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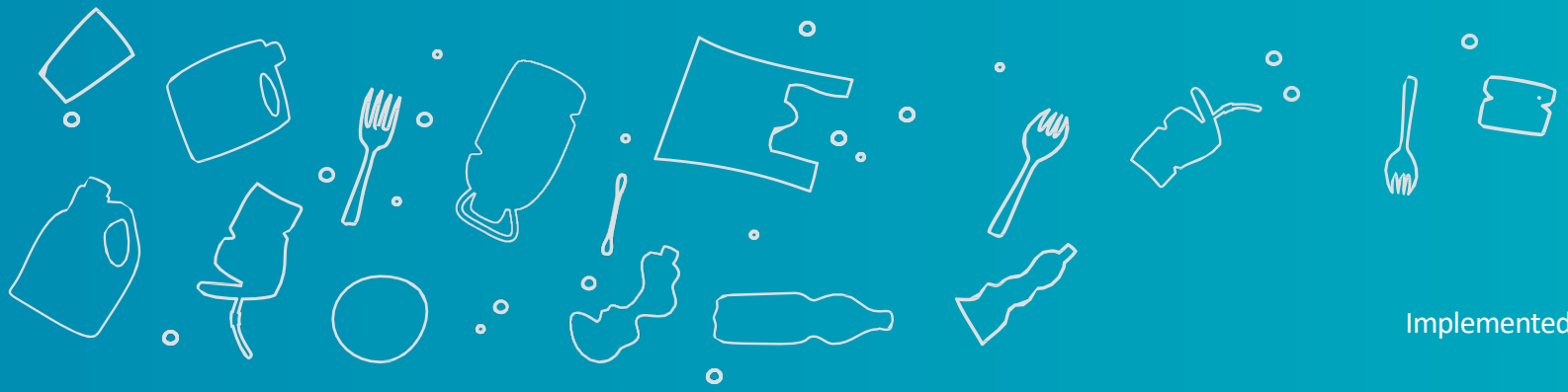
NATIONAL GUIDANCE FOR PLASTIC POLLUTION HOTSPOTTING AND SHAPING ACTION

MODULE **T3**

Modelling Polymer/ Application/Sector Hotspots

V1.1
November
2020



Implemented with ea + Quantis

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Life Cycle Initiative

NATIONAL GUIDANCE FOR PLASTIC POLLUTION HOTSPOTTING AND SHAPING ACTION

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HOW TO READ THIS DOCUMENT

MODULE

Modules are the instruction for the tools. Each module is composed of one or several tools. Technical modules focus on generating hotspot information by the technical team. Strategic modules focus on generating interventions and instruments by involving a wider group of stakeholders.

TOOL REFERENCE

Tools are the building blocks of the guidance. Tools are of three categories: input tools (for data collection), assessment tools (to generate the hotspots, interventions and instruments) and output tools (to provide summarised information and shareable data repository).

White background	**WORKFLOW SLIDE**
Grey background	**SUPPORTING INFORMATION**
Blue background	**DEFINITIONS AND DESCRIPTIONS**

Describes key stages and main actions to run the module and associated tools.

Provides supporting information, references of background data.

Provides key definitions and high level objectives of the modules and tools.

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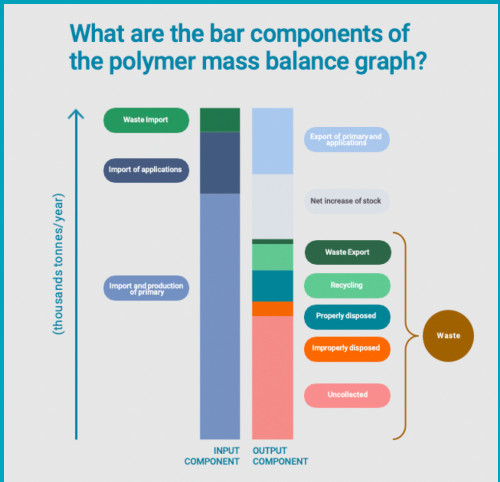
OBJECTIVES OF THE MODULE

The aim of this module is to determine which polymer, application or sector is most critical in the country regarding plastic leakage. In more detail it will allow to :

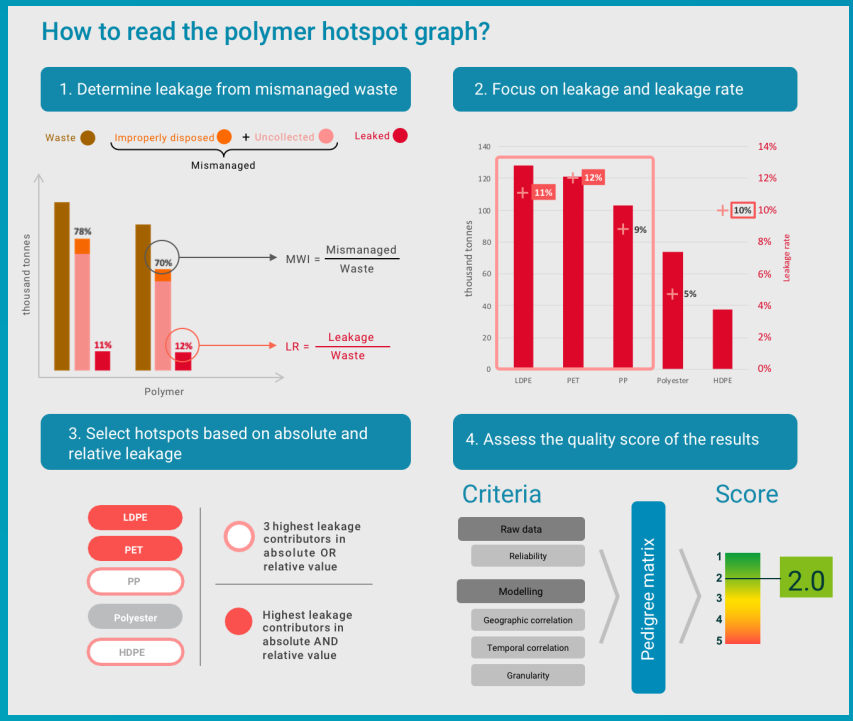
1. Reconcile data between polymer/application and sectors
2. Generate the missing data by mass balance (stock and total waste) to create a coherent waste management model for all flows
3. Calculate the mismanagement per polymer/application/sector
4. Calculate the leakage by polymer/application/sector in a coherent way with total country leakage computed in T5

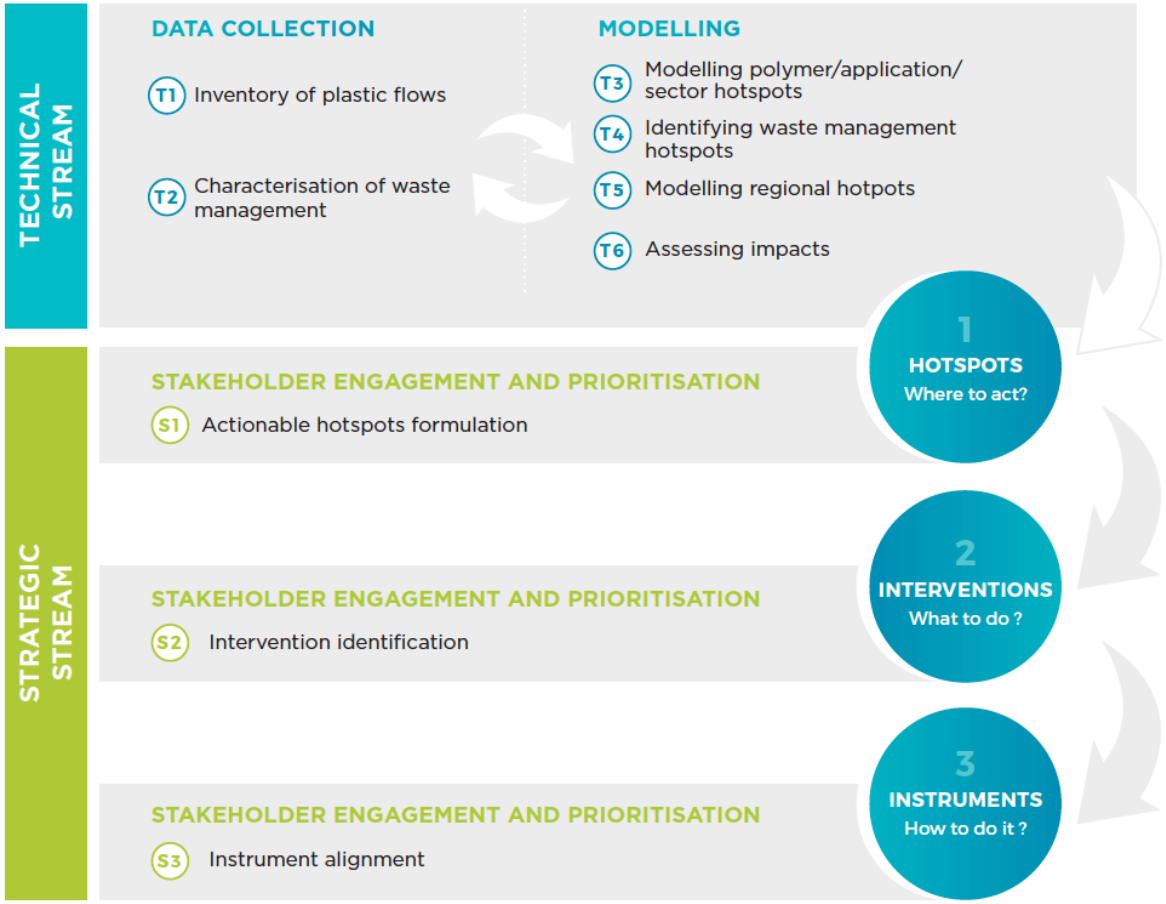
The module will yield a mass balance

(inputs in the country are balanced with the outputs)



Key stages of the process include :





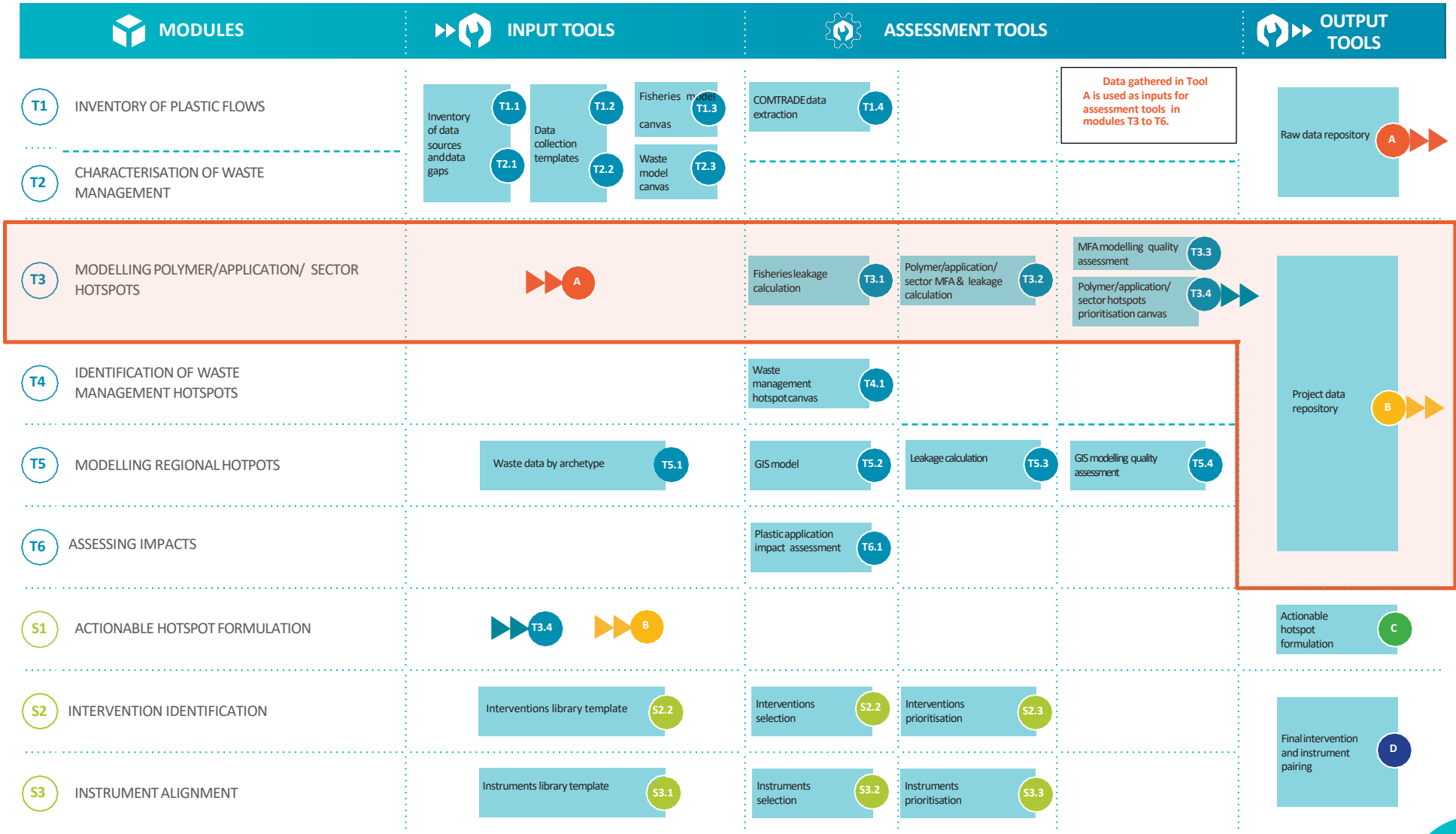
RELATIONSHIP OF MODULE T3 WITH OTHER MODULES

Module T3 is part of the technical work stream. The results of this module is the identification of the most relevant plastic polymers, applications, industrial sectors causing the leakage of plastics into waterways, the so-called «hotspots».

Module T3 organises the information collected in module T1 and T2, to establish plastic material flows for all polymers, sectors, and applications. It provides module T5 with total quantity of plastic waste generated, and it receives from module T5 the total plastic leakage for the country. The model then distributes the total leakage by polymer, application and sector.

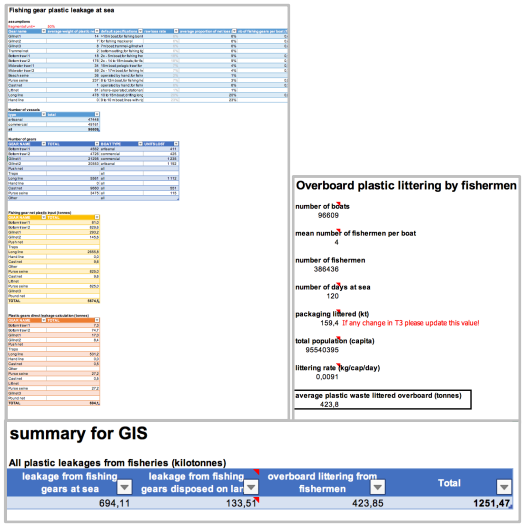
This process is fully automated in excel, once the required inputs form T1, T2 and T5 are copied in the appropriate tools.

TOOLS ASSOCIATED WITH MODULE T3



EXCEL TOOLS ASSOCIATED WITH THIS MODULE

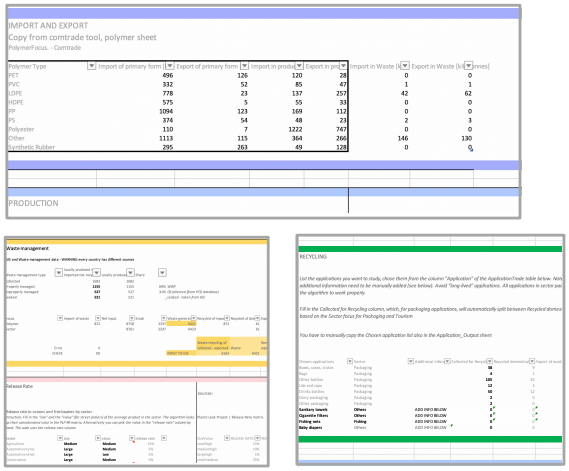
T3.1 FISHERIES LEAKAGE CALCULATION



TYPE: :
ASSESSMENT TOOL

OBJECTIVE:
Allows to calculate the total plastic leakage from fisheries including direct gear loss at sea, overboard littering by fishermen and mismanaged gears on land.

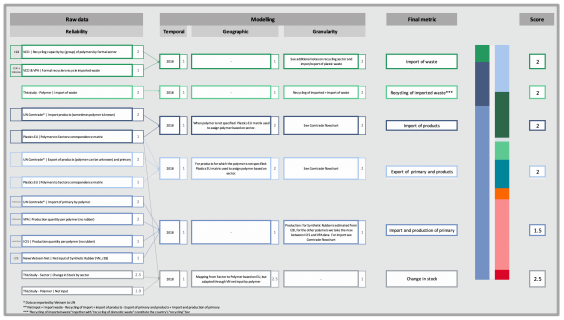
T3.2 POLYMER/ APPLICATION/SECTOR MFA & LEAKAGE CALCULATION



TYPE:
ASSESSMENT TOOL

OBJECTIVE:
Given input from tool T1, T2 and T5 by the user, it generates MFA (Material Flow Analysis) and leakage calculation by Polymer, Application and Sector.

