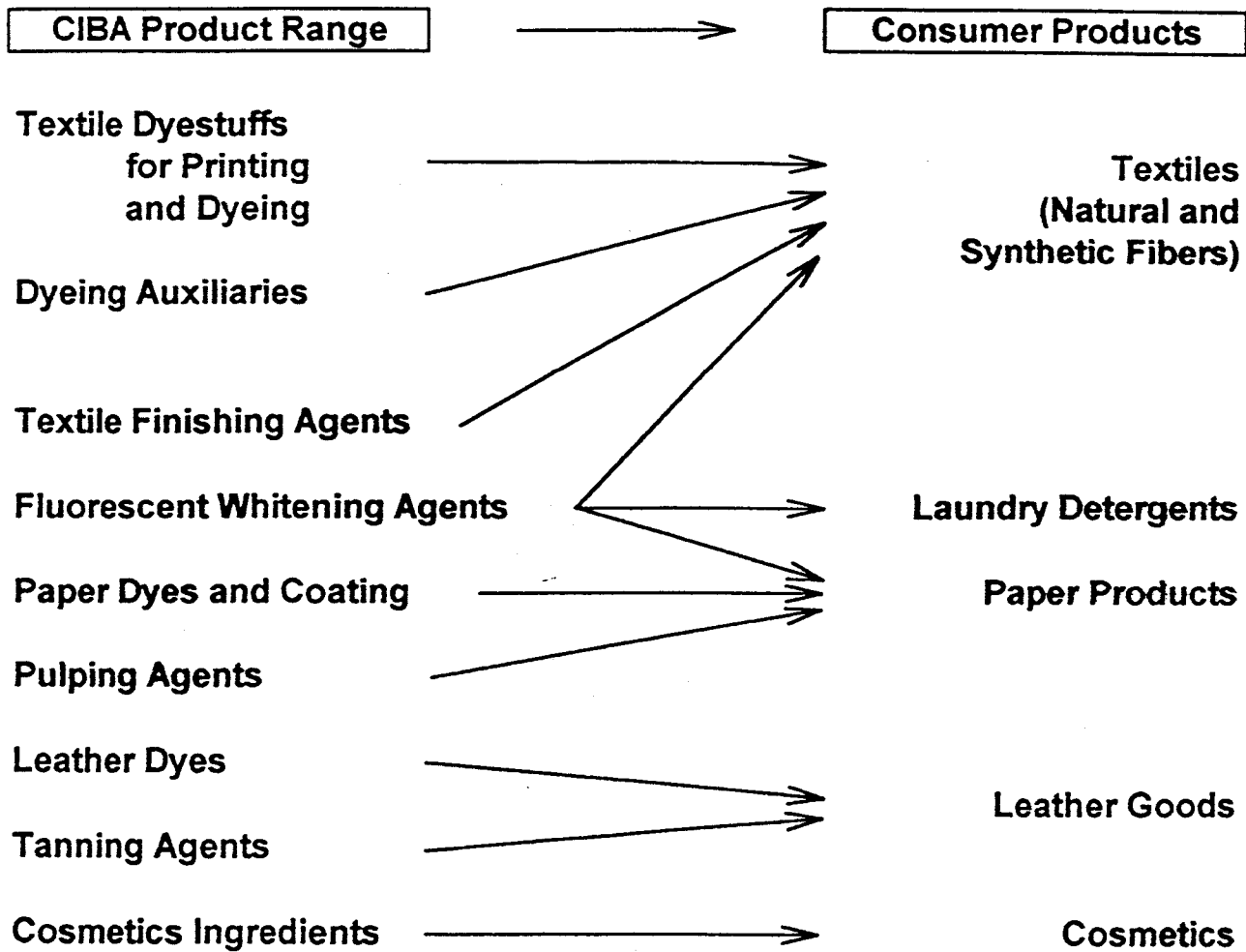


LCA at CIBA

Textile Dyes Division
Chemicals Division



Life Cycle Assessment at CIBA Applications and Goals

"Internal":

