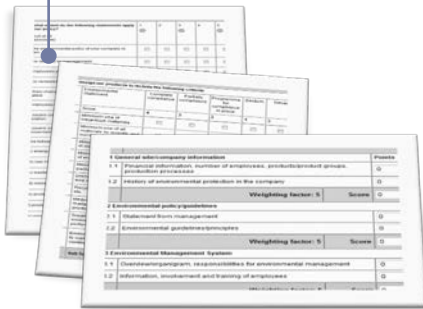


1
Review Existing Eco-Design Tools

2
Identify Applicable Tools at the Early Stages of Product Design

3
Analyze Existing Eco-Design Checklists

4
Develop an Eco-Design Checklists Selection Guide



Step 1: Review Existing Eco-Design Tools



Step 1: Review Existing Eco-Design Tools

► More than 100 Existing Eco-Design Tools

Category	Tool Type	Tool Name
Quantitative	Analytical	LCA
		...
	Accounting-Based	Cost-Benefit Analysis (CBA)
		Life-Cycle Cost (LCC) Analysis
		Eco-Value Analysis (Eco-VA)
		...
	Input/Output-Driven	Substance Flow Analysis (SFA)
		Environmental Input-Output Analysis (IOA)
		Energy and Material Flow Analyses (EMFA)
		...

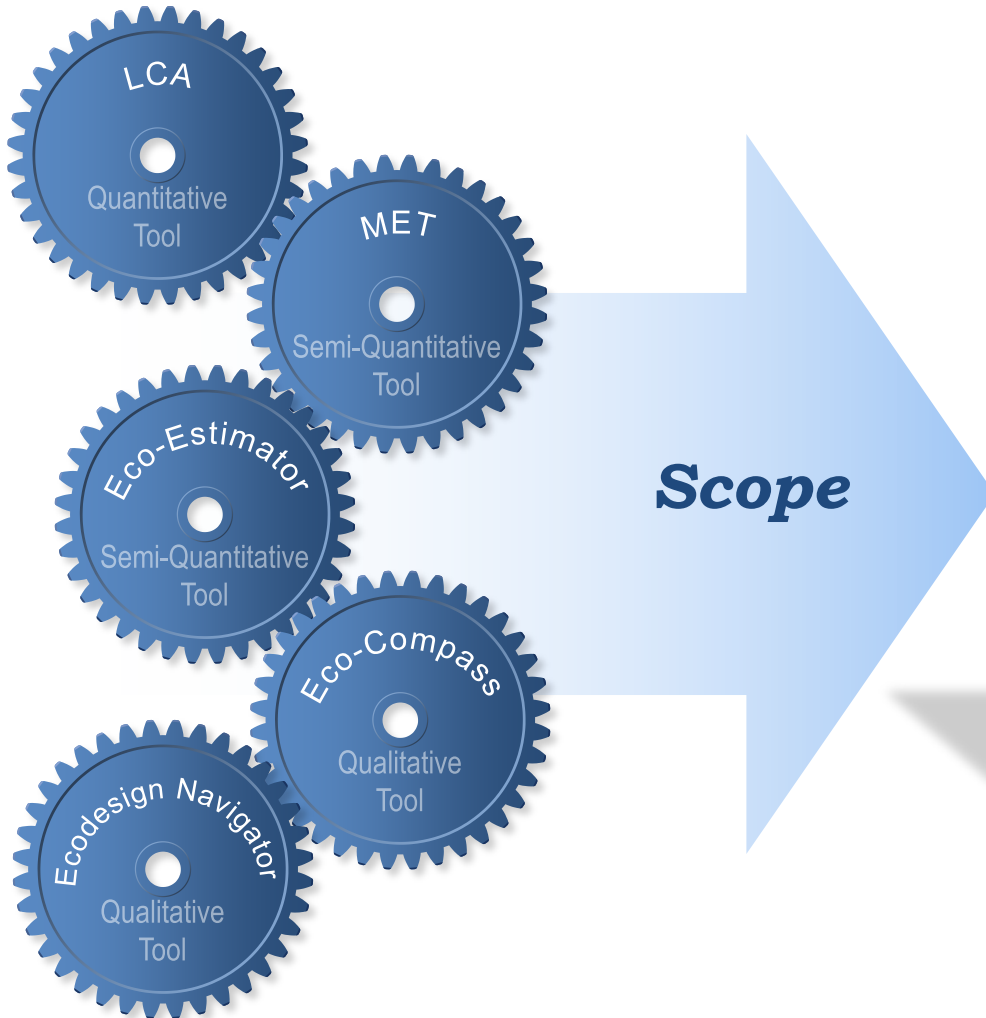
Step 1: Review Existing Eco-Design Tools

