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# The corporate environmental information system of Charoen Pokphand Food PLC (Thailand)

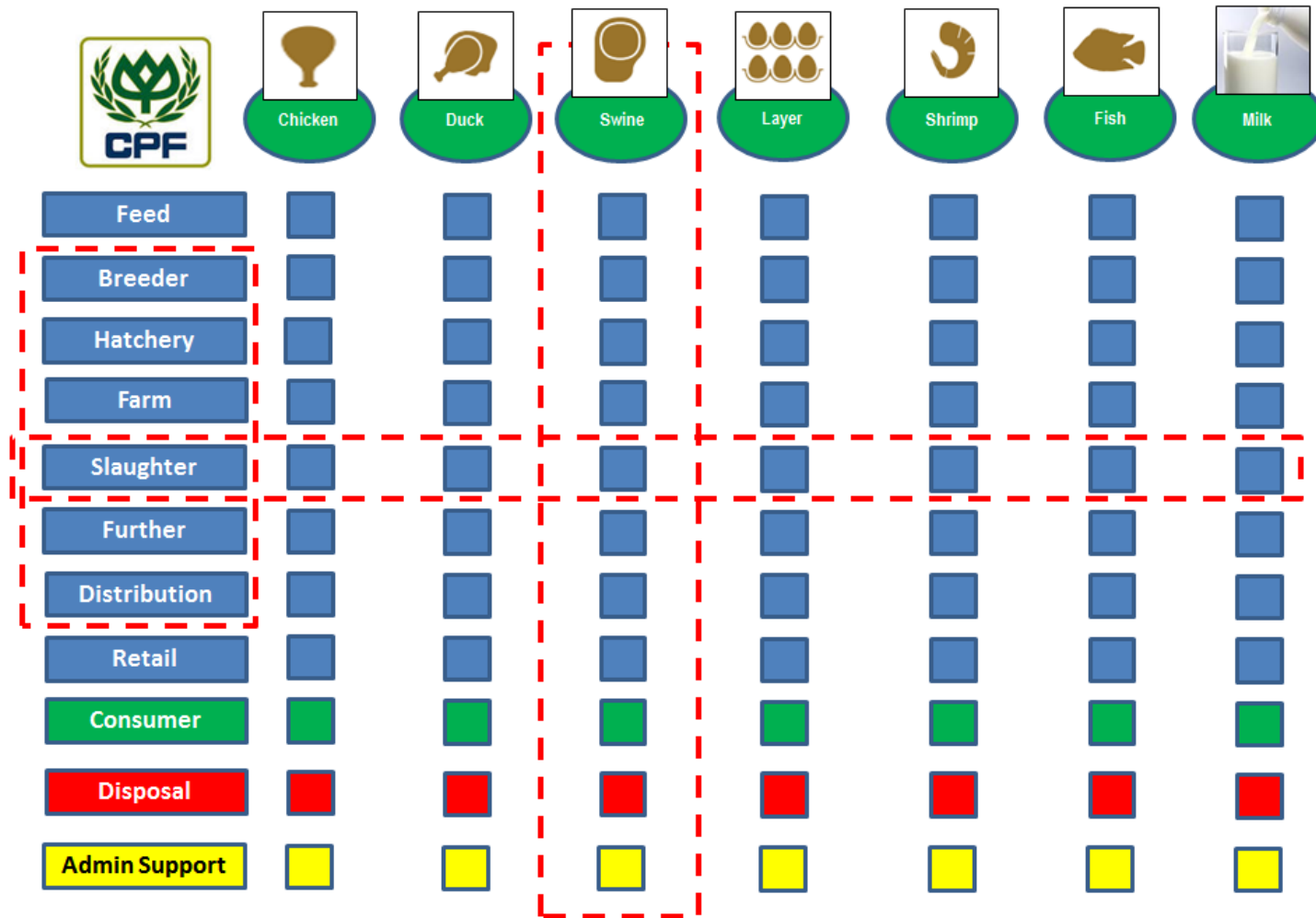
# Background and introduction

- Charoen Pokphand Food PLC, Thailand (CPF)
- large food producing company (> 2'500 products, > 60'000 employees, > 10 bill. EUR sales, operations in 14 countries, customers worldwide)
- product sustainability leader in the South-East Asian region (e.g., more than 100 verified carbon footprints)
- Footprints, ISO 14001, and many other activities are managed and supported by the department for environmental, quality and food safety standards headed by VP Kularb Kimsri
- CPF and INEC conducted a pilot project to conceptualize a corporate environmental information system in 2014/15