Optimization of Existing Processes

Tool for Product Development

Strategic Portfolio Decisions

"External":

**Communication with Customers
(Consumer Goods Industry)**

Support for Eco-Labeling

Communication with Authorities

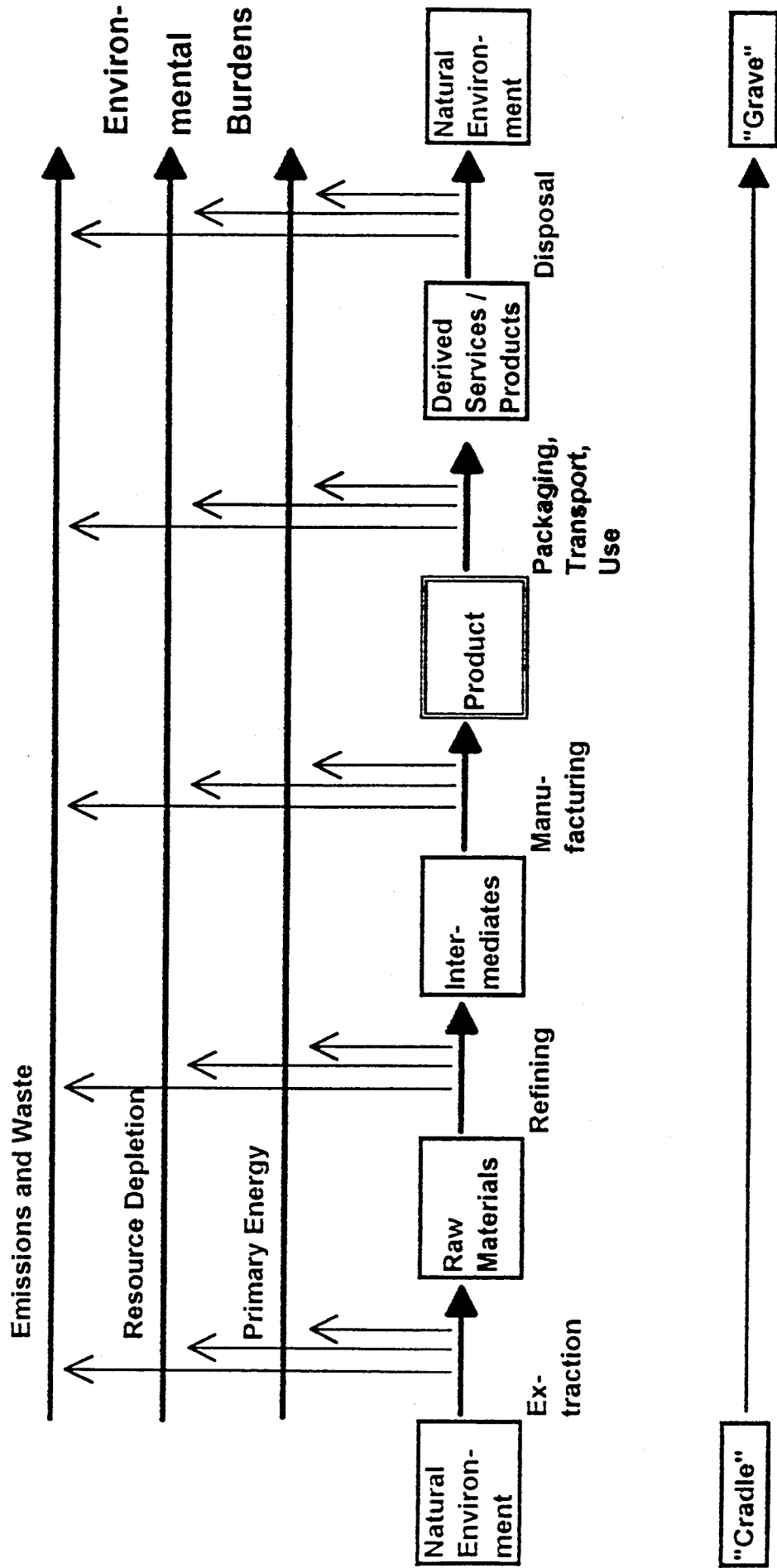
Communication with General Public

Structure of Life Cycle Assessment

Society for Environmental Toxicology And Chemistry Sesimbra 1993:
Guidelines for Life Cycle Assessment: A 'Code of Practice'