Category	Tool Type	Tool Name
Semi-Quantitative	Matrices	MET Matrix
		AT&T Matrix and Target Plot
		Boeing Process Environmental Matrix
		...
	Assessment-Based	Eco-Estimator
		Cumulative Energy Demand Analysis (CED)
		Environmental Impact Assessment (EIA)
		Strategic Environmental Assessment (SEA)
		Environmental Risk Assessment (ERA)
		Environmental Effect Analysis (EEA)
		...

Step 1: Review Existing Eco-Design Tools

Category	Tool Type	Tool Name
Qualitative	Matrices	Dominance Matrix
		Eco Design Priority Matrix
		...
	Network Diagrams	Eco-Compass
		Spiderdiagram
		...
	Manuals and Guidelines	Ecodesign Navigator
		Ten Golden Rules
		...
	Checklists	The EcoDesign Checklist
		Eco-Design Health Check
		ECODESIGN PILOT
		...

Step 2: Identify Applicable Tools at the Early Stages of Product Design



Eco-design checklists


Environmental Statement	Complete compliance	Partially compliance	Programme for compliance in place	Seldom	Never
Score	4	3	2	1	0
Minimum use of hazardous materials.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Minimum use of all materials by quantity and number of types.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Minimum use of energy in manufacture.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Minimum consumption of energy while in use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Minimum need for packaging.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dismantleable at the end of life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recyclable at the end of life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Measurement and management of production waste.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suppliers checked for environmental performance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Environmental benefits to customers continuously improved.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sub Totals	0	0	0	0	0
Total	0 points (maximum score = 40)				Reset

Step 2: Identify Applicable Tools at the Early Stages of Product Design


- ▶ Why “Eco–design checklists”?
 - Lack of detailed information at the **early stages** of product design
 - “Eco–design checklist” tools are preferred for quick evaluation and consideration of environmental impacts

Step 3: Analyze Existing Eco-Design Checklists

Review existing eco-design checklists critically



Develop five key questions to identify features of existing eco-design checklists



Identify essential features of existing eco-design checklists



Analyze all existing eco-design checklists in-depth

Step 3: Analyze Existing Eco-Design Checklists

- ▶ Review existing eco-design checklists critically

How extent do the following statements apply your policy?	1	2	3	4	5
1.1 Is not at all satisfactorily					
1.2 The environmental policy of your company is then:					
1.3 It is defined by management					
1.4 Employees participated in defining the policy					
1.5 It is reviewed at regular intervals					
1.6 When changes occur in the company it is adapted					
1.7 Employees are informed about the policy					
1.8 Covers compliance with environmental legislation					
1.9 Covers commitment to continuous improvement of environmental performance					
The following site-related areas are taken into account:					
a) energy					
b) raw materials and water					
c) waste					
d) noise					
e) production processes					
f) product planning					
g) environmental performance of contractors					

management in your company:				
1.1 Choice of raw materials				
1.2 Choice of energy				
1.3 Choice of water and wastewater				
1.4 Prevention and reduction of waste				
1.5 Recycling and selective separation of waste				
1.6 Pollution, dust and odours				
1.7 Storage of products				
1.8 Reduction and control of noise and vibrations				
1.9 Health and safety in the workplace				
1.10 Mobility and transport of employees and goods				
1.11 Prevention of environmental accidents				
1.12 Environmental information (internal and external)				
1.13 Communication with suppliers				
1.14 Human planning for goods and services				
1.15 Neighbourhood				
1.16 Involvement of managers				
1.17 Involvement of employees				
1.18 Administrative situation				

Subject	Reference (R)	Fulfillment (F)	Priority (P)
1.1 Are the materials used in the product show a good environmental performance?			
1.2 Measure: Use of materials with a view to their environmental performance (see)			
1.3 Idea for Realisation:			
1.4 Costs:			
1.5 Feasibility:			
1.6 Action:			
1.7 As the use of toxic materials been avoided in the product?			
1.8 Measure: Avoid or reduce the use of toxic materials and components (see)			
1.9 Idea for Realisation:			
1.10 Costs:			
1.11 Feasibility:			
1.12 Action:			