T3.3 MFA MODELLING QUALITY ASSESSMENT



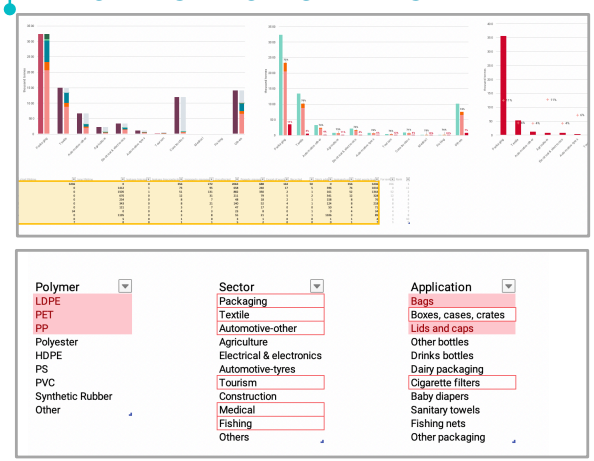
TYPE:
ASSESSMENT TOOL

OBJECTIVE:
It offers a framework to keep track of sources of data and modelling assumptions, in order to assess the quality of the results in T3.2

These tools are available in the Excel files associated with this module.

EXCEL TOOLS ASSOCIATED WITH THIS MODULE

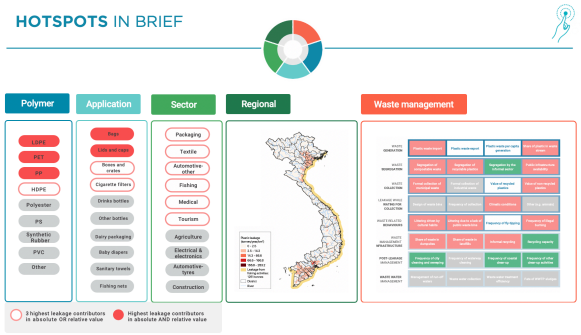
T3.4 POLYMER/ APPLICATION/SECTOR HOTSPOTS PRIORITISATION CANVAS



TYPE:
ASSESSMENT TOOL

OBJECTIVE:
Given MFA tables from T3.2 as input, it generates MFA and Leakage graphs for Polymer, Application and Sector. It also automate the hotspots selection.

B PROJECT DATA REPOSITORY



TYPE:
OUTPUT TOOL

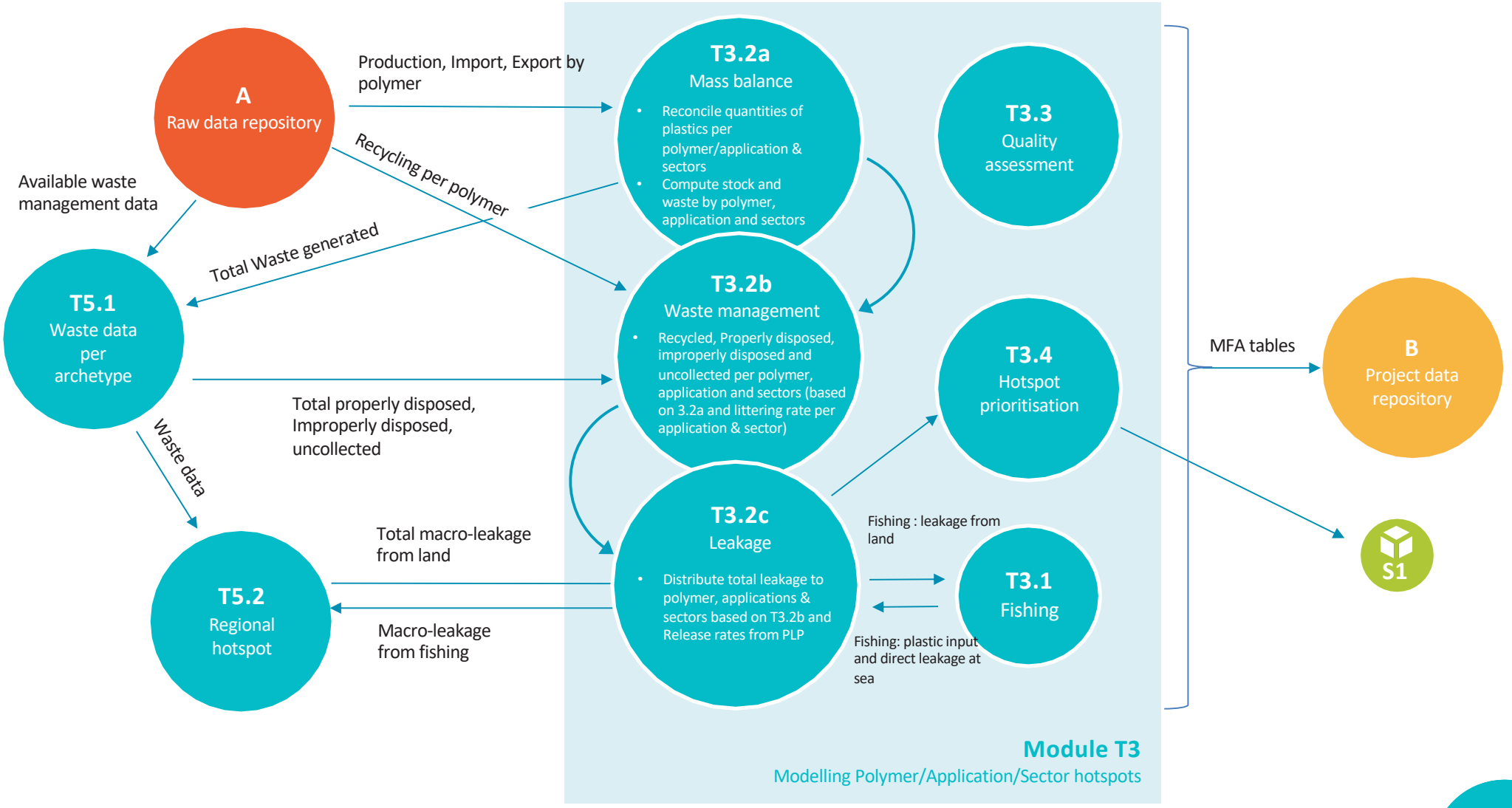
OBJECTIVE:
Canvas in PowerPoint to recap all hotspots by category.

These tools are available in the Excel and PowerPoint files associated with this module.

-

Modelling process overview

MODELLING IN THIS MODULE – Visual overview



MODELLING IN THIS MODULE – Descriptive overview

Here we describe the chart of the previous slide. In order to better understand how module T3 functions, and in particular its inputs and outputs, we illustrate the interactions between tools in module T3 and other tools outside of module T3.

The main source of input for module T3 is tool A, which consists in a raw data repository, organised in a way that matches the needs of tool T3.2. For clarity, we conceptually break tool T3.2 into 3 parts, a), b), and c).

Part a) needs manual input of data on production, import and export (by polymer and application) from tool A in order to generate data on stock and waste (by polymer, application, and sector). The tool T3.2 allows to reconcile the data so that the mass balances by polymer and by sector are coherent one with another. This is achieved by mapping shares of polymers by sector and vice versa (a matrix is provided by default but can be adapted for the country if data is available). All of the data generated by tool T2.3 a) are used by tool T3.2 b), while tool T5.1 (manually) receives as input from tool T2.3 a) the total plastic waste generated.

Tool T5.1 takes available data on waste management from tool A, e.g. shares of waste going to sanitary landfills or incinerators (proper disposal practices), or to unsanitary landfills and dumpsites (improper disposal), and combines them with the total waste generated from tool T3.2 a) in order to generate a coherent picture of plastic waste properly managed, improperly managed and uncollected in the different geographical areas.

Part b) of tool T3.2 needs manual input from tool T5.1 on total quantitiy of plastic properly managed, improperly managed and uncollected which are used to generate a break-down of the waste into recycled, properly managed, improperly managed and uncollected by polymer, sector and application. Data on recycling are provided the tool T3.2 by tool A.

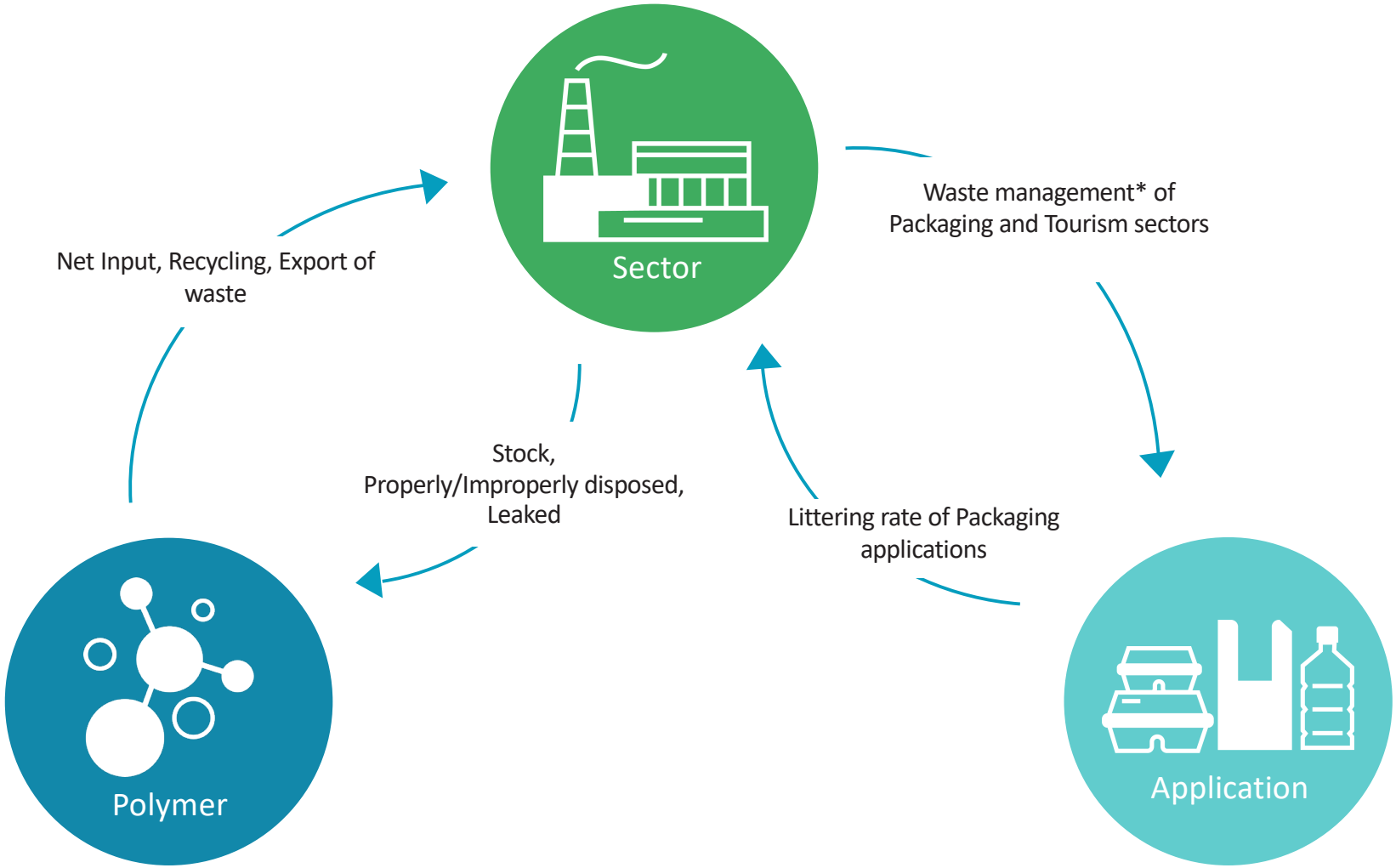
GIS tool T5.2 is then run (using data from tool T5.1) to determine how much of the mismanaged waste leaks into waterways from different geographical areas. The generated information on total leakage is used as input for tool T3.2 c).

Part c) breaks down the total plastic leakage in plastic leakage by polymer, sector and applications, based on their mismanaged quantities and specific release rates. To determine the leakage for the fishing sector, a couple of iterations are needed between tool T3.2 and T3.1. This completes the material flow analysis (MFA) by polymer, application and sectors.

Once T3.2 is completed, all MFA tables for polymers, applications and sectors are used by tool T3.4 to run the hotspot prioritisation (and generate graphic visualisation of MFA, MWI and leakage). The strategic module S1 will use the hotspot prioritisation to determine actionable hotspots. All generated data are gathered in a structured data repository (output tool B).

Tool T3.3 is used all along the way to keep track of data quality, data sources and modelling assumptions and can be completed in parallel with tool T3.2.

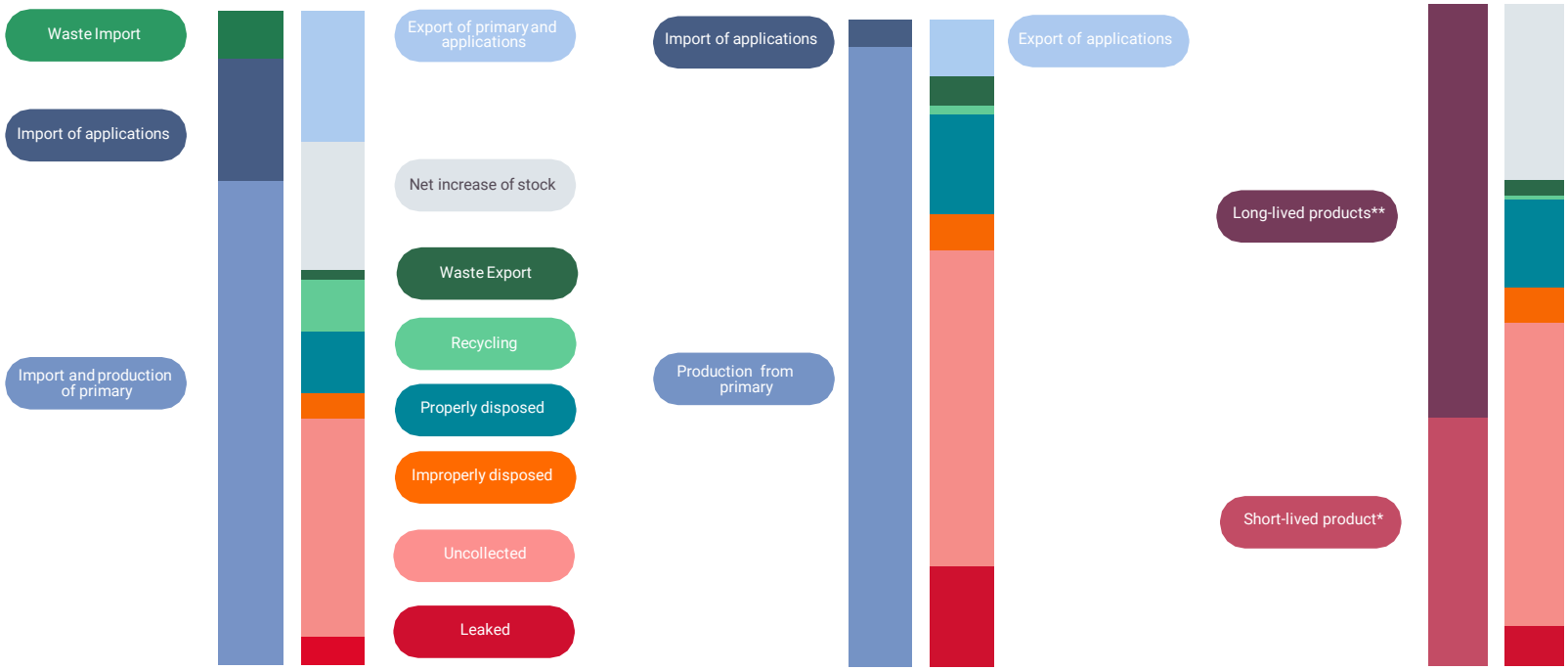
RECONCILING Sector, Polymer and Application MFAs



*Waste management includes: Export of waste, Recycling, Properly/Improperly disposed, Uncollected and Leaked

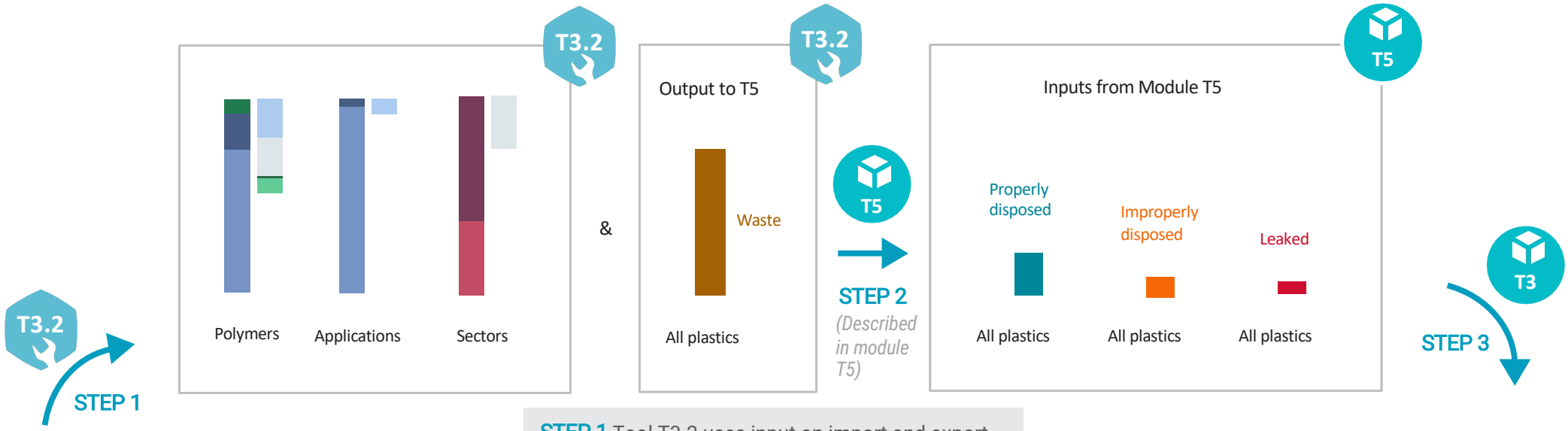
Modelling Polymer/Application/Sector hotspots

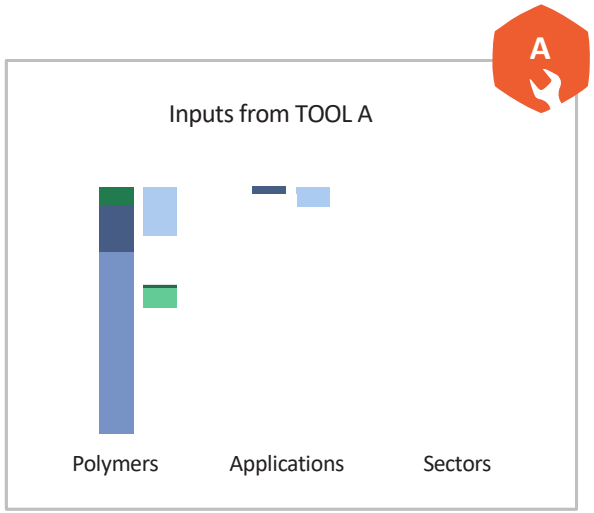
To identify Application and Sectors hotspots we use the same approach as for the Polymer hotspots. However, the mass balance bars slightly differ from one category of hotspots to the other. Only few elements (which are labelled on respective bar charts) change from Polymer to Application and Sector mass balances



* <u>Short-lived products</u>: products that are disposed within the year of study (Life-time < 1 year)
** <u>Long-lived products</u>: products that are disposed after the year of study (Life-time > 1 year)

HOW DOES THIS MODULE INTERACT WITH THE OTHERS?