	SETAC Step	Definition	Comment
1	Goal Definition / Scoping	Purpose (internal / external); Functional Unit; Boundaries	<i>"Critical"; Many Different Goals and Scopes Possible</i>
2	Inventory Analysis	Systems / Processes; Flows of Material / Energy / Waste;	<i>"Scientific": Consensus, Hard Facts, little Controversy</i>
3	Impact Assessment	Assessment of Effects of Environmental Burdens	<i>3 Steps, see below; formerly (SETAC Leiden): 3a and 3c</i>
3a	Classification	Grouping of Environmental Effects into Impact Categories	<i>"Choice": General Protection Areas; Multiple Impacts</i>
3b	Characterization	Quantification and Aggregation of Environmental Impacts: Equivalence Factors	<i>"Soft science": many Hypotheses, Models necessary; Controversial</i>
3c	Valuation	Weighted Comparison of Dissimilar Criteria	<i>"Political": Value-Bound, Subjective; Consensus Difficult</i>
4	Improvement Assessment	Selection of Options; Practical Consequences	<i>No Consensus; Goes beyond Life Cycle Assessment?</i>

**Life Cycle Assessment:
Environmental Burdens of a Product**



**Life Cycle Assessment at CIBA
Systems and Data:
Why own System ECOSYS?**

In-House Data Bases

- Numerous, Wide Scope (Material Flow, Waste, Tox etc.)
- Well Maintained and Up-to-date (for other Purposes)
- Only Partially Compatible (Historical, Purpose-Specific)
- Not Designed for / Geared to LCA Work