Environmental Statement	Complete compliance	Partially compliance	Programme for compliance in place	Seldom	Never
Score	4	3	2	1	0
Minimum use of hazardous materials					
Minimum use of all materials by quality and number of types					
Minimum use of energy in manufacture					
Minimum consumption of energy while in use					
Minimum need for packaging					
Disassemblable at the end of life					
Recyclable at the end of life					
Measurement and management of production waste					
Suppliers checked for environmental performance					
Environmental benefits to customers continuously improved					
Sub Totals	0	0	0	0	0
Total					

The collage shows several overlapping documents related to environmental management and eco-design. Key sections visible include:

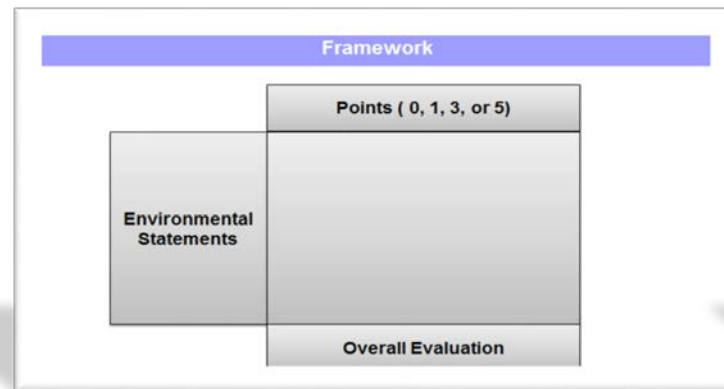
- 1 General site/company information:** A checklist with items like 'Financial information, number of employees, products/product production processes' and 'History of environmental protection in the company'.
- 2 Environmental policy/guidelines:** A section for 'Statement from management' and 'Environmental guidelines/principles'.
- 3 Environmental Management System:** A section for 'Overview/organigram, responsibilities for environmental management' and 'Information, involvement and training of employees'.
- Life cycle stage 1: Production and supply of materials and components:** A detailed checklist with sub-sections for 'Raw materials', 'Manufacturing', 'Distribution', and 'Use and Consumption'. It includes criteria like 'Consumption of resource', 'Emission of materials influencing global warming', and 'Discharge of water pollution materials'.
- Environmental Impact Items:** A table with columns for 'A. Resource extraction', 'B. Manufacturing', 'C. Distribution', and 'D. Use and Consumption'.

Step 3: Analyze Existing Eco-Design Checklists

- ▶ Review existing eco–design checklists critically

Brief Description		Inventor/ Author		
This checklist help companies finds out how well they incorporate he concepts of environmental design in product planning.		The International Network for Environmental Management (INEM)		
Advantage		Disadvantage		
1) It focuses on integrating environmental aspects into product planning activities.		1) It does not cover all issues over the whole life cycle of a product.		
Objective	Life-Cycle Perspective	Application Time	Level of Analysis	Weighting
Evaluates the level of ntegrating environmental issued in product planning	Selected environmental issues of life cycles	Short (< 1 hr.)	Low (Rough Data Needed)	Rating (0 to 4)

Environmental Statements	Points (0, 1, 3, or 5)
A. Individual elements	
B. Overall quality of content	
C. Quality of communication	
Overall Evaluation	



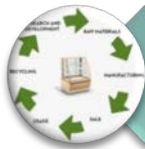
Framework			
A Life Cycle Phase			
Question	Relevance	Fulfillment	Priority
Measure	Guideline		
Cost			
Feasibility			
Action			

Step 3: Analyze Existing Eco-Design Checklists

- ▶ Develop five key questions to identify features of existing eco-design checklists



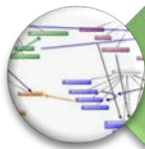
1) What is the target of assessment?



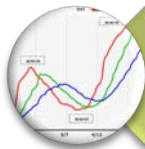
2) What is the coverage of life cycle span?



3) What type of input is needed?



4) What level of analysis is required?



5) What type of output is demanded?

Step 3: Analyze Existing Eco-Design Checklists

- ▶ Identify essential features of existing eco-design checklists

Assessing Target

Product, Strategy, Policy, etc.

Coverage of Life Cycle

Whole Life Cycle, Materials Extraction, etc.

Qualitative Screening

Detailed/ Rough

Quantitative Screening- Subjective Opinion

Rating (1 to 5, etc.)

Quantitative Screening- Objective Measurement

Rating, Detailed, etc.