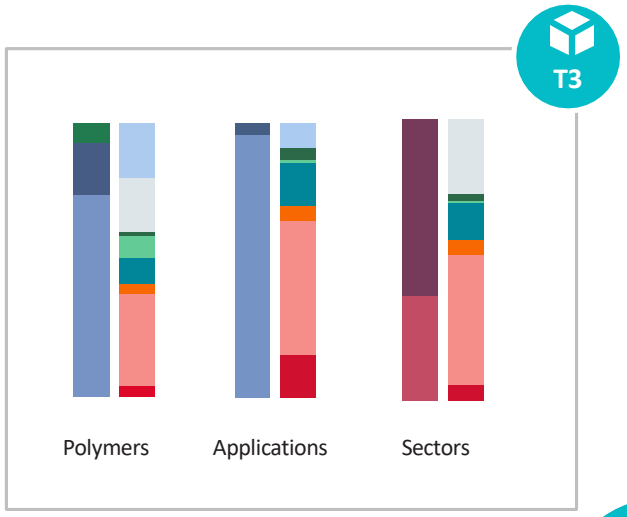




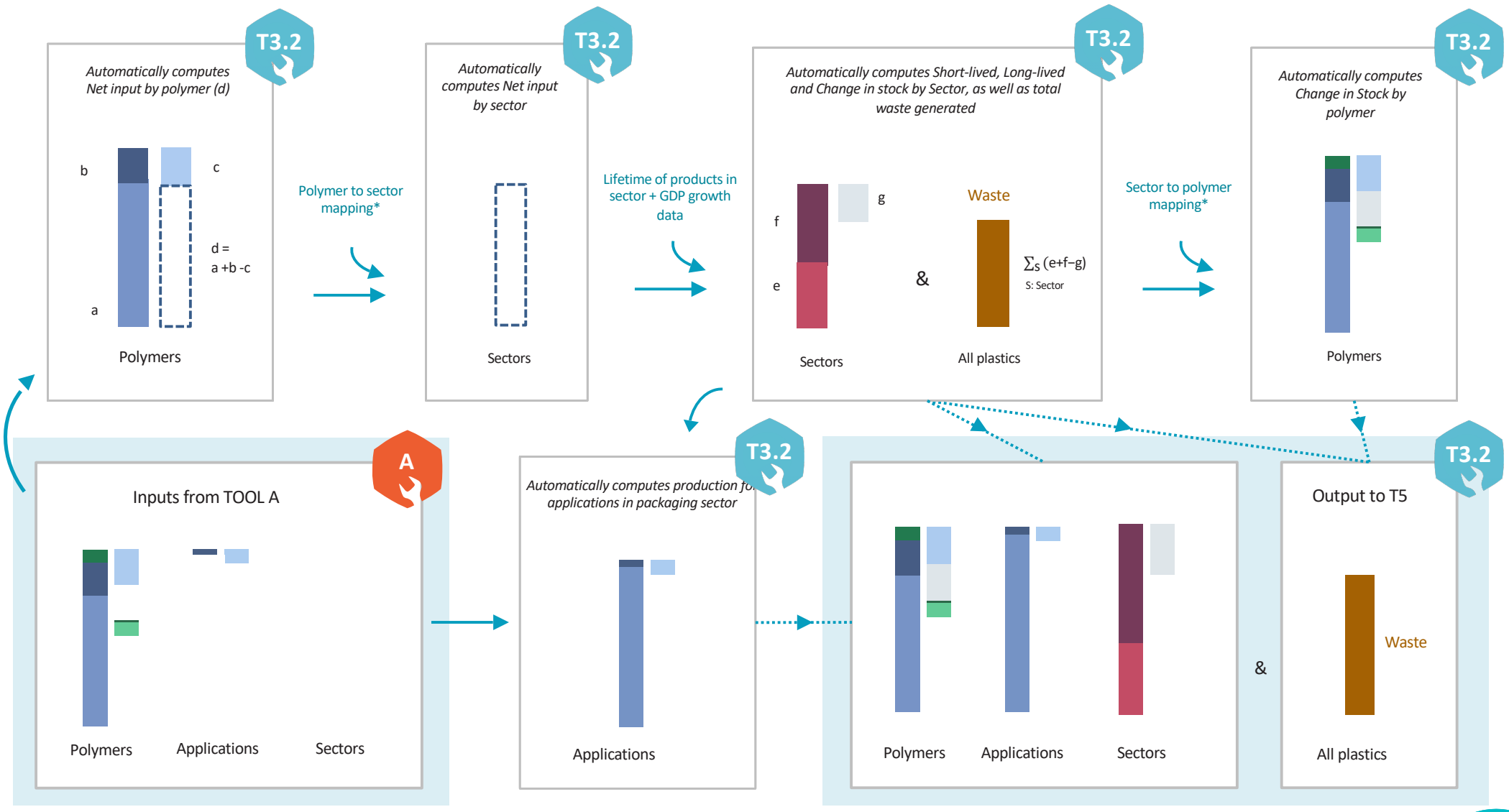
STEP 1 Tool T3.2 uses input on import and export by polymer and application as well as recycling and production by polymer (available in Tool A). It then generates production by packaging application; short-lived, long-lived by sector; change in stock by polymer and sector. This allows to compute the total waste generate, needed as input to module T5.

STEP 2 With the information of total waste generation, Module T5 can be completed (see Module T5). Module T5 generates the total amount of Properly disposed, Improperly disposed and macro-plastic Leaked as input for Module T3.

STEP 3 Module T3 (tool T3.1 & T3.2) distributes waste management quantities of T5 by polymer, application and sector

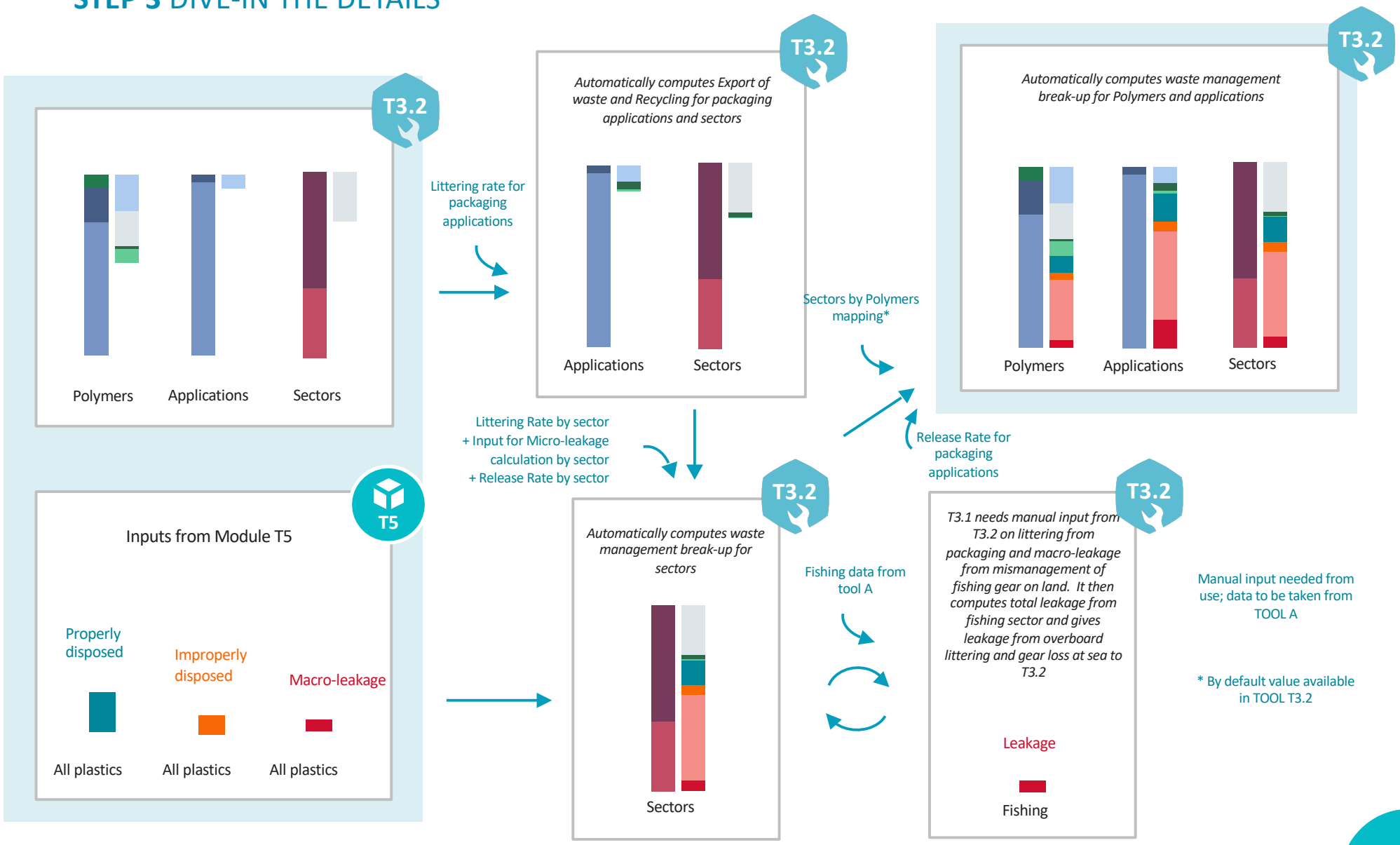


STEP 1 DIVE-IN THE DETAILS



Manual input needed from user; data to be taken from TOOL A,
* By default value available in TOOL T3.2

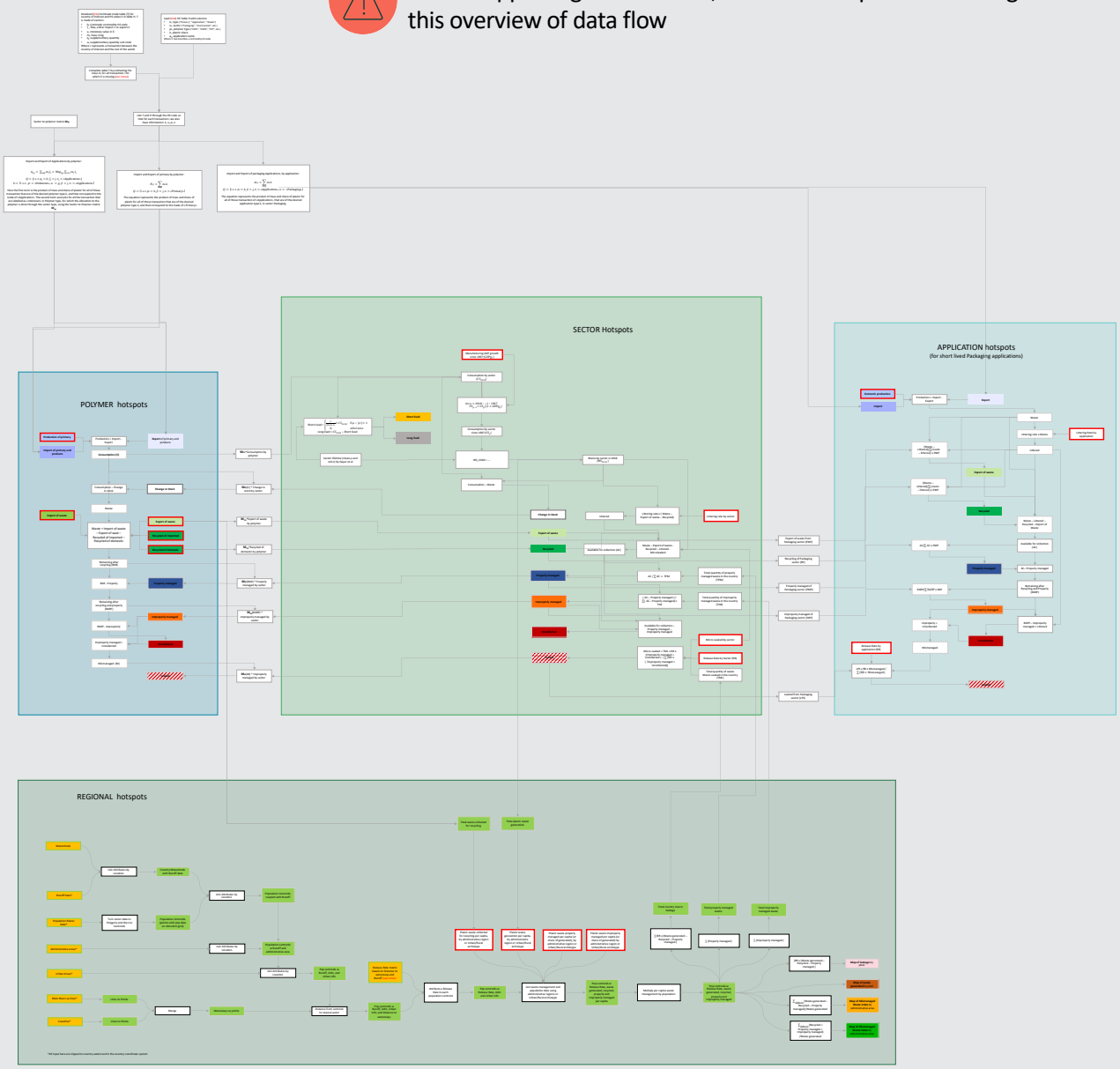
STEP 3 DIVE-IN THE DETAILS



Modelling Polymer/Application/Sector hotspots

COMTRADE flowchart

This is supporting information ; zoom-in to capture modelling details of this overview of data flow

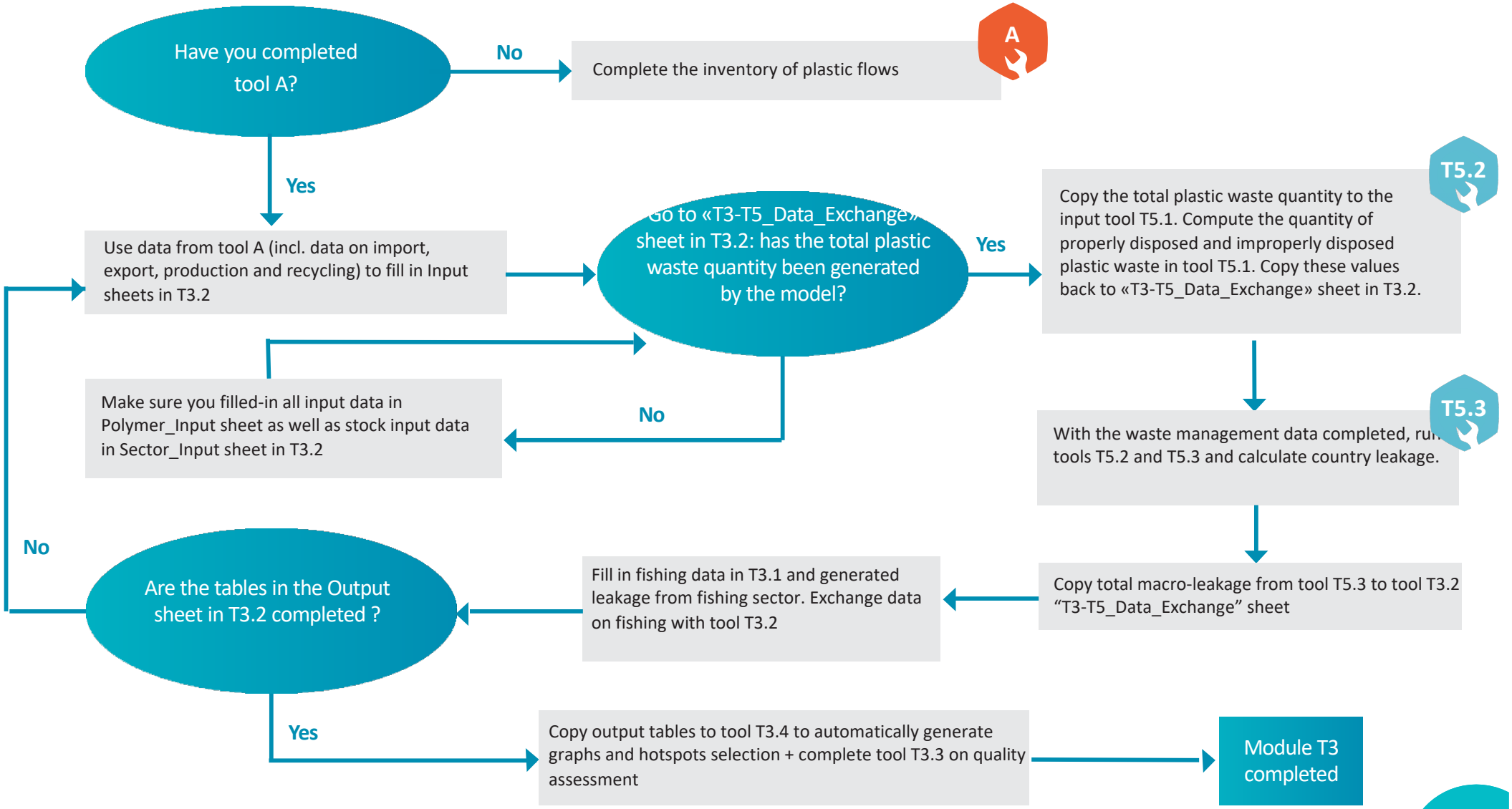


TOOL T1.4 (Comtrade modelling

TOOL T3.2 modelling

MODULE T5 modelling

HOW TO USE THIS MODULE?