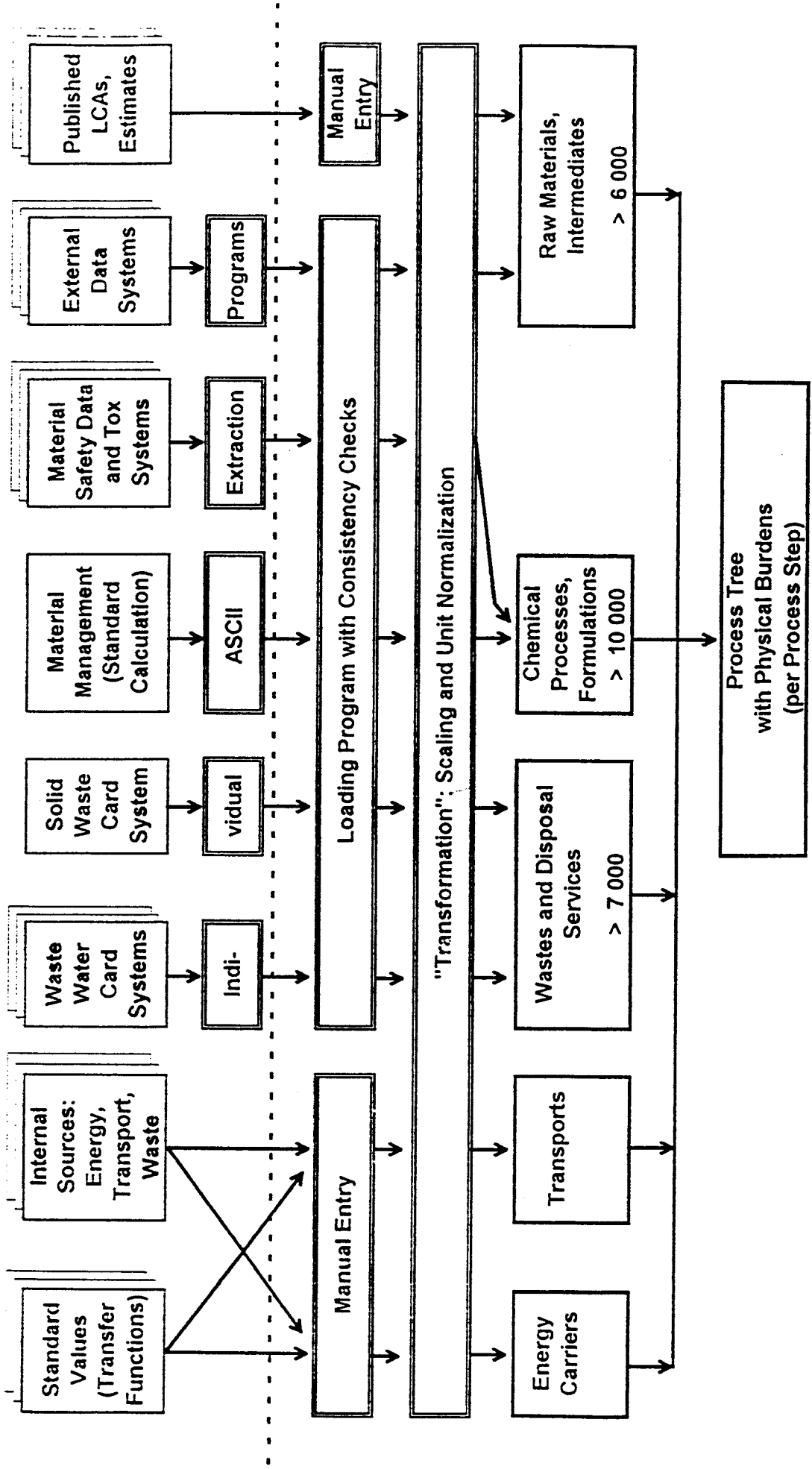
External LCA Data Bases

- Great Variety of Systems
- Difficult to Interface to In-house Systems
- Not Compatible amongst each other