Strategy and Guidance

Detailed/ Rough

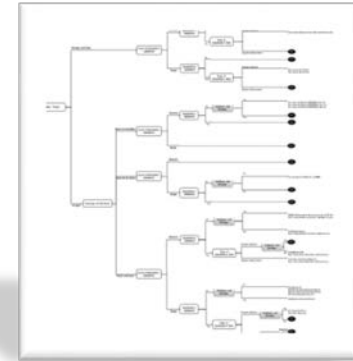
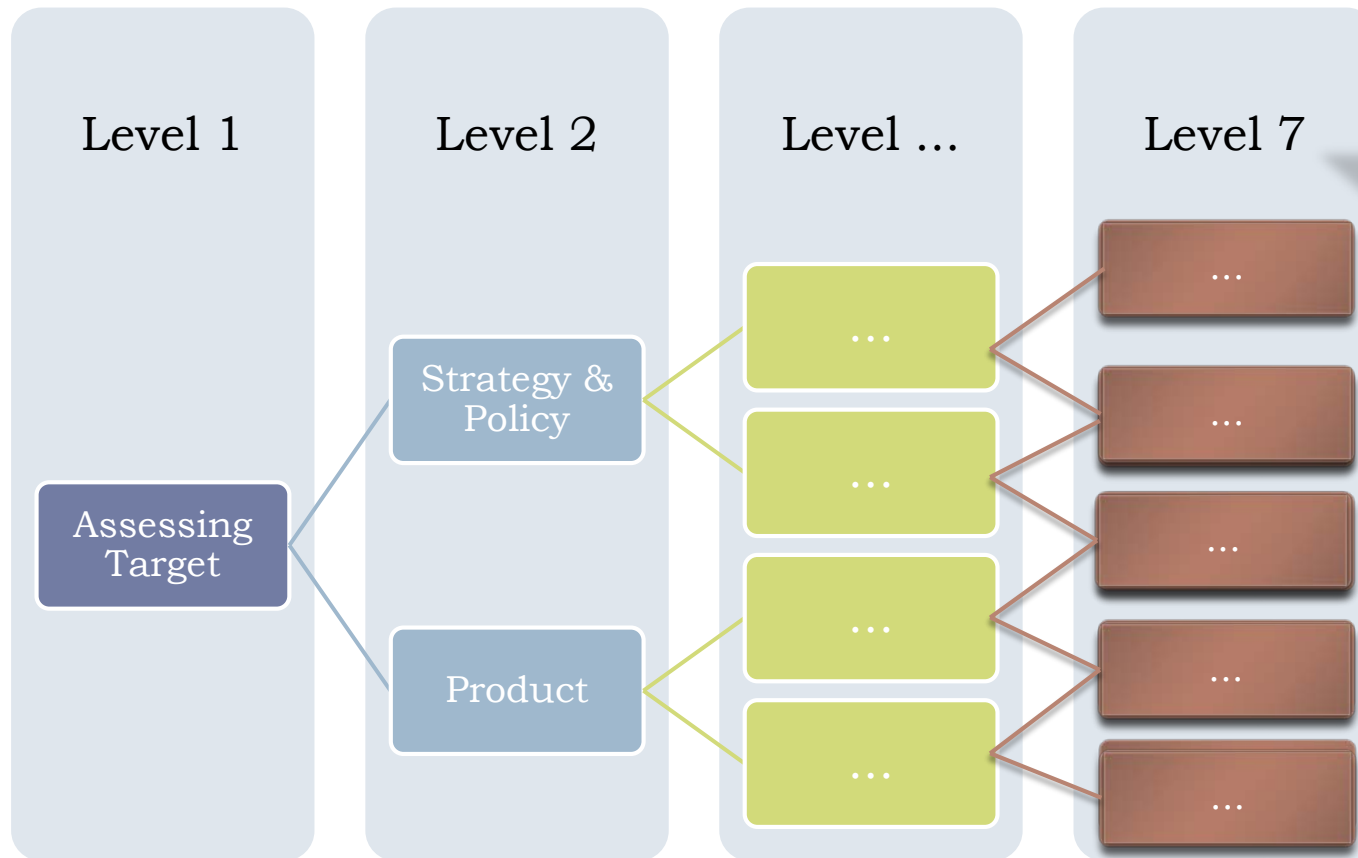