TOOL

T3.1 Fisheries leakage calculation

HOW TO USE THIS TOOL ?

a. Start with the “Leakage_at_sea” sheet of the excel file. The sheet requires to provide either directly the number of fishing gears by type **(1)** or alternatively the number of boats and average number of gears derived from another country dataset **(2)**. Look at the data repository (Tool A) to find these values. You can also pre-calculate values and tidy existing datasets in the “BACKEND_...” sheets of the excel file.

b. On the same sheet, decide upon what fraction of trawl nets and seine nets are lost on average **(3)**. This value is set to 50% by default, and affects the final leakage result from direct loss at sea of these specific fishing gears (trawl nets, seine nets).

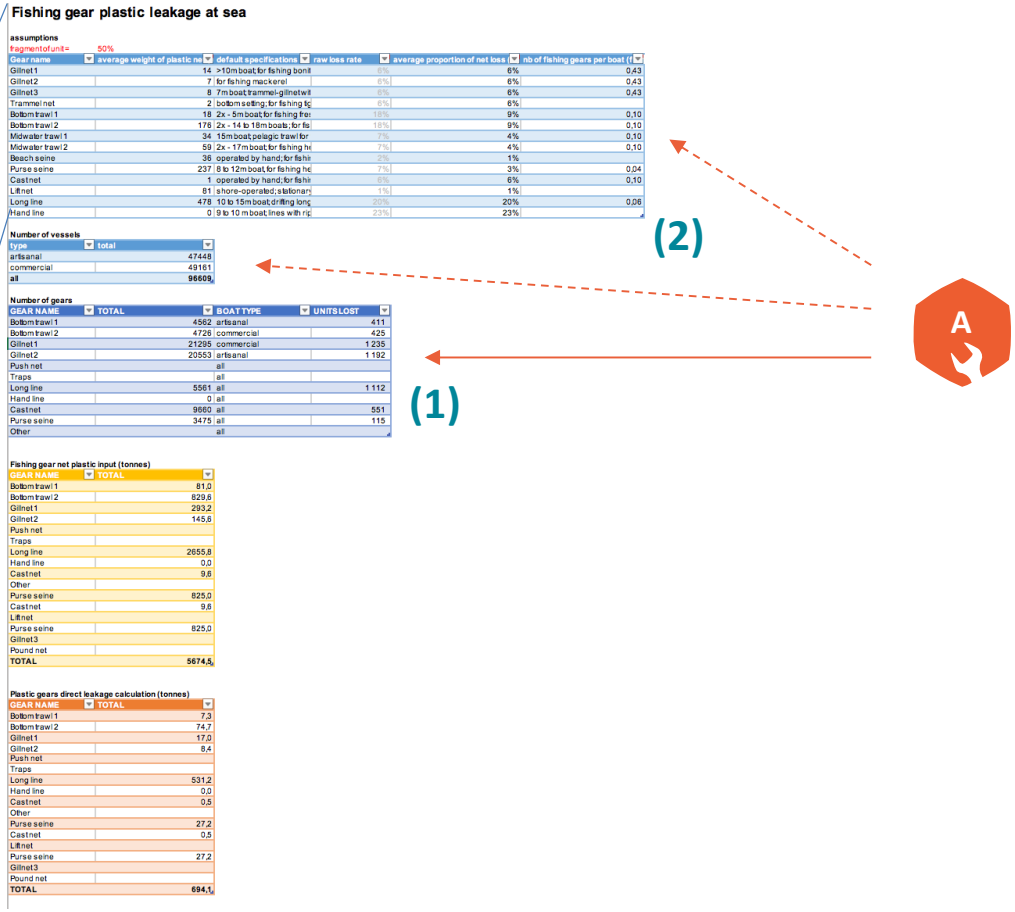
(3)

Fishing gear plastic leakage at sea

assumptions

fragment of unit = 50%

Gear name	average weight of plastic net (kg)	default specifications
Gillnet 1	14	>10m boat; for fishing bonito
Gillnet 2	7	for fishing mackerel
Gillnet 3	8	7m boat; trammel-gillnet with
Trammel net	2	bottom setting; for fishing tig
Bottom trawl 1	18	2x - 5m boat; for fishing fresl
Bottom trawl 2	176	2x - 14 to 18m boats; for fish
Midwater trawl 1	34	15m boat; pelagic trawl for fi
Midwater trawl 2	59	2x - 17m boat; for fishing her
Beach seine	36	operated by hand; for fishing
Purse seine	237	8 to 12m boat, for fishing her
Cast net	1	operated by hand; for fishing
Lift net	81	shore-operated; stationary
Long line	478	10 to 15m boat; drifting longli
Hand line	0	9 to 10 m boat; lines with ripj



HOW TO USE THIS TOOL ?

c. On the "leakage_at sea" sheet, the tool automatically computes total plastic input of fishing gears based on average plastic weight per gear and number of gears by type **(4)** and the plastic leakage from direct loss at sea based on total plastic input and loss rates per gear* **(5)**. The user can check if all fishing gears used in the country have a displayed value in both tables ("total plastic input" and "direct leakage at sea").

Gear name	average weight of plastic net (kg)
Gillnet 1	14
Gillnet 2	7
Gillnet 3	8
Trammel net	2
Bottom trawl 1	18
Bottom trawl 2	176
Midwater trawl 1	34
Midwater trawl 2	59
Beach seine	36
Purse seine	237
Cast net	1
Lift net	81
Long line	478
Hand line	0

GEAR NAME	TOTAL
Bottom trawl 1	4562
Bottom trawl 2	4726
Gillnet 1	21295
Gillnet 2	20553
Push net	
Traps	
Long line	5561
Hand line	0
Cast net	9660
Purse seine	3475
Other	

(4)

Fishing gear plastic leakage at sea

Fishing gear net plastic input (tonnes)

GEAR NAME	TOTAL
Bottom trawl 1	81,0
Bottom trawl 2	829,6
Gillnet 1	293,2
Gillnet 2	145,6
Push net	
Traps	
Long line	2655,8
Hand line	0,0
Cast net	9,6
Other	
Purse seine	825,0
Cast net	9,6
Lift net	
Purse seine	825,0
Gillnet 3	
Pound net	
TOTAL	5674,5

Plastic gears direct leakage calculation (tonnes)

GEAR NAME	TOTAL
Bottom trawl 1	7,3
Bottom trawl 2	74,7
Gillnet 1	17,0
Gillnet 2	8,4
Push net	
Traps	
Long line	531,2
Hand line	0,0
Cast net	0,5
Other	
Purse seine	27,2
Cast net	0,5
Lift net	
Purse seine	27,2
Gillnet 3	
Pound net	
TOTAL	694,1

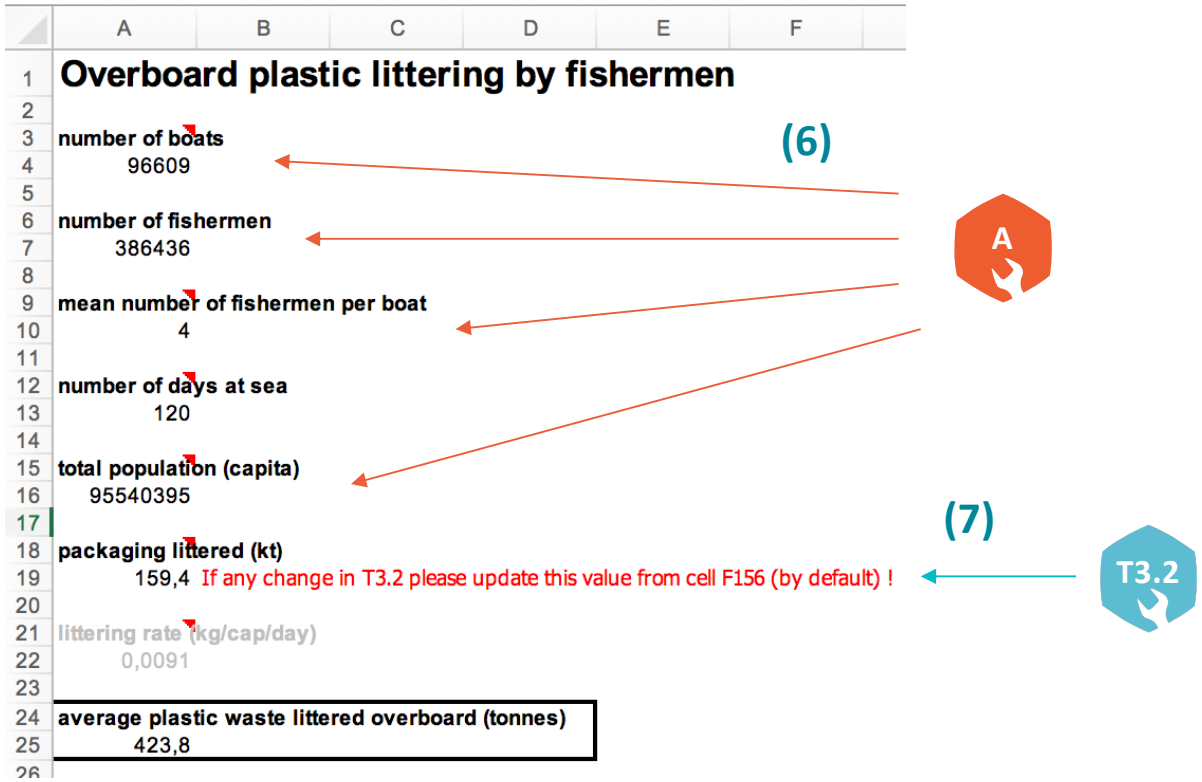
(5)

Gear name	average proportion of net loss (%)
Gillnet 1	6%
Gillnet 2	6%
Gillnet 3	6%
Trammel net	6%
Bottom trawl 1	9%
Bottom trawl 2	9%
Midwater trawl 1	4%
Midwater trawl 2	4%
Beach seine	1%
Purse seine	3%
Cast net	6%
Lift net	1%
Long line	20%
Hand line	23%

*Richardson, K., Hardesty, B. D., & Wilcox, C. (2019). Estimates of fishing gear loss rates at a global scale: A literature review and meta-analysis. Fish and Fisheries, 20(6), 1218-1231.

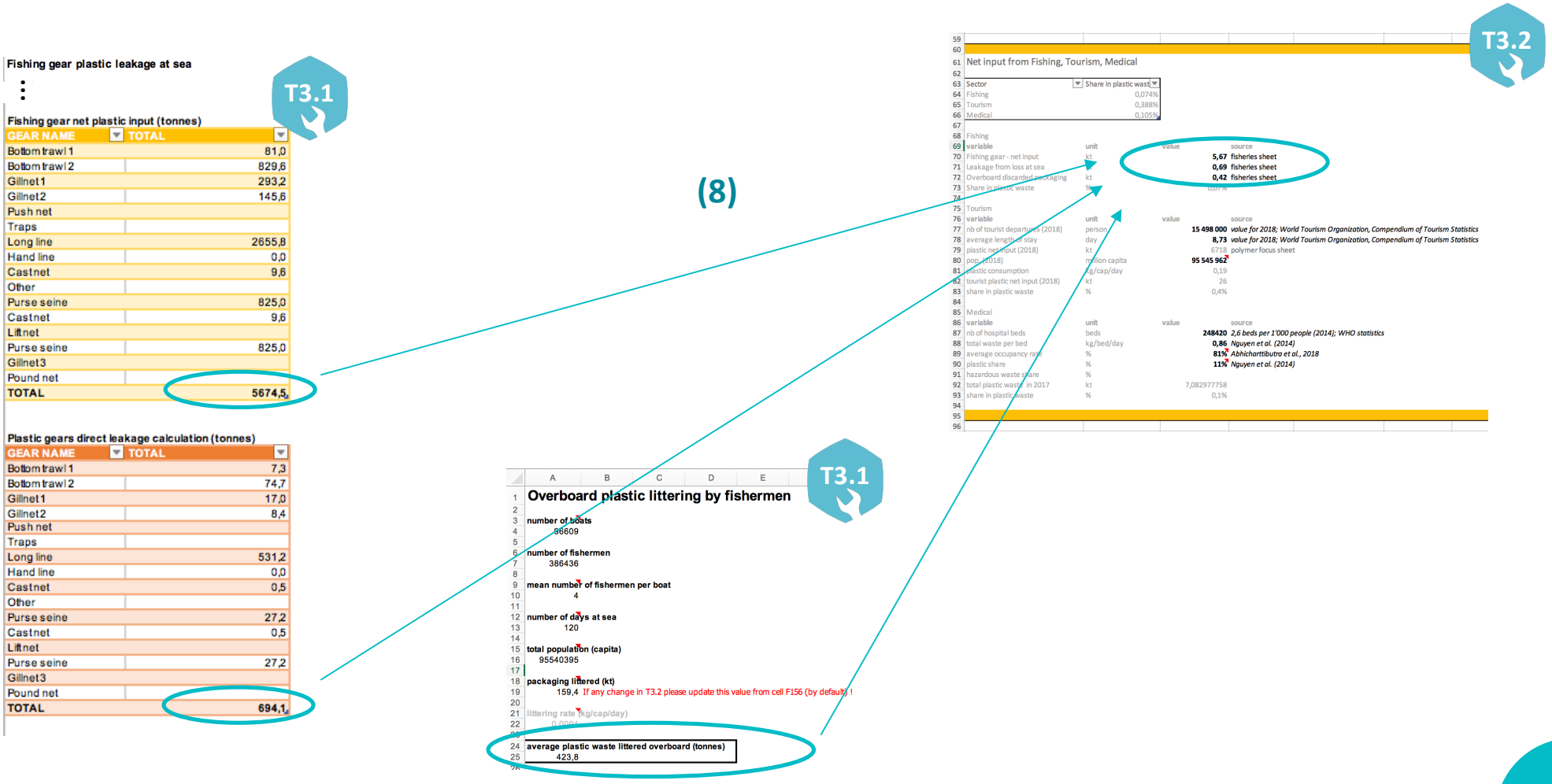
HOW TO USE THIS TOOL ?

d. Once the “leakage_at sea” sheet is completed, move to the “overboard_littering” sheet. Fill the values of number of boats, number of fishermen, mean number of fishermen per boat and total population of the country from the data repository (Tool A) **(6)**. Also, fetch the value for packaging littered from cell *F156* in the “Sector_Output” of Tool T3.2 **(7)**.



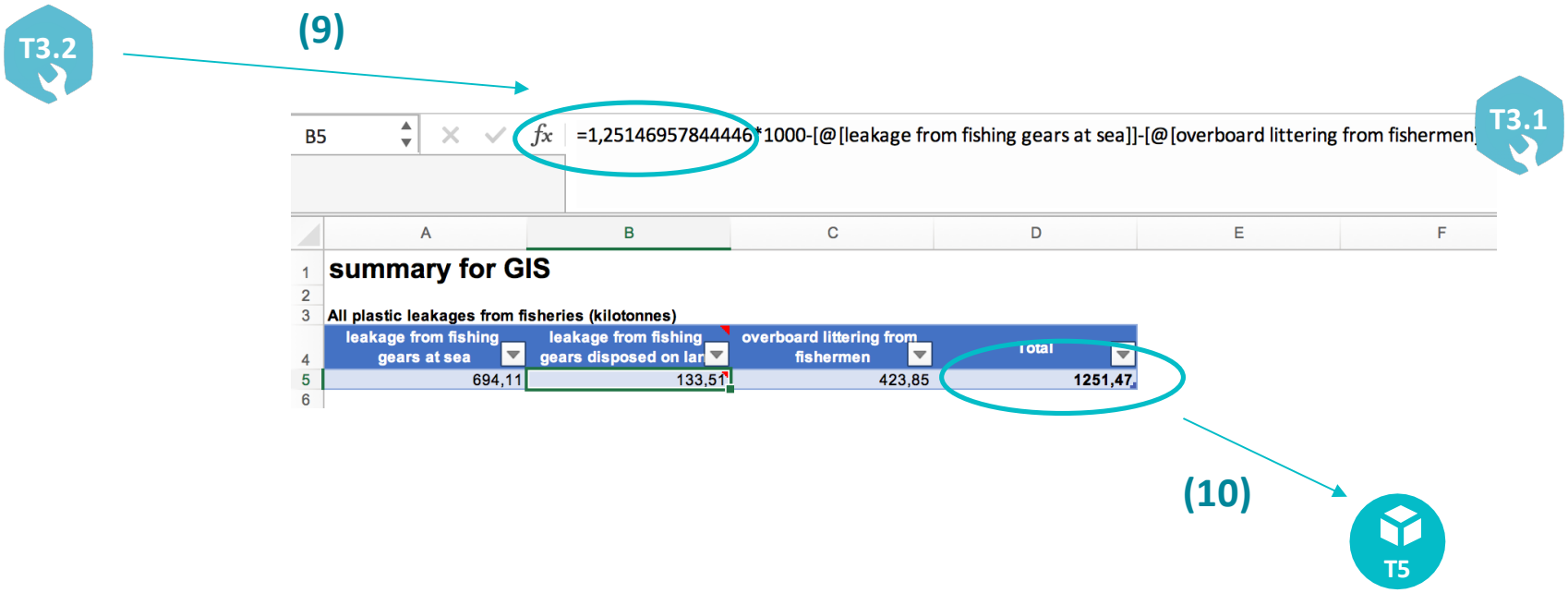
HOW TO USE THIS TOOL ?

e. Once the “overboard_littering” sheet is completed, copy total values of plastic input and direct leakage from the “leakage_at_sea” sheet as well as overboard littering value from the ”overboard littering” sheet and paste them into the “Net input from Fishing, Tourism, Medical” section in sheet “Sector_input” of Tool T3.2 **(8)**.