LCA System ECOSYS

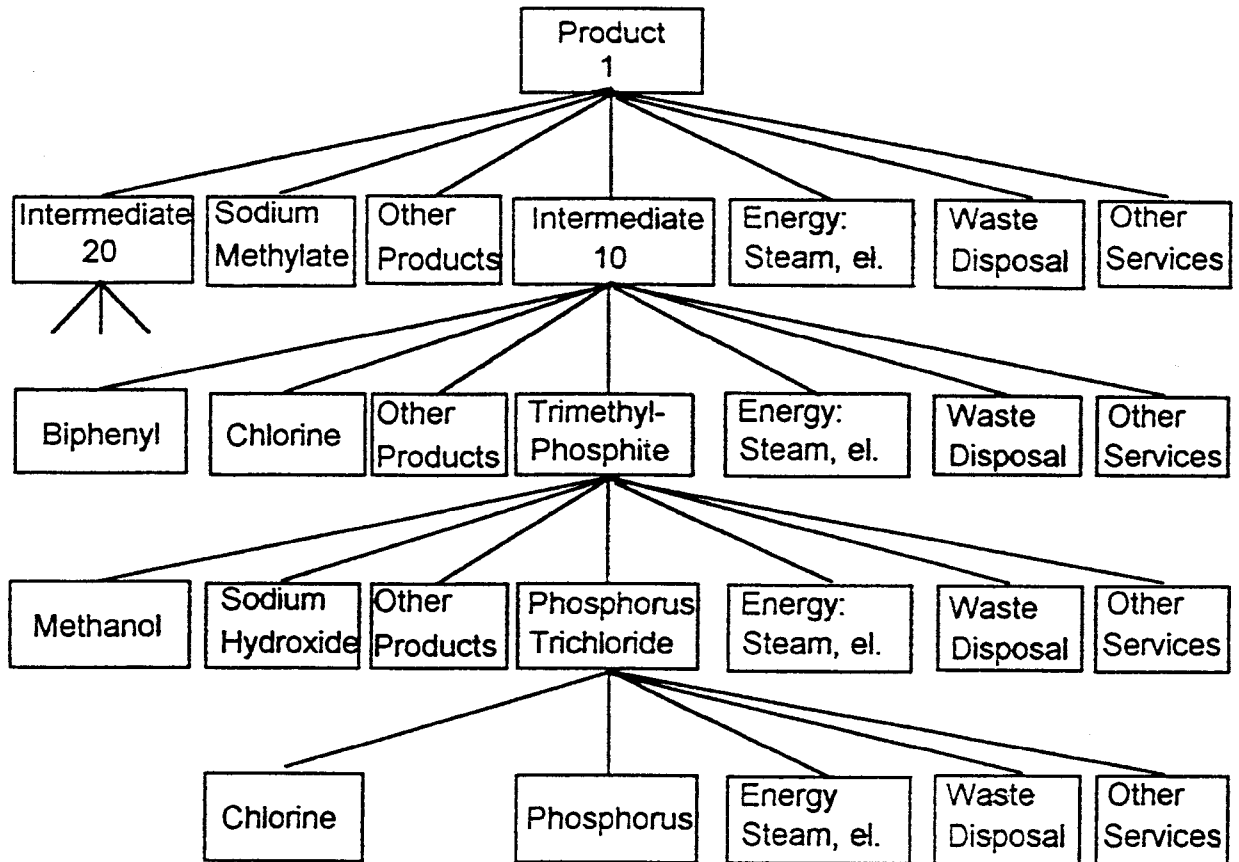
- Data Integrator, not Data Generator
- Interface / Data Extractor for In-house Systems
- Collection / Calculation Tool for External Data
- LCA Data will cover:
 - CIBA-Processes, esp. Chem. Syntheses
 - Energies (Energy Carriers, Fuels)
 - End-of-Pipe Waste Treatment Processes
 - Starting Materials (Raw Products)
 - Application Processes (Application Burdens)
 - Final Disposal, Environmental Fate