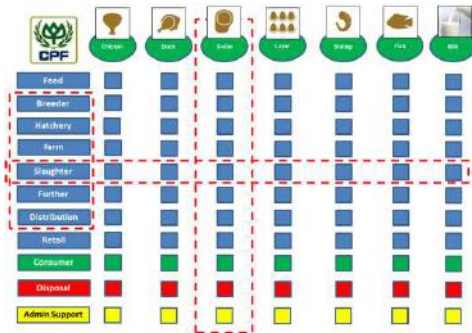
Image sources: CPF

# Challenges and requirements



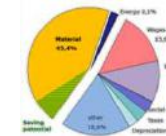
Source: CPF

# Challenges and requirements



- huge number of value chains, business units, and locations
- heterogeneous internal stakeholders (IT and ERP experts, top managers, accountants, engineers, product managers, ...)
- various information systems (ERP, EHS, emissions tracking tools, ...) as data providers

- support of carbon/water/environmental footprints, labels, and declarations, site-specific assessments (hot spots, EPIs, ISO 14001), and company-wide assessments (benchmarks, CCF, sustainability reporting)
- integration of cost information and physical environmental data
- consistent system suitable for product- site- and company-specific assessments
- inclusion of up- and downstream information

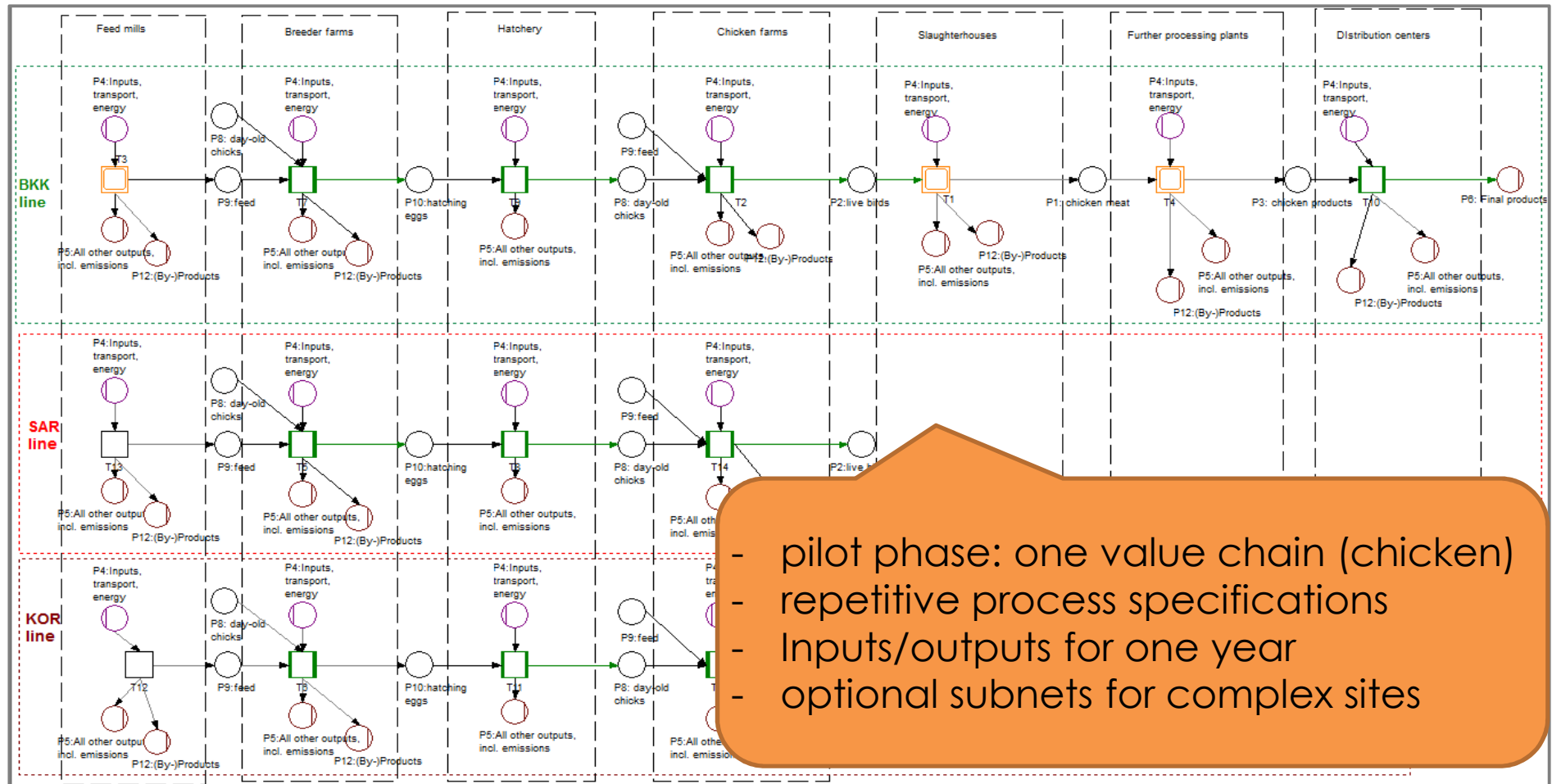