HOW TO USE THIS TOOL ?

f. Finally, revert to Tool T3.1 the final value of leakage from mismanaged plastic in fisheries calculated in the "Sector_Output" sheet (cell *L61* by default) of Tool T3.2 **(9)**. This value should be integrated to the formula in cell *B5* of the sheet "summary_for_GIS" of Tool T3.1.



g. Eventually, the total leakage value from fisheries (including direct gear loss at sea, overboard littering by fishermen and leakage from mismanaged fishing gears on land) can be transferred to module T5 for geographical visualisation. **(10)**

SUPPORTING INFORMATION FOR TOOL T3.1

HOW ARE AVERAGE PLASTIC WEIGHTS OF FISHING GEARS ESTIMATED?

A bottom-up approach was adopted in order to estimate the average weight of each fishing gear. First, technical drawings were found for all common fishing gears from various sources[1,2,3]. Then, a calculation process was applied based on technical specifications and formulas from literature[4,5] . The technical guidance and associated gear weight calculation sheets are available in the ANNEX_T3.1 excel file, and illustrated in figures A and B.

Estimation of weight of netting

source: MR Boopendranath, 2012. Basic principles of fishing gear design and classification

5.3 Estimation of weight of netting

Information on weight of netting is required for ordering netting requirements and for determination of underwater weight of netting for rigging purposes.

The first step is to have the complete design drawing including specifications. Every net is composed of a number of sections of particular geometric shapes such as rectangle, trapezium and triangle each with a uniform mesh size, twine size and material specification. Length of the twine used in each of the netting sections are estimated as below:

$$L_t = K.[((M_{t1}+M_{t2})/2).M_n].2m.10^{-3}$$

where L_t = length of twine used in m

M_{t1} and M_{t2} = number of meshes in width along top and bottom edges

M_n = number of meshes in depth

m = stretched mesh size in mm

K = correction factor for length of twine used in a knot.

= length of twine used in a mesh / 2m

Figure A

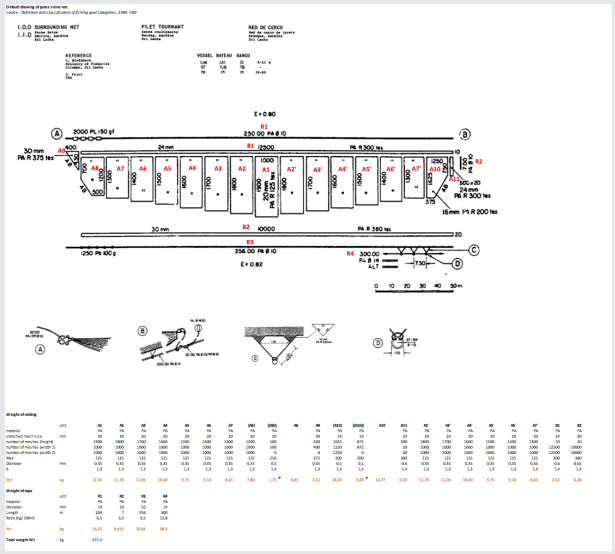


Figure B

[1] Nédélec, C., & Prado, J. (1990). Definition and classification of fishing gear categories (No. 222). FAO.

[2] Kishan, W., Rahul, S., Ashish, M., Vijay, M., & Jayyapa, K. (2018). Design characteristics and technical specifications of mackerel gill nets of Sindhudurg, Maharashtra. Journal of Experimental Zoology, India, 21(1), 373-378.

[3] Queirolo, D., Ahumada, M., Gaete, E., Zamora, V., Escobar, R., Montenegro, I., & Merino, J. (2009). Improved interspecific selectivity of nylon shrimp (Heterocarpus reedi) trawling in Chile. Latin American Journal of Aquatic Research, 37(2), 221-230.

[4] Boopendranath, M. (2012). Basic principle of fishing gear desing and classification.

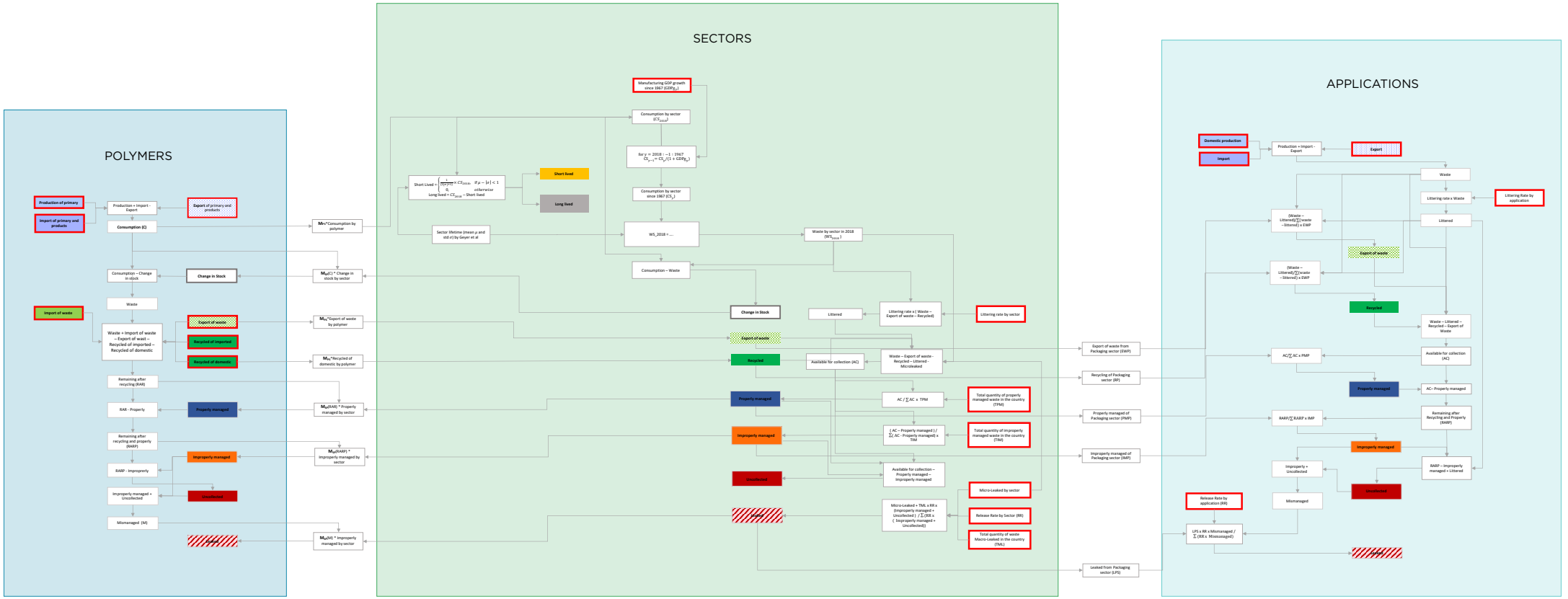
[5] Prado, J., & Dremiere, P. Y. (1990). Fisherman's workbook. Fishing News Books.

TOOL

T3.2

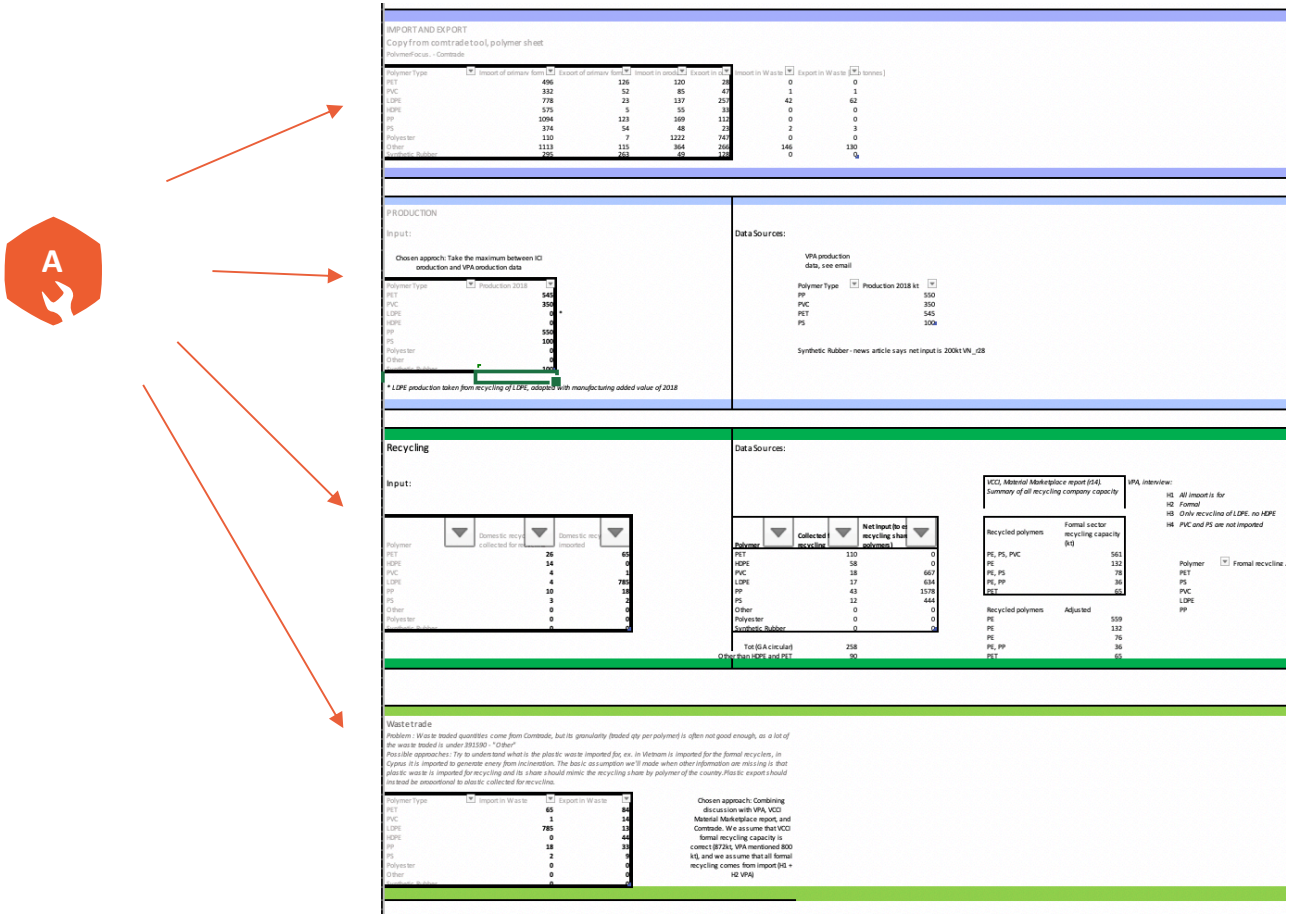
Polymer/application/sector MFA & leakage calculation

MODELLING FLOWCHART



HOW TO USE THIS TOOL ?

1. Start with the “Polymer_Input” sheet . The sheet requires import, export, production of primary and recycling quantities by polymer. Look at the data repository (Tool A) to find these values.



Import and export by polymer

Production by polymer

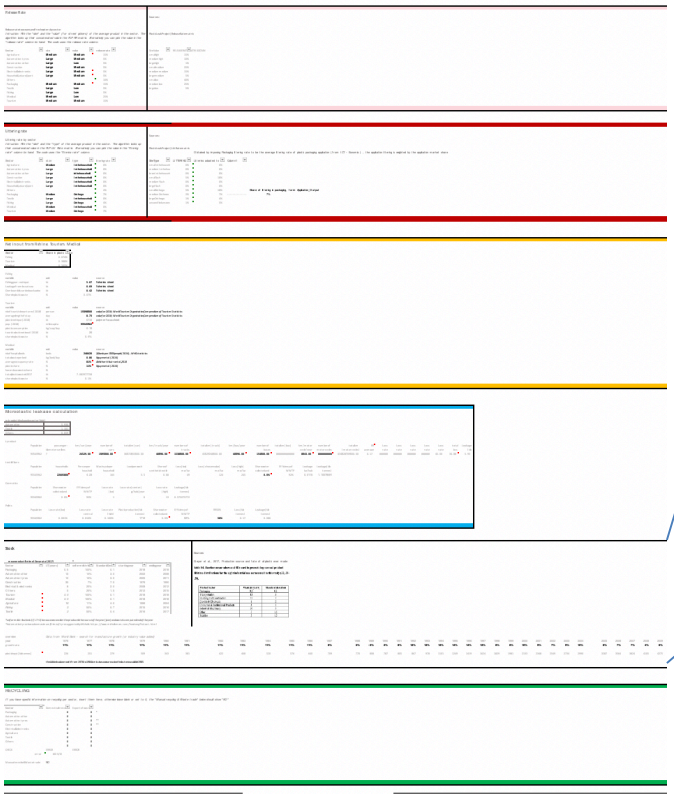
Recycling

Trade of waste

“Polymer_Input” sheet

HOW TO USE THIS TOOL ?

2. Once ”Polymer_Input” sheet is completed, move to “Sector_Input” sheet. Go to the “Stock” section within the sheet, and complete it with the required data (GDP growth).



“Sector_Input” sheet

Data used to calculate the Change in Stock

Stock

mean product lifetime (Geyer et al., 2017)

Sector	LT (years)	uniform distributio	Standard Dev	starting year	ending year	
Packaging	0.5	100%	0.1	2018	2018	
Automotive-other	13	14%	3.0	2002	2008	
Automotive-tyres	10	14%	3.0	2005	2011	
Construction	35	7%	7.0	1976	1990	
Electrical & electronics	8	20%	2.0	2008	2012	
Others	5	25%	1.5	2012	2015	
Tourism	*0.5*	100%	0.1	2018	2018	
Medical	*0.5*	100%	0.1	2018	2018	
Agriculture	*18*	11%	4.0	1996	2004	
Fishing	*3*	50%	0.7	2015	2016	
Textile	*2*	50%	0.4	2016	2017	

**uniform distribution is 1/(LT+1) because we consider the produce in the course of the year (june) and waste is computed end of the year*
** Automotive tyres based on maximum lifetime of tyre suggested by Michelin : https://www.michelinman.com/howLongTireLast.html*

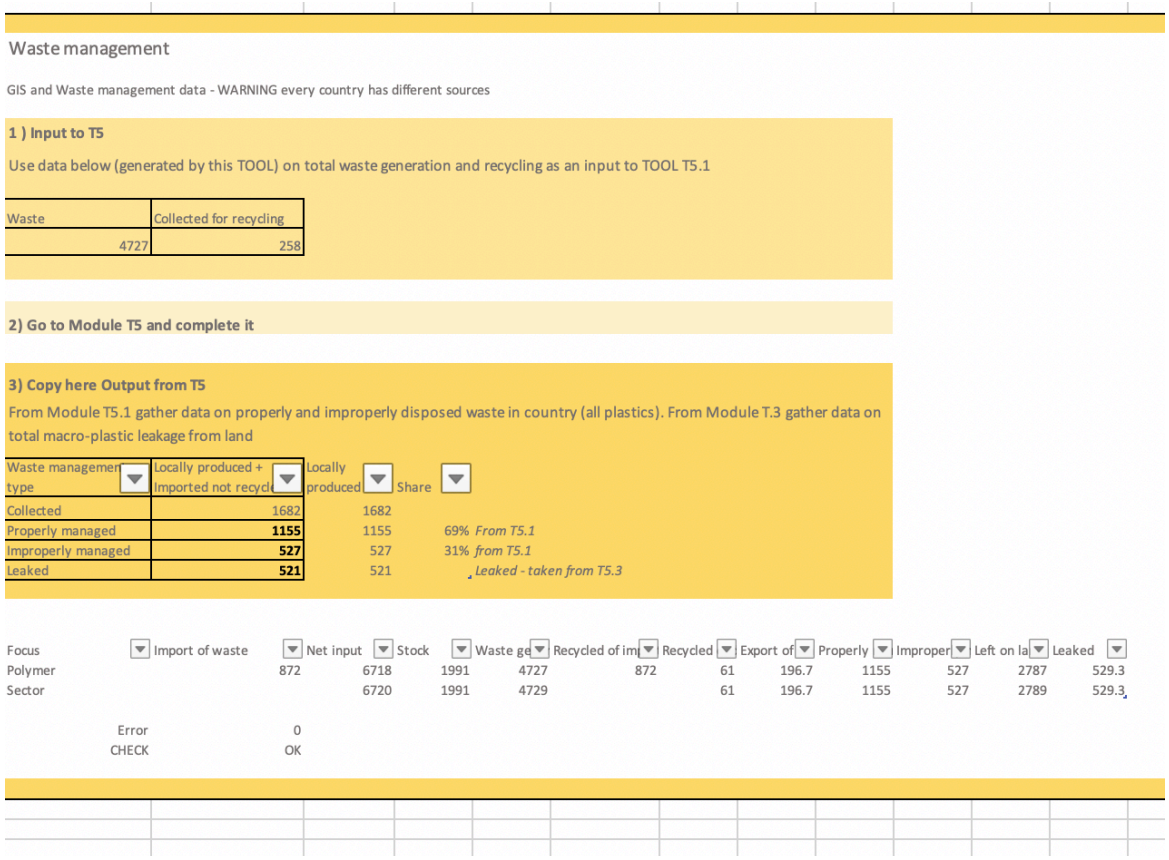
overview	Data from World Bank - search for manufacture growth (or industry value added)					
year	1976	1977	1978	1979	1980	198
growth rate	11%	11%	11%	11%	11%	11
plastic input [kilo tonnes]	226	251	279	309	343	38

the Added value growth from 1976 to 1984 is missing, so we are using the last one available 1985

GDP growth

HOW TO USE THIS TOOL ?