Step 3: Analyze Existing Eco-Design Checklists

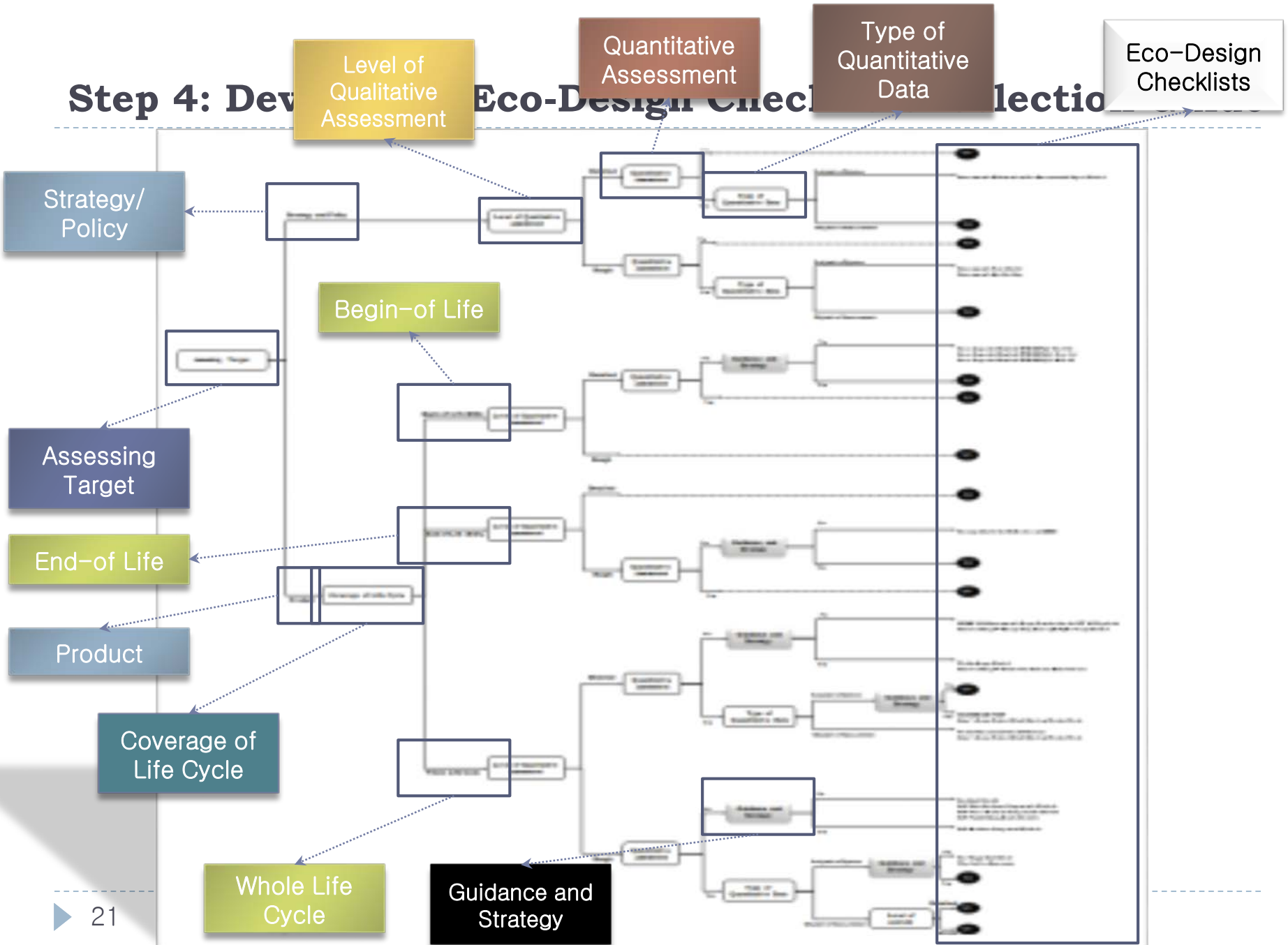
- Analyze all existing eco-design checklists in-depth

No	Eco-Design Checklist	Assessing Target	Coverage of Life Cycle	Screening			Guidance & Strategy
				Qualitative	Quantitative		
					Subjective Opinion	Objective Measurement	
1	ECODESIGN PILOT	Product	Whole Life Cycle	Detailed (216)	Rating	–	Yes (216)
2	Volvo's Corporate Standard	Product	Material Selection	Detailed (78)	–	–	–
21	Environmental Policy Checklist	Corporate Policy	–	Rough (20)	Rating	–	–