# General approach

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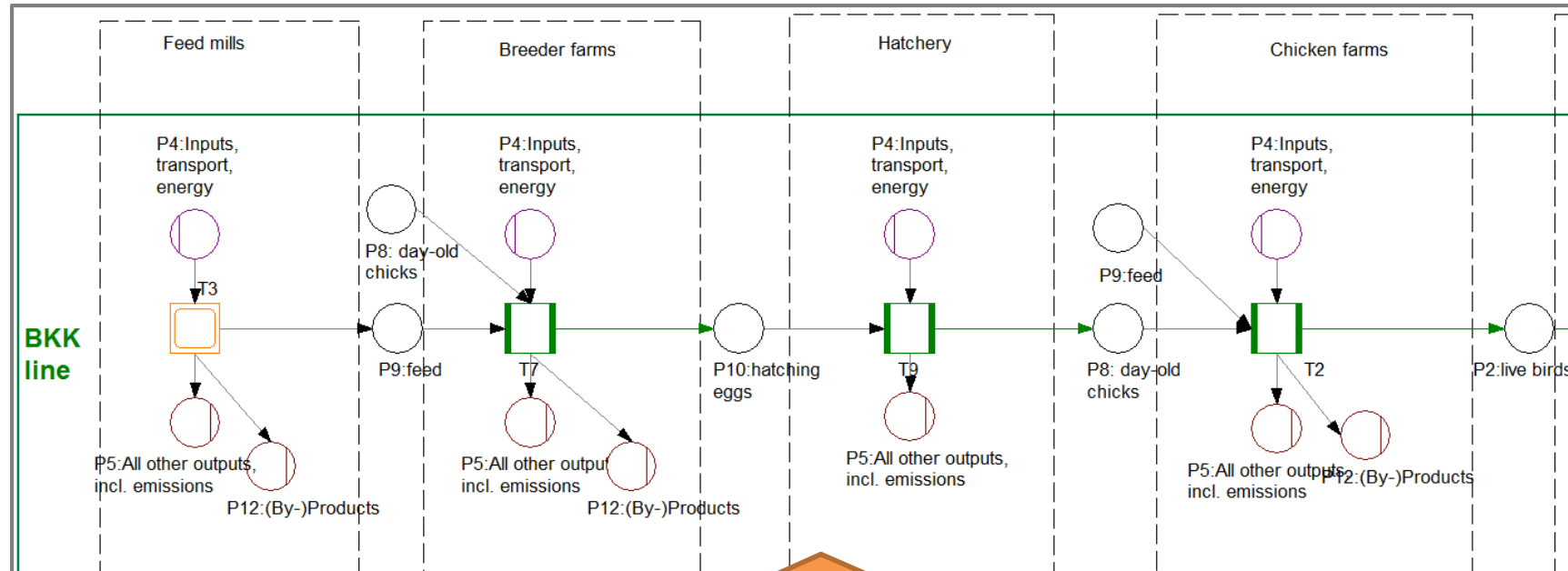
- Corporate Environmental Management Information Systems (CEMIS)
  - academic topic since the 1990s including sophisticated concepts for integrated solutions
  - in practice: specific tools for specific tasks (e.g. Umberto), loads of spreadsheets, no fully integrated solutions
  - recent developments: increasing number of vendors that (claim to) offer fully integrated solutions (e.g., SAP, enablon, thinkstep, WeSustain)
- CPF's CEMIS concept
  - Umberto network of the whole company as central platform and analysis tool for expert users
  - Excel-based interfaces for data import and export
  - background data from global and national life cycle inventory databases, relevant cost data etc.
  - future: Interfaces to further software and databases to support data input from and communication of results