3. Within the "T3-T5_Data_Exchange" sheet, the model has now generated the total waste in the country, after taking into account the import, export, production and stock. This value needs to be used in Tool 5.1 to complement waste management data, and subsequently get correct estimates of properly and improperly disposed waste.



Waste management

GIS and Waste management data - WARNING every country has different sources

1) Input to T5

Use data below (generated by this TOOL) on total waste generation and recycling as an input to TOOL T5.1

Waste	Collected for recycling
4727	258

2) Go to Module T5 and complete it

3) Copy here Output from T5

From Module T5.1 gather data on properly and improperly disposed waste in country (all plastics). From Module T.3 gather data on total macro-plastic leakage from land

Waste management type	Locally produced + Imported not recycl	Locally produced	Share	
Collected	1682	1682		
Properly managed	**1155**	1155	69%	*From T5.1*
Improperly managed	**527**	527	31%	*from T5.1*
Leaked	**521**	521		*Leaked - taken from T5.3*

Focus	Import of waste	Net input	Stock	Waste ge	Recycled of im	Recycled	Export of	Properly	Improper	Left on la	Leaked
Polymer	872	6718	1991	4727	872	61	196.7	1155	527	2787	529.3
Sector		6720	1991	4729		61	196.7	1155	527	2789	529.3

Error	0
CHECK	OK

"T3-T5_Data_Exchange" sheet

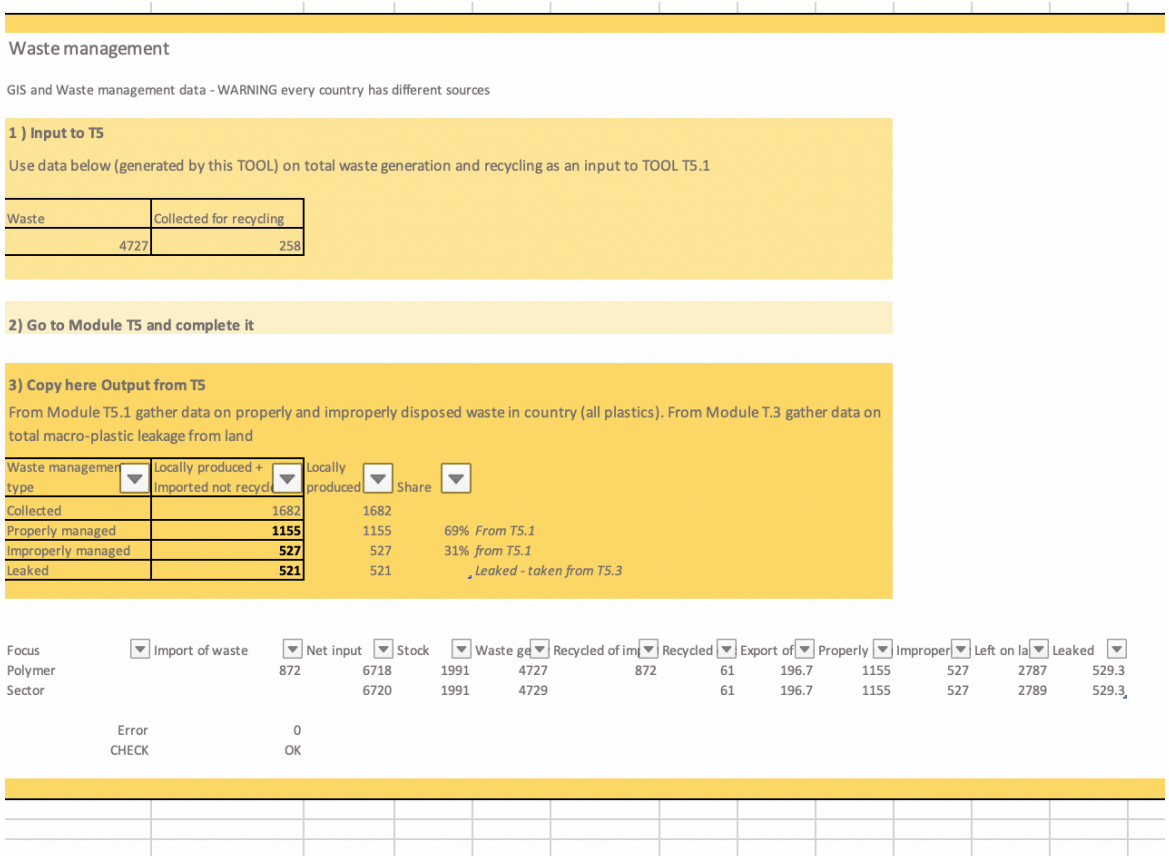
INPUT to T5:

- Total waste generated
- Total waste collected for recycling (available also in TOOL A)

HOW TO USE THIS TOOL ?

4. Run tools T5.2 and T5.3 in Module T5

5. Copy total quantity of plastic Properly disposed and Improperly disposed from tool T5.1, and total quantity of macro-plastic Leaked from T5.3 (macro-leakage from waste mismanagement) and to "T3-T5_Data_Exchange" sheet.



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Sector		6720	1991	4729		61	196.7	1155	527	2789	529.3

Error	0
CHECK	OK

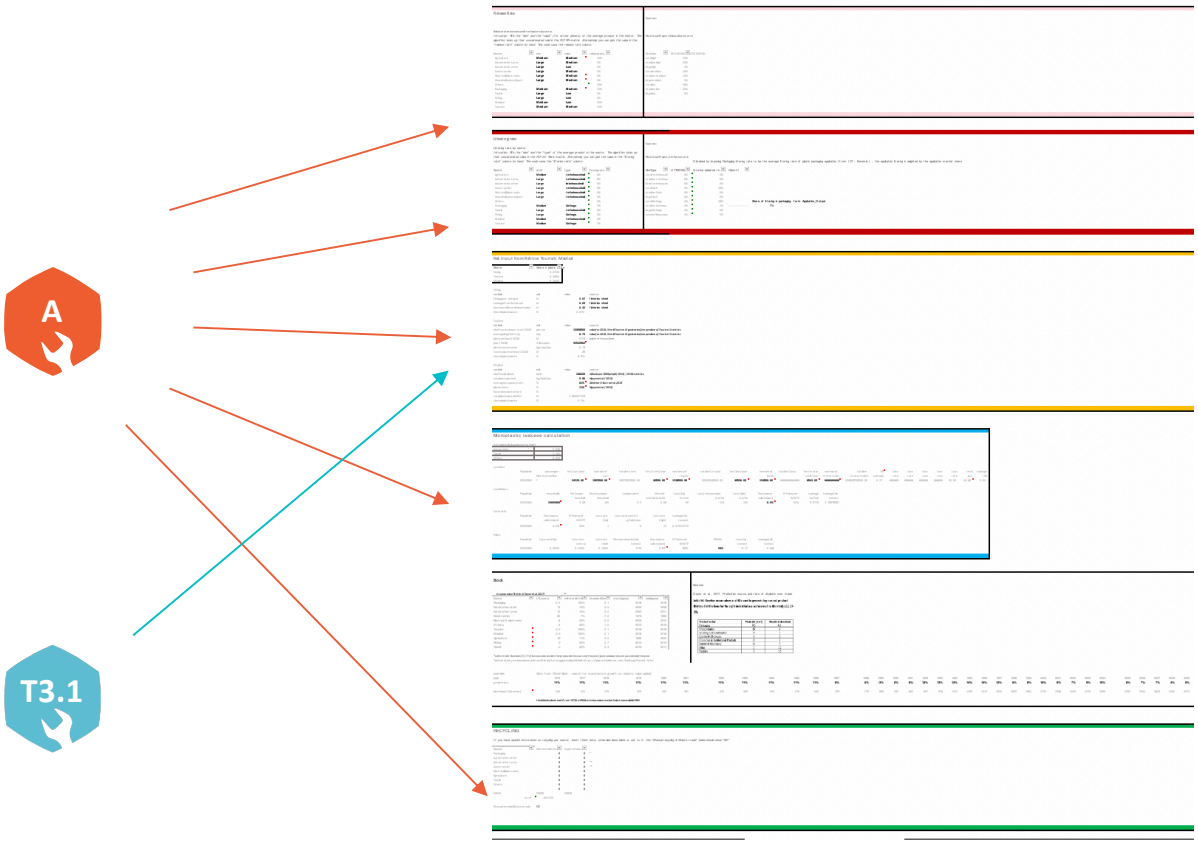
"T3-T5_Data_Exchange" sheet

OUTPUT from T5:

- Total Properly disposed
- Total Improperly disposed
- Total macro-plastic Leaked (from waste mismanagement)

HOW TO USE THIS TOOL ?

6. Finish completing “Sector_Input” sheet using values from tool A and tool T3.1 from the fishing sector.



“Sector_Input” sheet

Leakage rates by sector

Release rates by sector

Specific sector that need manual input: Fishing (from T3.1), Tourism and Medical

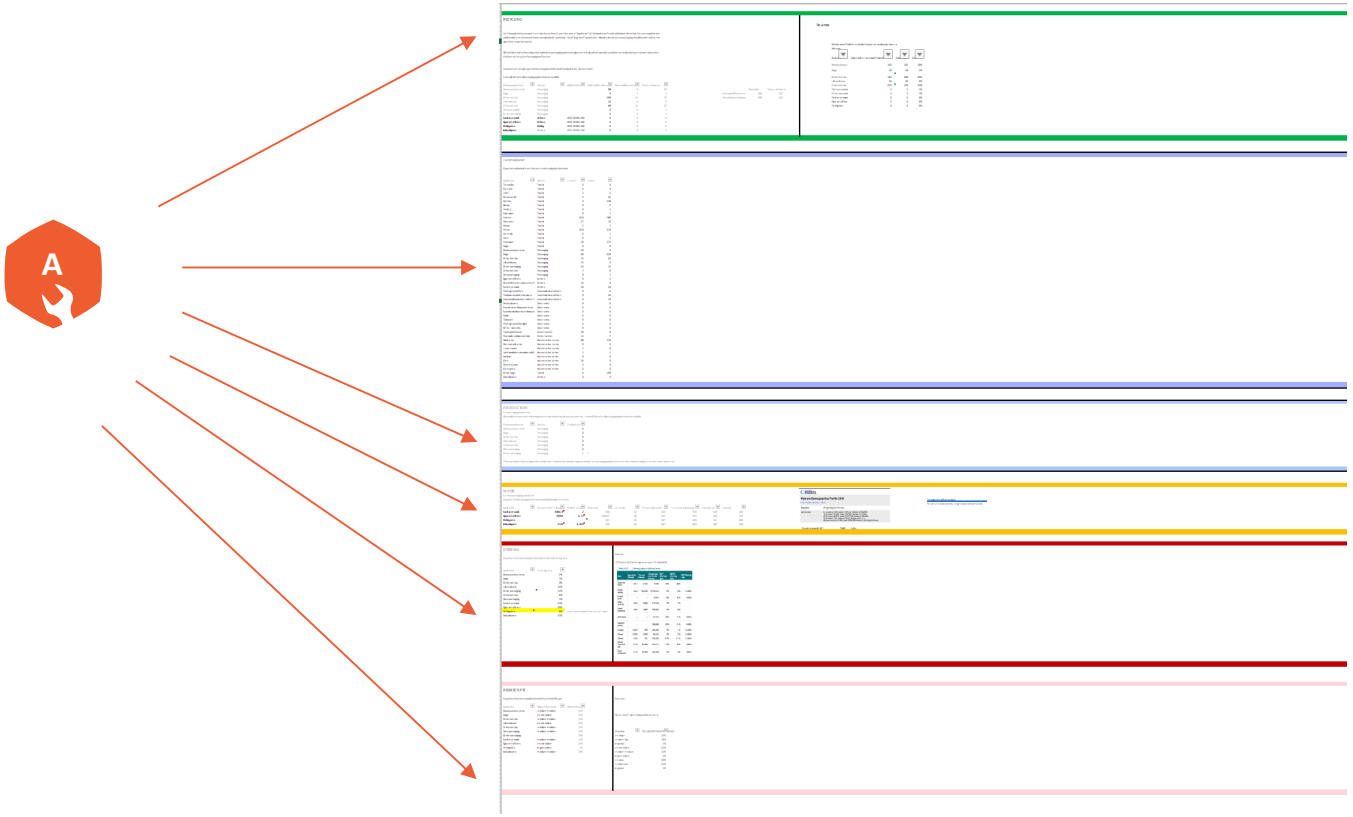
Micro-leakage from tyres, textiles, cosmetics and pellets

Stock by sector (already filled-in at step 2)

Recycling by sector (optional)

HOW TO USE THIS TOOL ?

7. Complete “Application_Input” sheet using values from tool A.



Recycling values by application (optional)

Import and export by application

Production by application

Specific applications that need manual input. By default, we add sanitary towels, nappies, cigarette filters and fishing nets

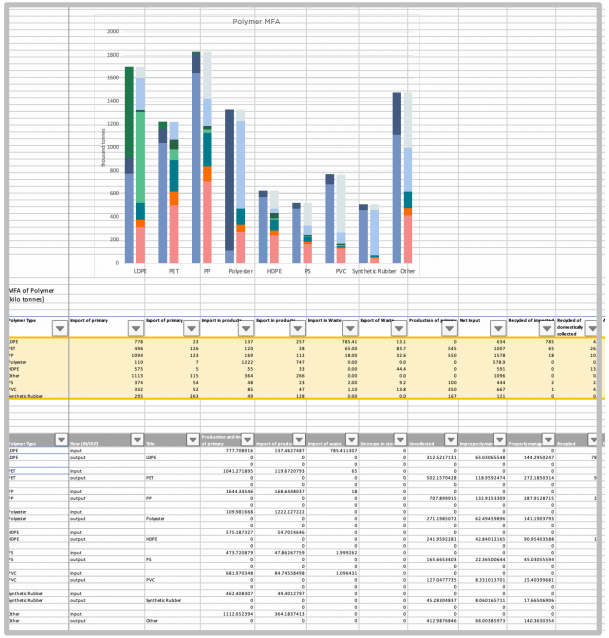
Littering rates by application

Release rates by application

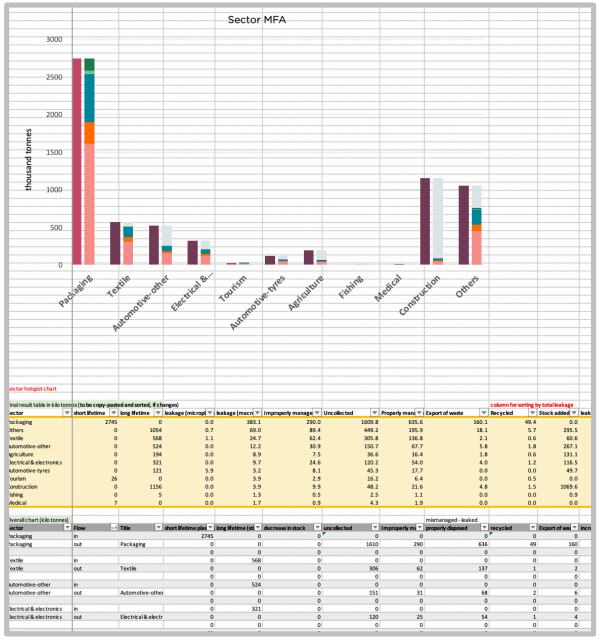
“Application_Input” sheet

HOW TO USE THIS TOOL ?

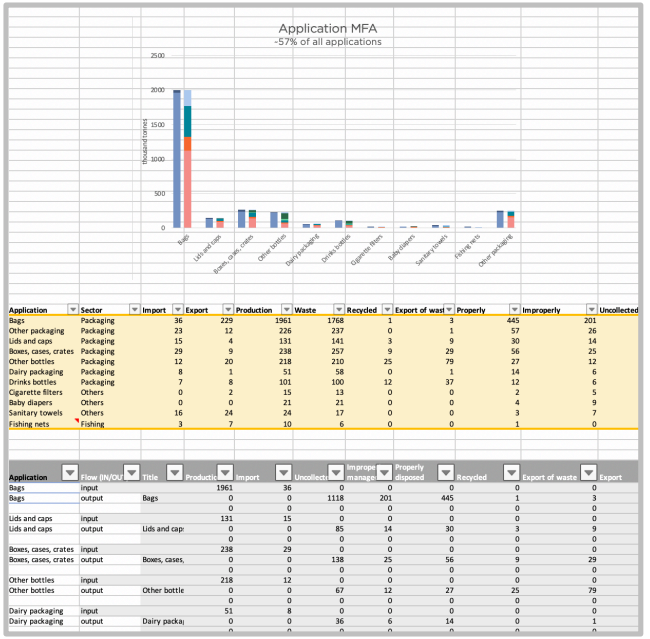
8. MFA tables have now been generated for all polymers, sectors and applications. They can be found in Polymer_Output, Sector_Output, and Application_Output sheets respectively.