Step 4: Develop An Eco-Design Checklists Selection Guide

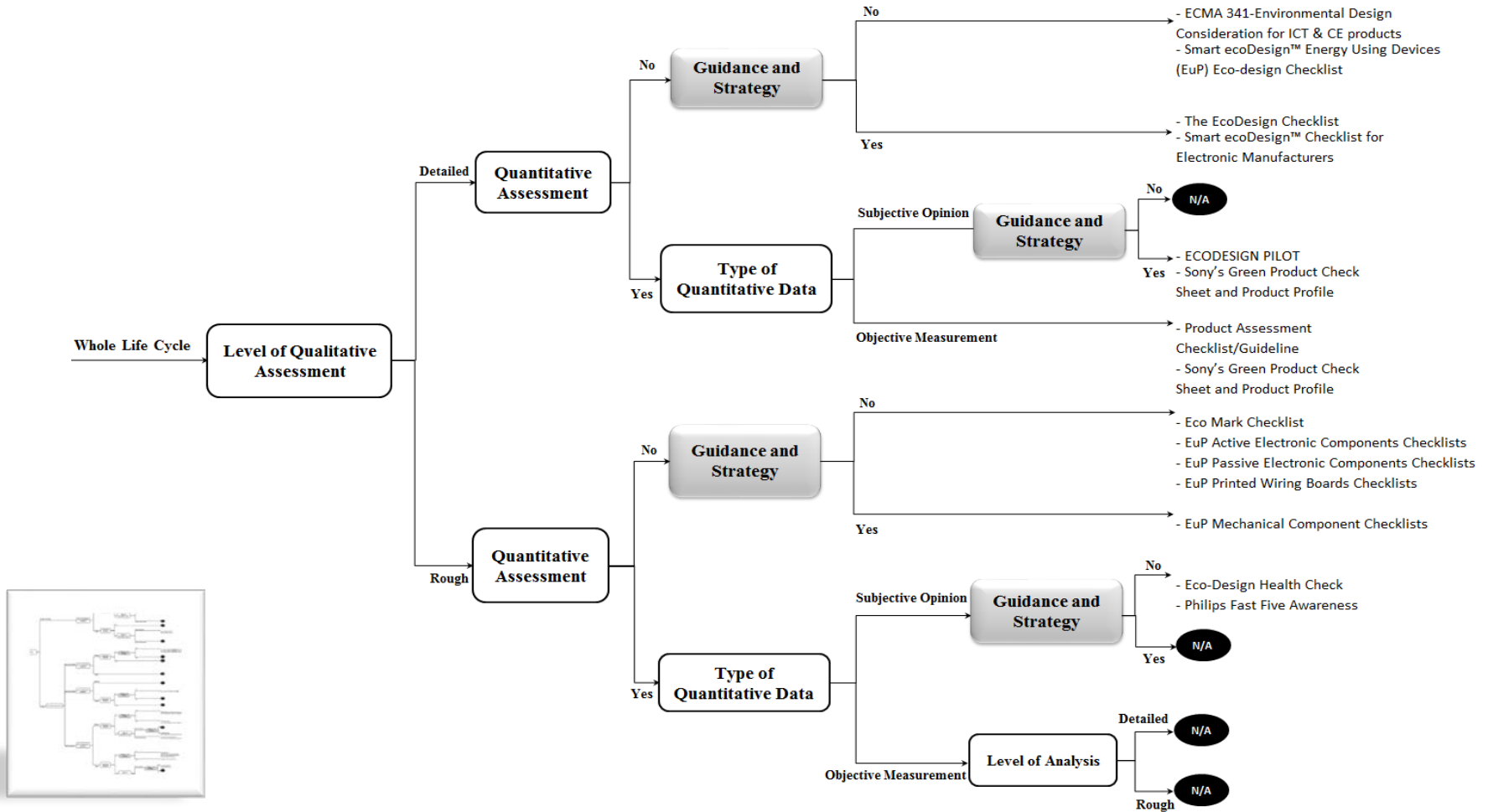


Step 4: Development of Eco-Design Checklists



Step 4: Develop An Eco-Design Checklists Selection Guide

► How to Apply the Selection Guide:





Discussion

- ▶ This research:
 - Developed a structured **taxonomy of Eco-design tools**;
 - Identified eco-design tools that can be applied at **the early stages** of product design and development process;
 - Distinguished **essential features** of existing Eco-design checklists; and
 - Proposed an **Eco-design checklists selection guide** to help product designers

▶ Future Research:

- ▶ 23 – Extend Eco-Design Checklists to “Sustainable Design Checklists”

Q & A



Thank You For Your Attention!