LCA at CIBA: ECOSYS Data Acquisition

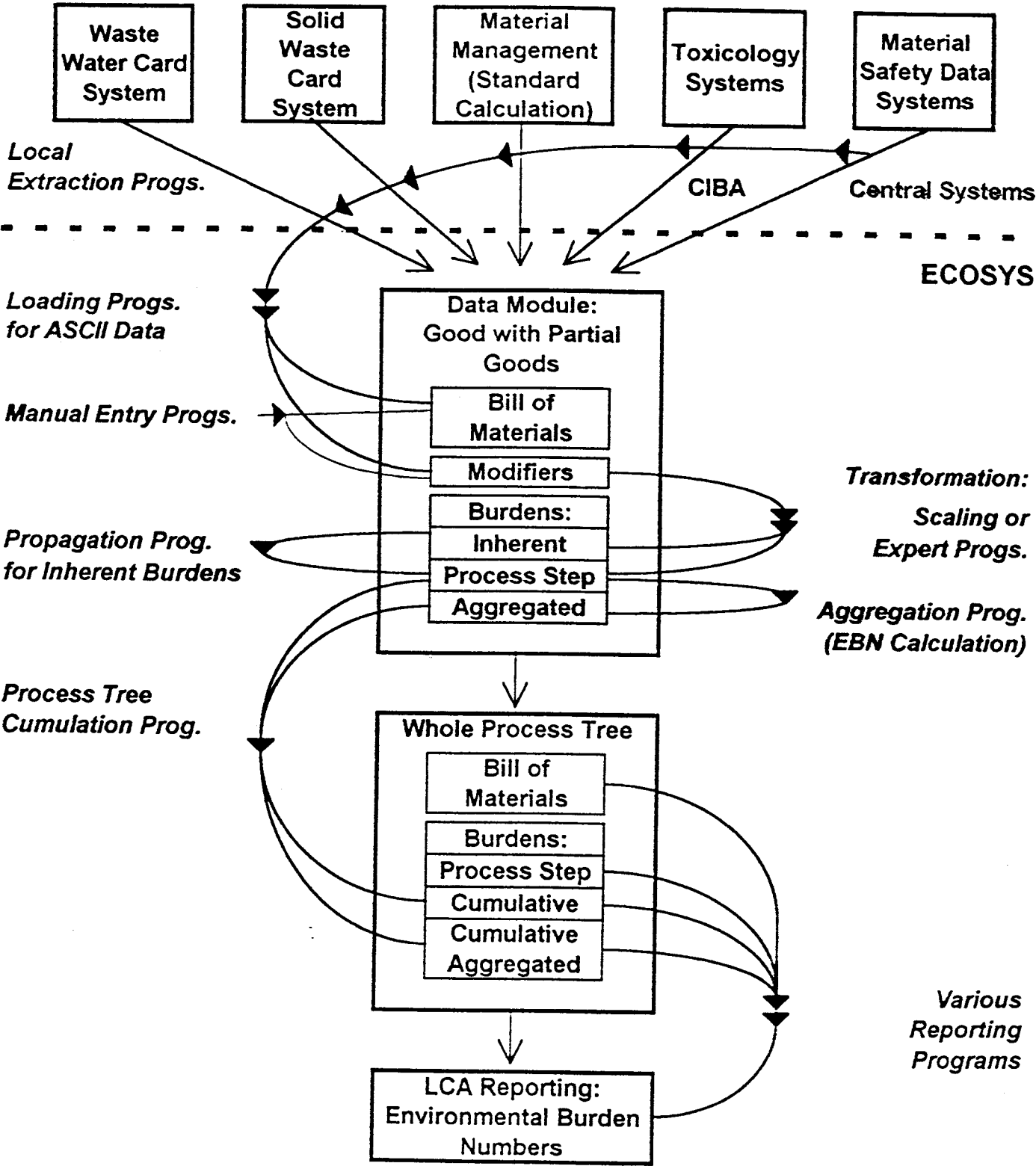


LCA at CIBA: Process Tree of Product 1

Example, not complete!



ECOSYS Data Processing



Life Cycle Assessment at CIBA Environmental Burden Numbers

Burdens for Product 1		
"Physical" Burden		Aggregated Burden
ENERGY:		BUWAL 133:
Gross Energy		Eco-Points
AIR:		
NO _x		BUWAL 132:
SO ₂		Energy Equivalent
CO ₂		Crit. Volume Air
H-C		Crit. Volume Water
HCl		Solid Waste Volume
HCFC		
...		Eco-Rational Path Method:
WATER:		SE (Burden Units)
DOC		
Phosphorus		Guinée-Svensson/SETAC:
Chloride		Non-renewable resources
Nitrate		Global warming
Sulfate		Ozone depletion
Ammonium		Acidification
...		Photo-oxidant formation
WASTE		Nutrification
Household	Solid waste	
Special	...	