# Corporate Umberto Model



Source: CPF/INEC Pilot project report

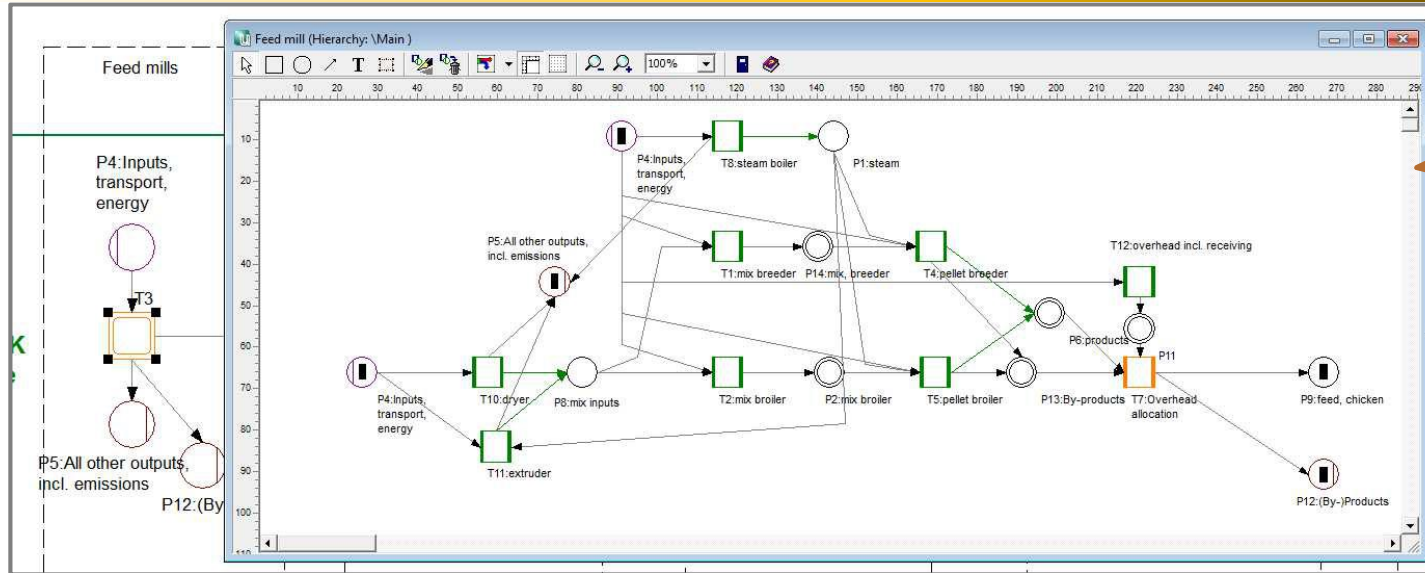
# Corporate Umberto Model



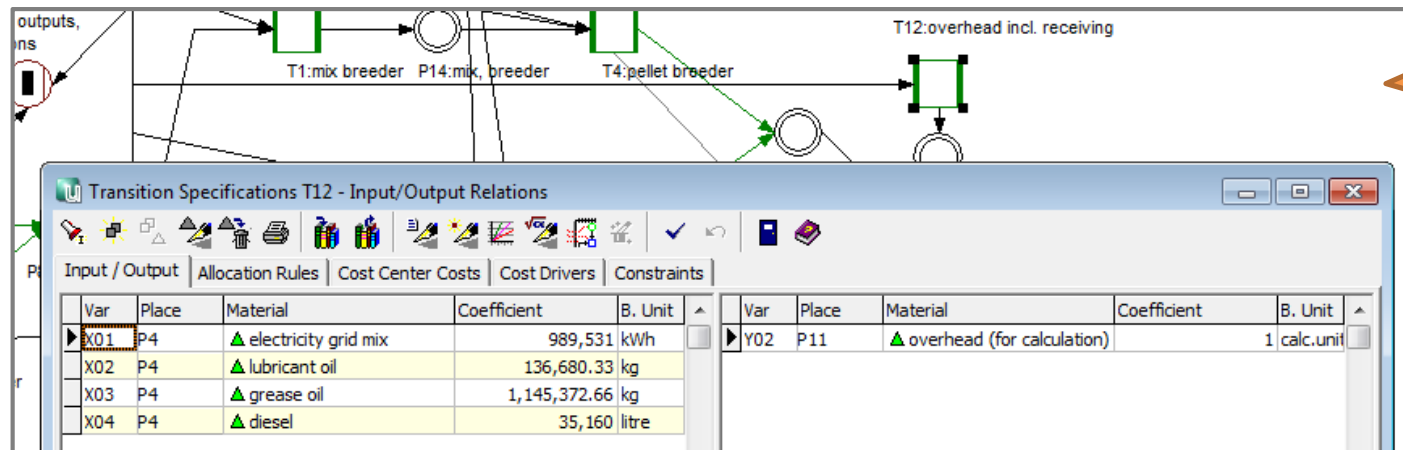
- one (duplicated) input place
- two (duplicated) output places
- storage places to connect multiple sites and units
- each process and any selection of processes can be calculated separately

Source: CPF/INEC Pilot project report

# Corporate Umberto Model



optional subnets



overhead processes

Source: CPF/INEC Pilot project report



# Material master file (Excel to Umberto)

1	Material Name	Extension	Basic Unit	Material Group	Material	Market Price	THB
2	alcohol 70%		kg	05 Auxiliaries	Root	0 THB/kg	
3			kg	03 Raw material	Root	0 THB/kg	
4			kg	05 Auxiliaries	Root	0 THB/kg	
5		e	kg	05 Auxiliaries	Root	0 THB/kg	
6			kg	03 Raw material	Root	0 THB/kg	
7			kg	05 Auxiliaries	Root	0 THB/kg	
8			kg	05 Auxiliaries	Root	0 THB/kg	
9			kg	06 Waste, wastewater	Root	0 THB/kg	
10			kg	03 Raw material	Root	0 THB/kg	