"Polymer_Output" sheet



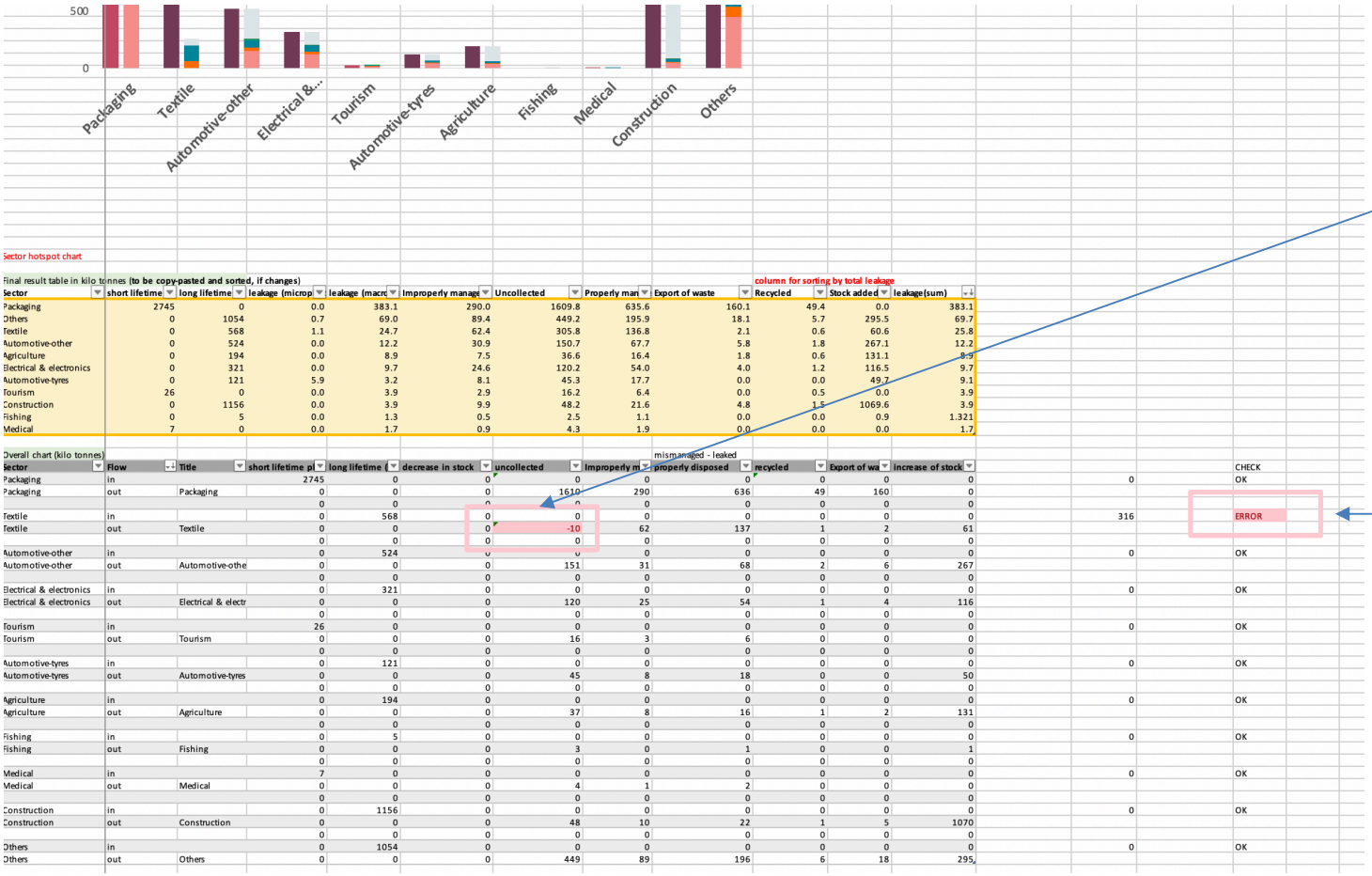
"Sector_Output" sheet



"Application_Output" sheet

HOW TO USE THIS TOOL ?

9. Check that there are no error code appearing in the output sheets. Error messages can be generated by negative values of volume quantities or by an incongruence in the mass balance.



Error: negative mass

Error: mass balance inconsistent

"Sector_Output" sheet, example of error

RECAP OF INPUT NEEDED FOR TOOL T3.2 (1/3)

Data	TOOL Source	Data source	Destination TOOL, Sheet
Production by polymer	A	To be defined	T3.2, Polymer_Input
Import of primary by polymer	A	Comtrade[6]	T3.2, Polymer_Input
Import of applications by polymer	A	Comtrade[6] w/ modelling	T3.2, Polymer_Input
Total import of waste	A	Comtrade[6]	T3.2, Polymer_Input
Import of waste by polymer	A	To be defined	T3.2, Polymer_Input
Export of primary by polymer	A	Comtrade[6]	T3.2, Polymer_Input
Export of applications by polymer	A	Comtrade[6] w/ modelling	T3.2, Polymer_Input
Total export of waste	A	Comtrade[6]	T3.2, Polymer_Input
Export of waste by polymer	A	To be defined	T3.2, Polymer_Input
Recycling of domestic waste by polymer	A	To be defined	T3.2, Polymer_Input
Recycling of imported waste by polymer	A	To be defined	T3.2, Polymer_Input

[6] United Nations (2020). COMTRADE database. Import and export data. Retrieved from https://comtrade.un.org/data/

RECAP OF INPUT NEEDED FOR TOOL T3.2 (2/3)

Data	TOOL Source	Data source	Destination TOOL, Sheet
Import of packaging application by application type	A	Comtrade	T3.2, Application_Input
Export of packaging application by application type	A	Comtrade	T3.2, Application_Input
Littering rate category by packaging application	A	EU Commission[7]	T3.2, Application_Input
Release rate category by packaging application	A	PLP[8]	T3.2, Application_Input
GDP Growth	A	World Bank[9]	T3.2, Sector_Input
Fishing sector data (leakage from gear loss at sea, leakage from overboard littering)	T3.1	To be defined	T3.2, Sector_Input
Medical sector data: Number of hospital beds	A	WHO[10]	T3.2, Sector_Input
Medical sector data: Total waste per bed, Average occupancy rate, Plastic share in medical waste	A	To be defined	T3.2, Sector_Input
Various input data to compute micro-leakage by sector	A	To be defined	T3.2, Sector_Input
Release Rate category by sector	A	PLP	T3.2, Sector_Input
Littering Rate category by sector	A	PLP	T3.2, Sector_Input

[7] European Commission (2018). Plastics: Reuse, recycling and marine litter, final report.
[8] PLP (2019). Plastic Leak Project. (https://quantis-intl.com/metrics/initiatives/plastic-leak-project/)
[9] The World Bank, World Development Indicators (2012). Industry (including construction), value added (annual % growth). Retrieved from https://data.worldbank.org/indicator/NV.IND.TOTL.KD.ZG
[10] World Health Organization, The Global Health Observatory (2020). Viet Nam statistics summary (2002-present). Retrieved from https://apps.who.int/gho/data/node.country

RECAP OF INPUT NEEDED FOR TOOL T3.2 (3/3)

Data	Source TOOL	Origin	Destination TOOL, Sheet
Total plastic waste properly disposed in country	T5.1	To be defined	T3.2, T3-T5_Data_Exchange
Total plastic waste improperly disposed in country	T5.1	To be defined	T3.2, T3-T5_Data_Exchange
Total macro-leakage from waste mismanagement in country	T5.3	Modelling	T3.2, T3-T5_Data_Exchange
Polymer to Sector mapping	A	Plastics EU[11] w/ modelling	T3.2, PolymerBySectorMatrix

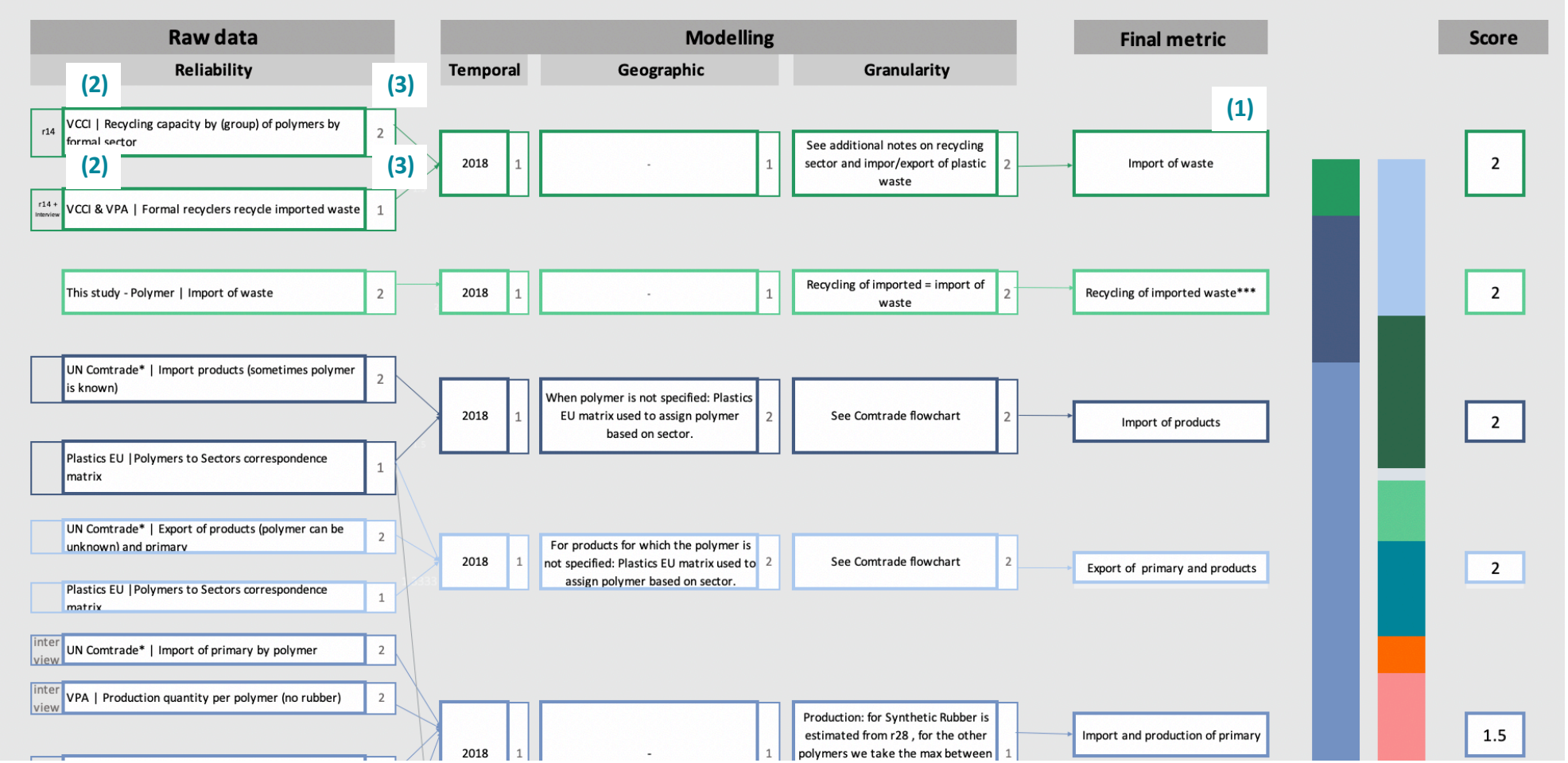
[11] PlasticsEurope (2018). Plastic - the Facts 2018.

TOOL

T3.3 MFA modelling quality assessment

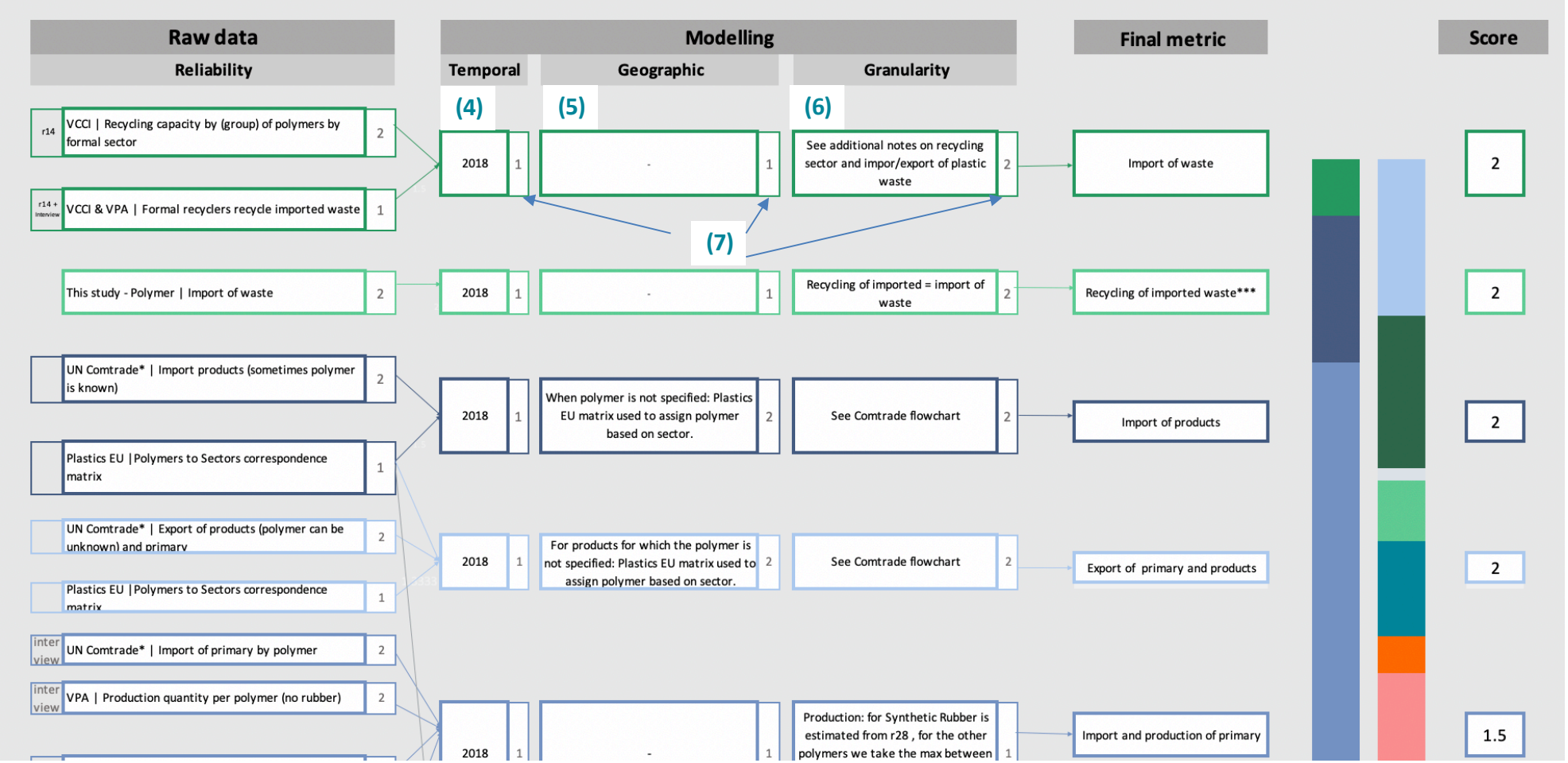
HOW TO USE THIS TOOL ?

In the Raw data section, for each final metric **(1)**, mention the main sources of raw data **(2)** and attribute a reliability score to it **(3)** based on the pedigree matrix prepared for the project (see slide 42).