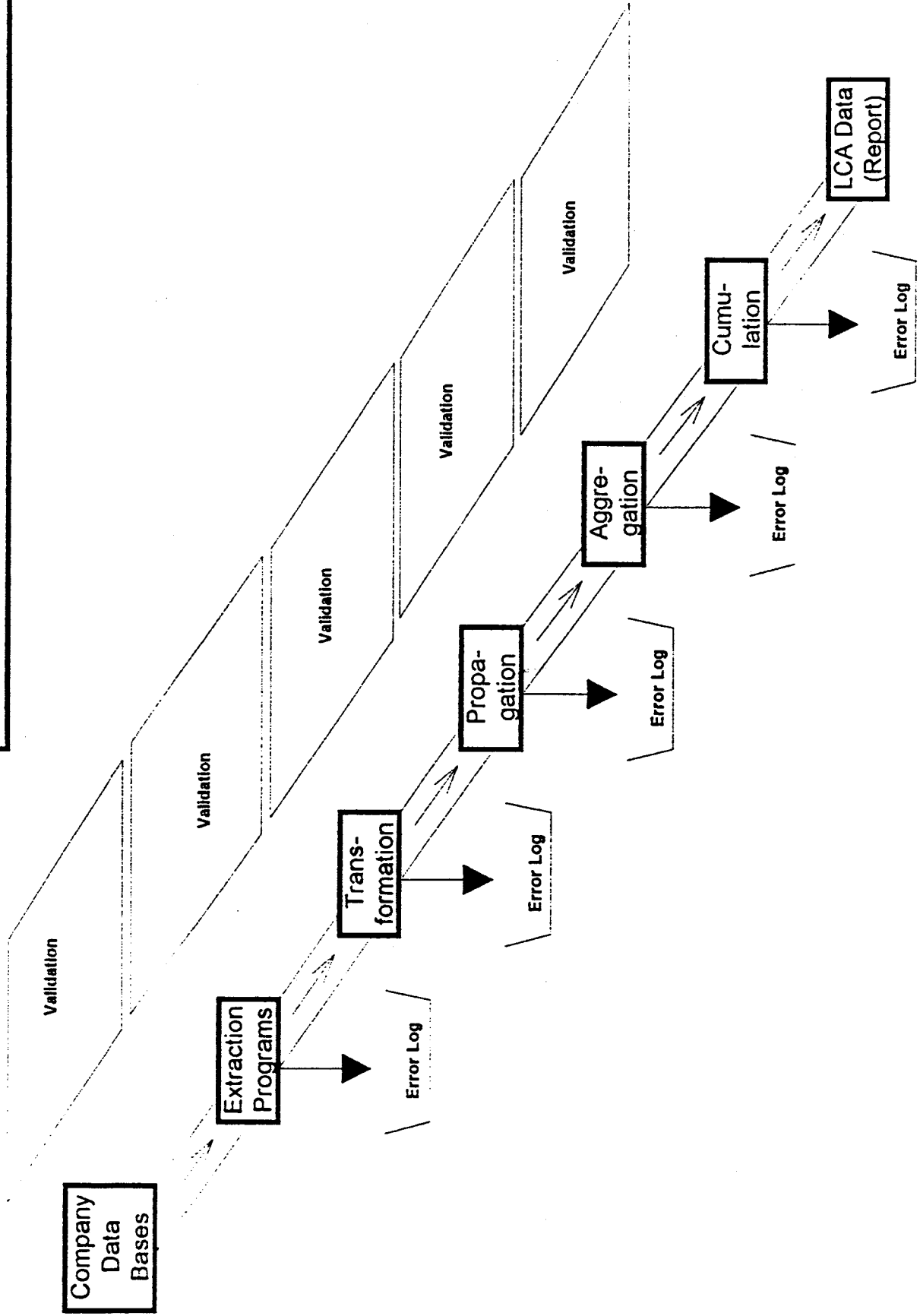
ECOSYS LCA System: Main Features

- **Software Base: PC/FOCUS**
- **PC Version, Portable to other Platforms, Network**
- **Tree Structures (Processes, Applications, Coupled Goods, Aggregated Burdens, Geography etc.) ⇒ Parent - Child - Relation 1 : n (Bill of Materials, of Applications, of ...)**
- **Relational Data Model, 8 Process-Related Entities**
- **12 Catalog Entities (System/Referential Integrity): Units, Burdens, Geography and their Hierarchies**
- **Data-Loading/Entry Programs with Integrity Check**
- **Data Extraction from External Systems: 6 Standard ASCII Formats (each for 1 Entity)**
- **Burden Calculation Programs: Linear (Tree) and Iterative (Network, planned)**
- **Burden Aggregation: Data Driven - Flexible Linear Combination ⇒ Weighted Addition Matrix of Weighting Factors = Bill of Burdens (no extra Programs)**
- **Reports: Bill of Materials, Sum of Materials, Total Burdens, Step Burdens, Application Burdens Burdens within/outside System Border (planned) Burdens by Sector (Energy, Transport, End-of-Pipe)**