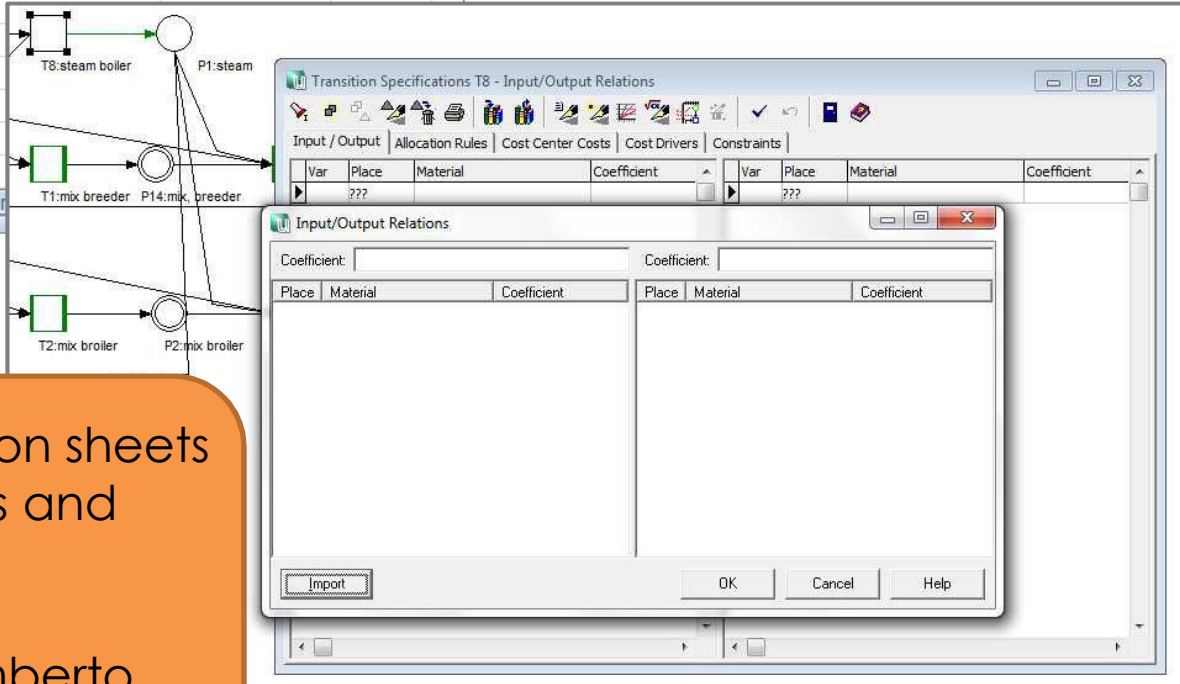
1	NAME	EXTENSION	GWP_Scope1	GWP_Scope2	GWP_Scope3	GWP_Total	GreenWater	BlueWater	GreyWater
2	UNIT		kg CO2eq	kg CO2eq	kg CO2eq	kg CO2eq	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>
3	CATEGORY		Ecological	Ecological	Ecological	Ecological	Ecological	Ecological	Ecological
4	DESCRIPTION		Year 2013	Year 2013	Year 2013	Year 2013	Year 2013	Year 2013	Year 2013
55	diesel		2,7080	0,0000	0,2790	2,9870	0,0000	0,0020	0,0000
56	dihydrogenated tallowdimonium chloride		0,0000	0,0000	5,0000	5,0000	0,0000	0,0000	0,0000
57	distilled water		0,0000	0,0000	1,0000	1,0000	0,0000	0,0000	0,0000
58	dl 99%		0,0000	0,0000	5,0000	5,0000	0,0000	0,0000	0,0000
59	d-light clear		0,0000	0,0000	1,0529	1,0529	0,0000	0,0000	0,0000
60	dusty corn		0,0246	0,0000	0,0000	0,0246	0,0000	0,0000	0,0000

- material master list for consistent administration of material names, units, costs and ecological impacts (LCI factors from ecoinvent, Thai GHG database, etc.)
- cost/impact factors = material properties

Source: CPF/INEC Pilot project report

# Import of site-specific data (Excel to Umberto)

	A	B	C	D	E	F
1	salt	1.200,00 kg		steam	23.135.600,00 kg	
2	ht-b100	2.400,00 kg		ash	297.335,00 kg	
3	electricity grid mix	194.212,00 kWh		waste water, untreated	62.400,00 litre	
4	corncoobs	40.047,00 kg				
5	chip wood	2.061.373,67 kg				
6	palm shell	2.425.158,13 kg				
7	cashew shell	588.096,96 kg				
8	coconut shell	1.045.530,00 kg				
9	ground water	23.198.000,00 litre				
10						



- Excel-based data collection sheets (filled by various engineers and managers throughout the company)
- import of this data into Umberto model by CEMIS experts