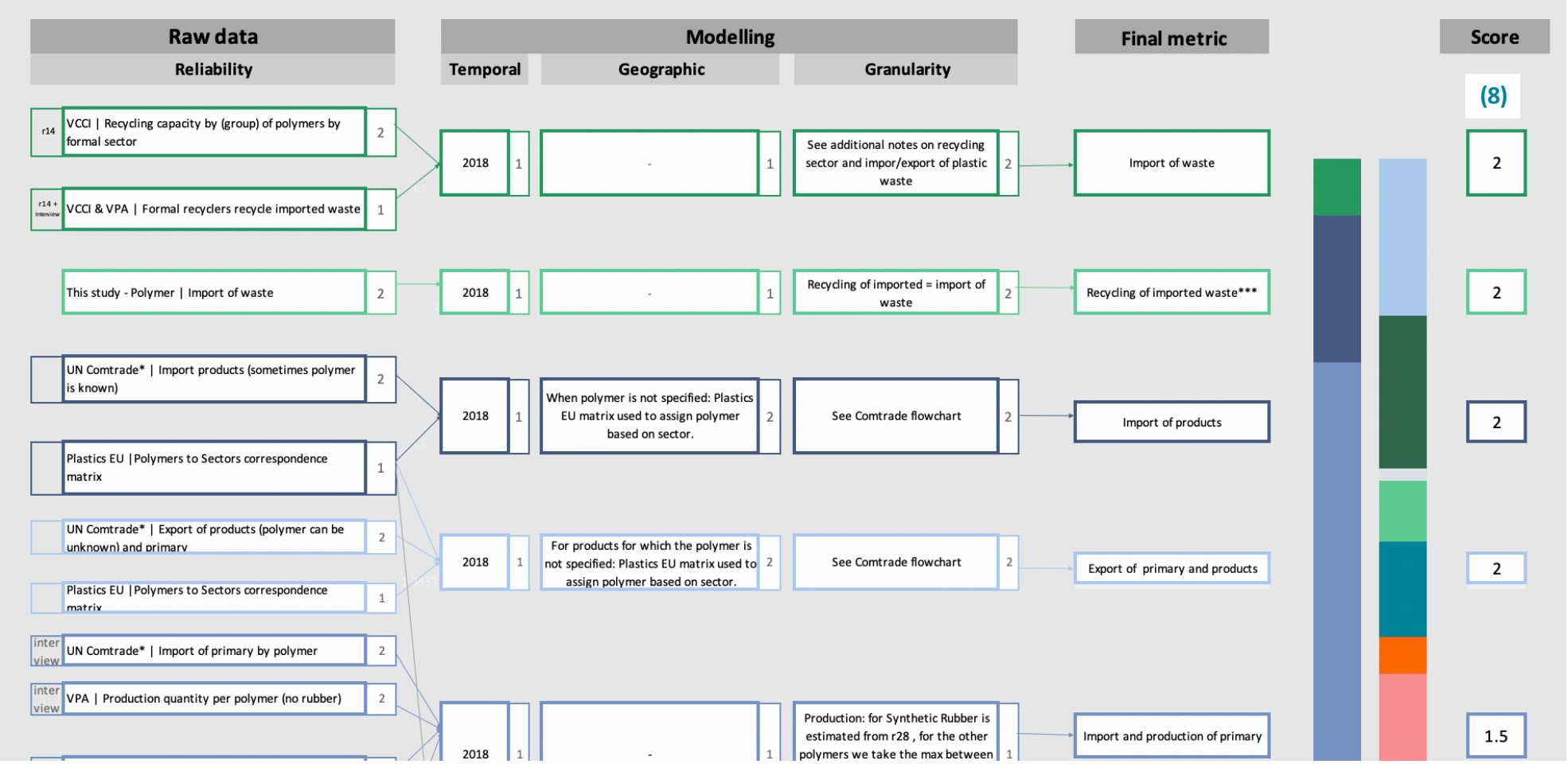
HOW TO USE THIS TOOL ?

In the modelling section, note the main temporal **(4),** geographic **(5)** and granularity **(6)** modelling assumptions and attribute their respective scores **(7)** based on the pedigree matrix prepared for the project (see slide 42).



HOW TO USE THIS TOOL ?

In the score column, compute the score **(8)** for each final metric as the maximum score between the Raw data, Temporal modelling, Geographical modelling and Granularity modelling scores. If there is more than one Raw data, take the average of all the Raw data scores as a overall Raw data score for each metric.

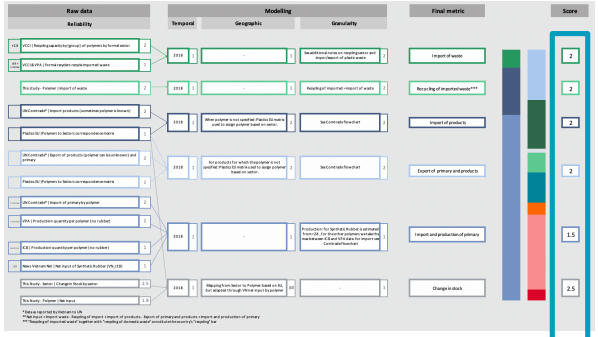


HOW TO USE THIS TOOL ?

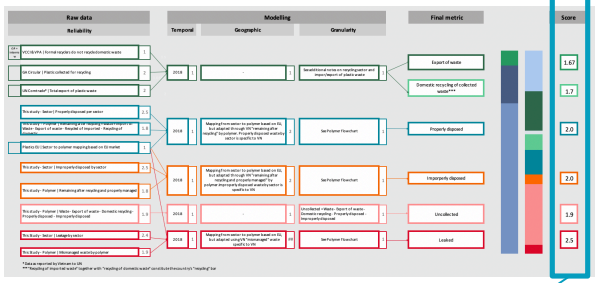
Six templates for modelling quality assessment sheets are available in Tool T3.3. Compute the final MFA quality score for Polymers, Sectors and Applications as the average of all the final metrics scores.

Polymers

Production, Trade and Stock



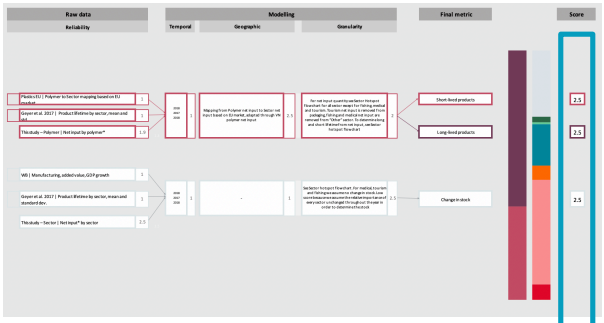
Waste and leakage



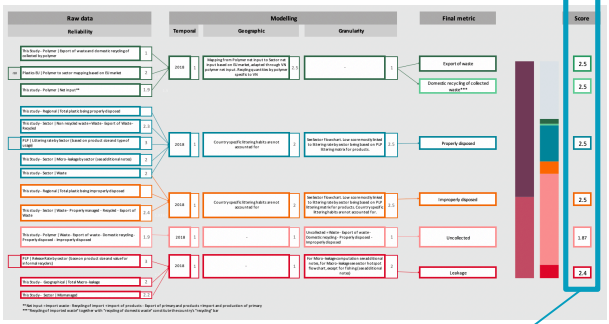
Average

Sectors

Production, Trade and Stock



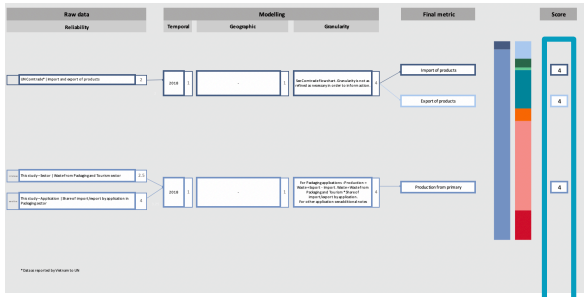
Waste and leakage



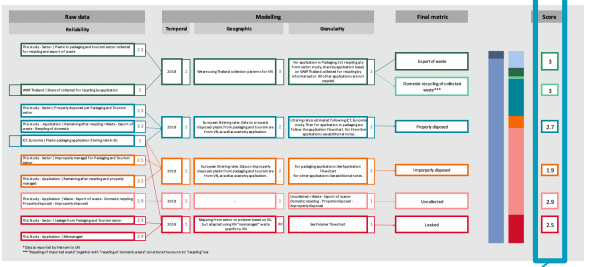
Average

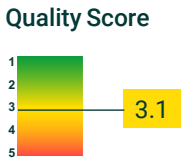
Applications

Production, Trade and Stock



Waste and leakage





Average

SUPPORTING INFORMATION FOR TOOL T3.3

Detailed pedigree matrix used for scoring

	1 BEST	2 GOOD	3 AVERAGE	4 BAD	5 WORST
RELIABILITY	Verified (e.g. peer-reviewed or highly trustable source) data based on measurements, multiple sources showing coherent values	Verified data based on calculation, multiple sources showing coherent values	Unverified data from measurement or calculation and/ or from single source	Documented estimate	Undocumented estimate
TEMPORAL CORRELATION	Less than 3 years of difference with date of study	Adapted to the year of reference based on clear population or GDP correlation	Adapted to the year of reference based on unclear population or GDP correlation	Not adapted to the year of reference (< 10 years old data)	Not adapted to the year of reference (> 10 years old data)
GEOGRAPHICAL CORRELATION	Data is complete and representative of the area of study	Data extrapolated to the area of study based on weighted average (multiple archetypes)	Data extrapolated to the area of study assuming homogeneous conditions	Data extrapolated to the area of study in spite of un-homogeneous conditions	Data from unknown area or with very different conditions
GRANULARITY	Data is complete and representative of the polymer/ application/sector of interest	Modelling based on allocation rules (comprehensive and specific)	Modelling based on allocation rules (non comprehensive or unspecific)	Modelling based on global average	Modelling based on estimates

TOOL

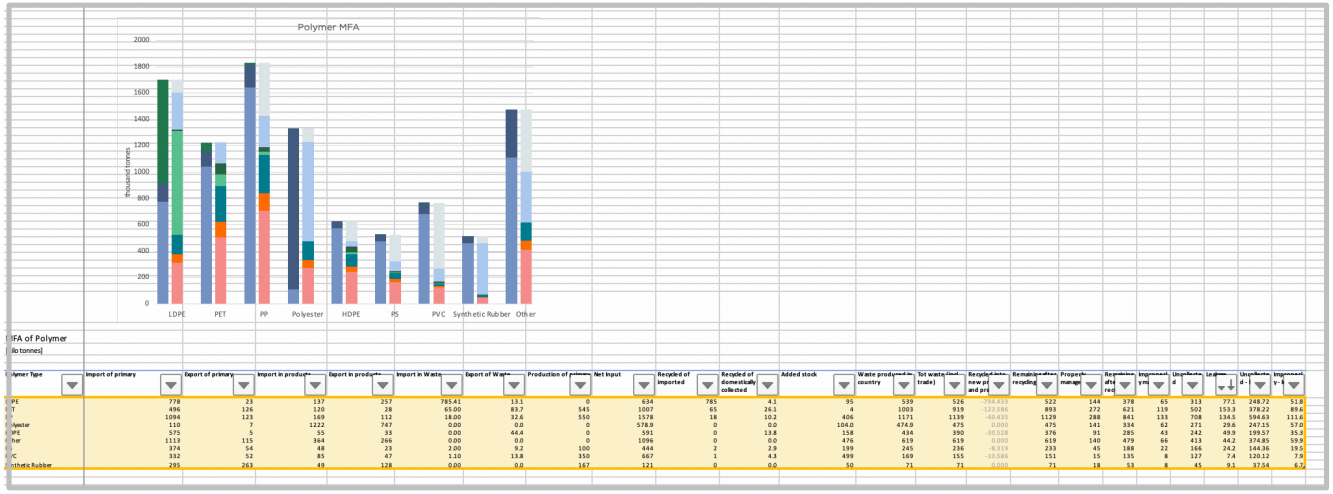
T3.4

Polymer/application/sector hotspots prioritisation canvas

HOW TO USE THIS TOOL ?

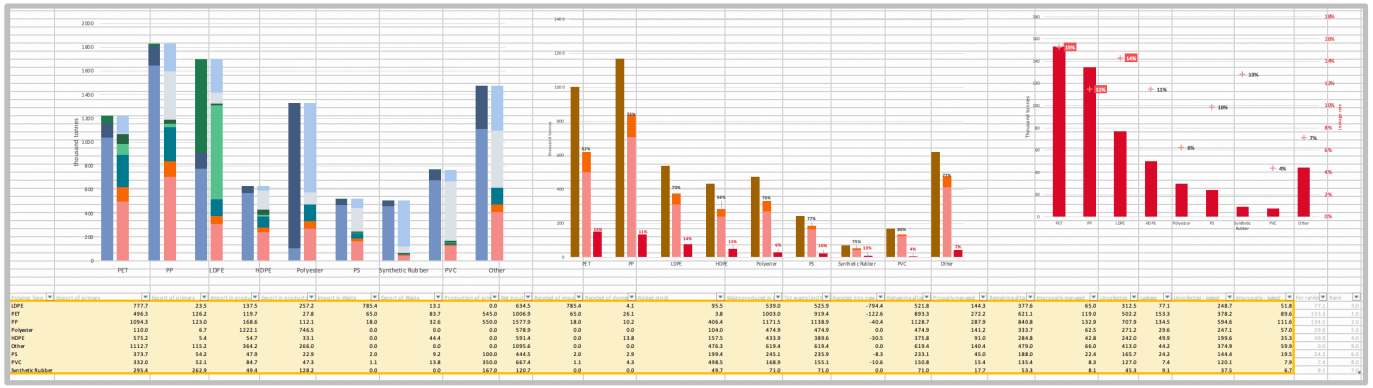
TOOL T3.4 generates all the charts that summarise the MFA analysis and the leakage computation. In order to obtain them, copy the MFA tables generated by Tool T3.2 in the yellow boxes.

T3.2



"Polymer_Output" sheet

T3.4



"Polymer_Hotspots" sheet

Copy-Paste
content of MFA table for Polymer, Sector and Application from Output sheets to Hostpots sheets

HOW TO USE THIS TOOL ?

In the sheet “Hotspot_Selection”, the model automatically selects the hotspots based on absolute leakage and leakage rate

Polymer
PET
PP
LDPE
HDPE
Polyester
PS
Synthetic Rubber
PVC
Other

Sector
Packaging
Textile
Automotive-other
Agriculture
Automotive-tyres
Electrical & electronics
Tourism
Construction
Medical
Fishing
Others

Application
Bags
Boxes, cases, crates
Lids and caps
Other bottles
Drinks bottles
Dairy packaging
Cigarette filters
Baby diapers
Sanitary towels
Fishing nets
Other packaging

TOOL

B

Project data repository

HOW TO USE THIS TOOL ?

Metrices for plastic leakage at a glance

Year:	2018	
Population:	95'540'395	
plastic consumption	7589	kt
plastic consumption per cap	79	kg/cap/year
total plastic waste	5598	kt
plastic waste per capita	59	kg/cap/year
total plastic stock	1991	kt
plastic stock per capita	21	kg/cap/year
total collected	2527	kt
share collected	45%	
collected per capita	26	kg/cap/year
total mismanaged	3314	kt
share mismanaged	59%	
mismanaged per capita	35	kg/cap/year
leakage	529	kt
leakage rate	9%	
leakage per capita	5.5	kg/cap/year

Recap of waste management by polymer (in % shares)

Polymer T	Waste produced in coun	Domestic recycl collec	Export of colle	Properly disp	Improperly disp	Uncollecte	Tot	Collec	Mismar	Leal	Waste produce impor	Domestic recyclir impor
PET	*1003*	3%	8%	27%	12%	50%	*100%*	50%	62%	15%	*1068*	9%
PP	*1171*	1%	3%	25%	11%	60%	*100%*	40%	72%	11%	*1189*	2%
Polyester	*475*	0%	0%	30%	13%	57%	*100%*	43%	70%	6%	*475*	0%
LDPE	*539*	1%	2%	27%	12%	58%	*100%*	42%	70%	14%	*1324*	60%
HDPE	*434*	3%	10%	21%	10%	56%	*100%*	44%	66%	11%	*434*	3%
PS	*245*	1%	4%	18%	9%	68%	*100%*	32%	77%	10%	*247*	2%
Other	*619*	0%	0%	23%	11%	67%	*100%*	33%	77%	7%	*619*	0%
Synthetic Rubber	*71*	0%	0%	25%	11%	64%	*100%*	36%	75%	13%	*71*	0%
PVC	*169*	3%	8%	9%	5%	75%	*100%*	25%	80%	4%	*170*	3%
Average	-	1%	4%	24%	11%	59%	*100%*	41%	70%	11%	*622*	17%

Polymer Type	Production a Import of prim	Import produc	Import of wast	Change in stock	Uncollected	Improperly managed	Properly m	Recycled	Expor waste	Export primar produc
LDPE	778	137	785	95	313	65	144	789	13	281
PET	1041	120	65	4	502	119	272	91	84	154
PP	1644	169	18	406	708	133	288	28	33	235
Polyester	110	1222	0	104	271	62	141	0	0	753
HDPE	575	55	0	158	242	43	91	14	44	38
PS	474	48	2	199	166	22	45	5	9	77
Synthetic Rubber	462	49	0	50	45	8	18	0	0	391
PVC	682	85	1	499	127	8	15	5	14	99
Other	1113	364	0	476	413	66	140	0	0	381

Polymer MFA and leakage in kt

Sector	short lifetime	long lifetime	leakage (microplastic	leakage (macroplastic	Improperly managed	Uncollected	Properly manage	Export of was	Recycled	Stock adde	leakage (sum
Packaging	3236	0	0	355	249	2228	546	163	50	0	355
Others	0	1412	1	73	87	715	191	17	5	396	74
Textile	0	1505	1	52	120	960	262	2	1	161	53
Automotive-other	0	670	0	12	29	230	63	5	2	341	12
Agriculture	0	234	0	9	7	53	14	2	1	158	9
Electrical & electronics	0	343	0	8	19	152	42	4	1	124	8
Automotive-tyres	0	121	6	3	6	53	13	0	0	50	8
Tourism	34	0	0	4	3	25	6	0	1	0	4
Construction	0	1195	0	3	7	60	16	4	1	1106	3
Fishing	0	5	0	1	0	3	1	0	0	1	1
Medical	7	0	0	1	1	5	1	0	0	0	1

Sector MFA and leakage in kt

Application	Sector	Import	Export	Production	Waste	Recycled	Export of waste	Properly	Improper	Uncollecte	Leakage
Bags	Packaging	36	229	2279	2086	1	2086	2086	229	2279	2279
Other packaging	Packaging	23	12	268	279	0	279	279	12	268	268
Lids and caps	Packaging	15	4	156	167	3	167	167	4	156	156
Boxes, cases, crates	Packaging	29	9	284	304	9	304	304	9	284	284
Other bottles	Packaging	12	20	256	248	25	248	248	20	256	256
Dairy packaging	Packaging	8	1	62	68	0	68	68	1	62	62
Drinks bottles	Packaging	7	8	119	118	12	118	118	8	119	119
Cigarette filters	Others	0	2	15	13	0	13	13	2	15	15
Baby diapers	Others	0	0	21	21	0	21	21	0	21	21
Sanitary towels	Others	16	24	24	17	0	17	17	24	24	24
Fishing nets	Fishing	3	7	10	6	0	6	6	7	10	10

Packaging application MFA and leakage in kt

UN environment programme

IUCN

Life Cycle Initiative

Implemented with ea + Quantis

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