ECOSYS: State of Implementation

- Data Model logical / physical O.K.
- Manual Data Entry Programs O.K.
- Catalogs (System Integrity) 95 % O.K.
- Data Extraction from CIBA EDP Systems:
 - Standard Calculation O.K.
 - Waste Water in Test
 - Solid Waste in Development
 - Safety / Tox / Ecotox under Investigation
- Data-Loading Program (universal) O.K.
- Processes:-Flow Sheets loaded 14'000
 Total Number of Goods 22'000
- Modifiers / Burdens loaded CIBA, BUWAL, PWMI
- Burden Calculation Programs O.K.
- Reports: Bill of Materials, Sum of Materials O.K.
- Other Standard Reports under Investigation
- *Ad hoc* Reports FOCUS TABLETALK
- Consistency Checks in Development

ECOSYS: Stepwise Validation Scheme



LCA of Product 1

Reference Amount: 1 kg

Example, Figures not complete

BURDEN TYPE	UNIT	CUMUL . BURDEN	STEP BURDEN
AIR ALDEHYDES	G	9.40E-03	0.00E+00
AIR CO	G	1.34E+00	5.17E-02
AIR CO2	KG	7.20E+00	2.86E-01
AIR DUST	G	7.16E-01	1.22E-03
AIR FLUORIDE	G	3.63E-05	0.00E+00
AIR HYDROCARBONS	G	1.14E+01	5.78E-02
AIR N2O	G	5.95E-01	3.62E-01
AIR NH3	G	1.78E-03	0.00E+00
AIR NOX	G	1.23E+01	4.58E-01
AIR ORGANICS	G	1.70E-02	0.00E+00
AIR SOX	G	3.10E+01	4.11E-03
PRIMARY ENERGY	MJ	9.74E+01	3.71E+01
LANDFILL SPECIAL WASTE WT.	G	2.69E+02	0.00E+00
LANDFILL ZN	G	1.78E-02	0.00E+00
WATER ACIDITY (AS CA(OH)2)	KG	1.29E-01	3.48E-03
WATER BOD	G	5.37E-04	0.00E+00
WATER CL	G	6.17E-05	0.00E+00
WATER COD	G	1.62E-03	0.00E+00
WATER F-	G	4.85E-03	0.00E+00
WATER FE	G	1.09E-05	0.00E+00
WATER INSOLUBLES	G	5.37E-04	0.00E+00
WATER NA	G	7.95E-04	0.00E+00
WATER NH4	G	2.25E-03	0.00E+00
WATER NO3	G	1.15E-03	0.00E+00
WATER OIL (MINERAL)	G	2.19E-02	0.00E+00
WATER SO4	G	1.02E-03	0.00E+00
WATER DISSOLVED SUBSTANCES	G	1.17E+00	0.00E+00
WATER TOC	G	1.16E+01	1.98E+01 !!
WATER ZN	G	3.91E-03	2.17E-02 !!
PRIMARY ENERGY EQUIVALENT	MJ	9.74E+01	3.71E+01
CRITICAL VOLUME BUWAL (AIR)	M3	1.46E+06	1.54E+04
CRITICAL VOLUME BUWAL (WATER)	DM3	6.73E+02	0.00E+00
LANDFILL SPECIAL WASTE VOL. AGG.	CM3	1.04E+03	0.00E+00
ECO-POINTS BUWAL (AIR)	EPOINT	1.65E+03	3.06E+01
ECO-POINTS BUWAL (WATER)	EPOINT	3.04E-02	0.00E+00
ECO-POINTS BUWAL (LANDFILL)	EPOINT	5.46E+03	0.00E+00
ECO-POINTS BUWAL (ENERGY)	EPOINT	9.74E+01	3.71E+01
ECO-POINTS BUWAL	EPOINT	7.21E+03	6.77E+01

ECOSYS: The Future
Ecological Portfolio Management