Source: CPF/INEC Pilot project report

# Calculation and balancing

**Balance Sheet Preview - Materials**

Input:			Output:		
Item	Quantity	U.	Item	Quantity	U.
01 Products and intermediates			01 Products and intermediates		
▲ chicken, chill meat	671,904	kg	▲ chicken, chill meat	186,795,190	kg
▲ chicken, chilled meat	46,764,000	kg	▲ chicken, frozen meat	161,360	kg
▲ chicken, purchase meat	7,845,903.9	kg	▲ egg	816,000	kg
▲ chicken, thawing meat	8,749,384.25	kg	▲ fg deep-fried pack 1000g	85,032	kg
▲ egg	816,000	kg			
▲ flake ice	2,255,000	kg			
▲ pork, chilled meat	19,632,000	kg			
▲ sausage	72,036,000	kg			
▲ shrimp	3,552,000	kg			
03 Raw material					
▲ canola meal	530,579	kg			
▲ casava chip pellet	18,439,707.4	kg			

Input:			Output:		
Item	Quantity	Unit	Item	Quantity	Unit
01 Products and intermediates			01 Products and intermediates		
▲ chicken, purchase meat	9,031	kg	▲ chicken, frozen meat	161,360	kg
▲ chicken, thawing meat	10,070	kg	06 Waste, wastewater and emissions		
	185	kg	▲ ash	171	kg
	6,431	kg	▲ culling eggs	2	kg
	63	t	▲ damaged eggs	1,730	kg
	11,542	kg	▲ dead birds, landfill	1,187	kg
	2,752	kg	▲ effluent water	1,752,305	litre
	260	kg	▲ eggs shell	118	kg
phosphate	962	kg	▲ sludge	1,520	kg
	0	kg	▲ used oil	4	kg
	8,795	kg	▲ waste water, untreated	61,618,886	litre
	30,816	kg	▲ waste, solid	62	kg
	183	kg			
	176	kg			
	1,097	kg			
	342	kg			
	12	kg			
	44	litre			
electricity grid mix	25,245	kWh			
▲ electricity grid mix, office	256	kWh			
Sum			Sum		
kWh	25,501	kWh	kg	166,154	kg
kg	176,899	kg	litre	63,371,192	litre

- 1<sup>st</sup> calculation delivers material and energy flow inventories of company/business units/sites
- 2<sup>nd</sup> calculation delivers product-specific inventories

Source: CPF/INEC Pilot project report

# Further assessments

The screenshot displays the Valuation System 'CPF environmental assessments' interface. It features a tree view on the left with categories like Carbon Footprint (2), Water Footprint (3), and various GWP Scopes. A table in the center lists variables such as 'Global Warming Potential total' and 'GWP Scope 1'. An Umberto chart shows the breakdown of Global Warming Potential into three categories: T1 Slaughterhouse (30,596.2), T2 Chicken farm, B (14,527.7), and T3 Feed mill, BKK (41,827.9). A pie chart illustrates the distribution of GWP across different scopes: GWP Scope 3 upstream (70.89%), GWP Scope 3 downstream (9.95%), GWP Scope 2 (17.64%), and GWP Scope 1 (1.52%).

**Equations:**  
 Carbon Footprint  
 $GWP_{sc1} = GWP_{1agg} + GWP_{1direct}$   
 $GWP_{sc2} = GWP_2$   
 $GWP_{sc3u} = GWP_{3up}$   
 $GWP_{sc3d} = GWP_{3down}$   
 $GWP_{tot} = GWP_{sc1} + GWP_{sc2} + GWP_{sc3u} + GWP_{sc3d}$   
 Product Output  
 $ProdOUT = ProdO$   
 $GWPPp = GWP_{tot} / ProdOUT$

**Global Warming Potential total breakdown:**

Category	Value
T1 Slaughterhouse	30,596.2
T2 Chicken farm, B	14,527.7
T3 Feed mill, BKK	41,827.9

**GWP Scope Breakdown:**

Scope	Percentage
GWP Scope 3 upstream	70.89%
GWP Scope 3 downstream	9.95%
GWP Scope 2	17.64%
GWP Scope 1	1.52%

**Valuation System Results (Multi, LCI, CPF e...)**

Item	Quantity	Unit
Eco-efficiency		
◆ Total production cost		
chicken, chill meat	1,039,204.00	THB
chicken, head	174,088,204.00	THB
total env. impact (here: GWF)		
chicken, chill meat	70,394.20	kg CO2eq
chicken, head	2,142,671.85	kg CO2eq
Cost per EnvImp		
chicken, chill meat	14.76	THB/kgCO2
chicken, head	81.25	THB/kgCO2

**Valuation System Results (Preview, LCI, CPF env...)**

Item	Quantity	Unit
Carbon Footprint		
◆ Global Warming Potential total	436,786,767	kg CO2eq.
◆ GWP Scope 1	6,651,769	kg CO2eq.
◆ GWP Scope 2	77,055,020	kg CO2eq.
◆ GWP Scope 3 upstream	309,618,346	kg CO2eq.
◆ GWP Scope 3 downstream	43,461,632	kg CO2eq.

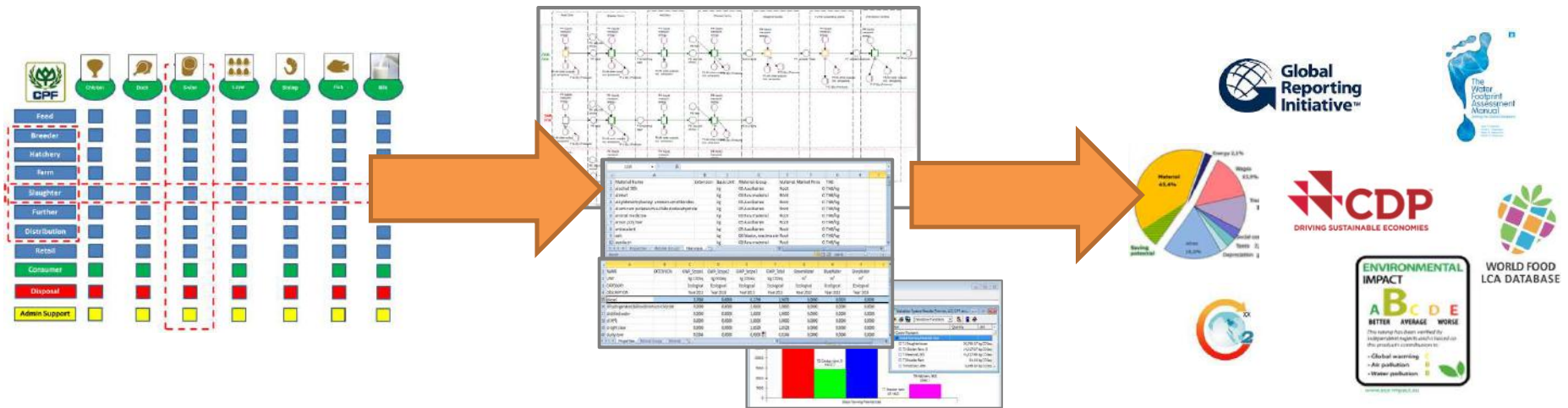
**Valuation System Results (Preview, Input/Output, ...)**

Item	Quantity	Unit
Carbon Footprint		
◆ Global Warming Potential total	436,786,767	kg CO2eq.
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◆ GWP Scope 3 upstream	309,618,346	kg CO2eq.
◆ GWP Scope 3 downstream	43,461,632	kg CO2eq.

- Self-defined valuation systems using material properties
- Support of CCF, PCF, PEF, eco-efficiency etc.

Source: CPF/INEC Pilot project report

# Results and observations



- pilot phase implementation proves general suitability of the approach
- most crucial topic: **data** (availability, quality, reliability, completeness, etc.)
  - ERP, EHS, ... provide partial data only
  - different names and units for same materials
  - missing or highly aggregated data
  - not specific for CPF's approach, the data challenge is evident (but sometimes not transparent) in all types of CEMIS applications

# Why Umberto 5.6 and not Umberto NXT?

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- Umberto NXT advantages for CEMIS
  - faster modeling (copy&paste)
  - easier import of process specifications from Excel
  - improved export of results to Excel
  - additional assessment options using phases
- Umberto 5.6 advantages for CEMIS
  - self-defined material properties
  - Self-defined indicators (valuation system)



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ขอขอบคุณ

*Heidelberg, September 22<sup>nd</sup>, 2015*

*Umberto User Workshop*