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## **A baseline for material flow models of French agri-food supply chains**

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This communication is an outcome of two research projects funded by Ademe and FranceAgriMer. The SCALABLE project aimed at characterizing material and organizational vulnerabilities of agri-food systems at local level (the Grenoble urban area) and at the national level, relying on socio-metabolic approaches. The goal of the REFFLUX project was to produce a baseline of MFA models for French agri-food supply chains, to be used by professionals, public institutions and scientists. It involved 7 agriculture technical institutes representing 10 supply chains, two consultancies (TerriFlux and Le Basic) and a scientific advisory board.

Ten supply chain models were designed (cereals, oil crops, fruits and vegetables, bovine meat, poultry meat, pork meat, horse meat, horse livestock, dairy, eggs), computing a total of over 19000 flows. The steps were the following: (i) representing the supply chain structure (with a bipartite graph), (ii) gathering data on flows and on coefficients, (iii) reconciling the data, (iv) analyze results with supply chain experts and iterate in order to improve the models. Key features are the use of hierarchies for products and sectors (multiple level of details), computation of intervals for under-determined flows (when there is not enough information, we provided min-max flow values) and multi-unit reconciliation of the dairy chain (in raw mass, proteins and fat mass).

The main deliverables are : (i) excel files detailing the input data, hypotheses and model results, (ii) a set of 38 "views", that is, "simplified" Sankey diagrams built to answer specific questions raised by stakeholders (available here : <https://www.filarmoni.fr/resultats-du-rmt/diagrammes-de-flux>), (iii) the publication of a baseline of coefficients (for both market and transformation processes), in the same vein than FAO's Technical Conversion Factors document (published in the 90's).

Finally, a typology has been drawn up to characterize the degree of openness of each value chain, based on production, import, consumption and export ratios. It identifies 9 theoretical types (e.g. producing-exporting chain vs. producing-consuming chain) which served as reference points to classify the French agri-food supply chains. For example, the dairy sector is closest to the "producing-consuming" type, with production accounting for 77% of supply and domestic consumption accounting for 72% (in mass of useful dry matter).

A study was also conducted at the scale of the Grenoble area. Three supply chains (dairy, cereals, bovine meat) were analyzed based on interviews and workshops with stakeholders in order to understand their perception of vulnerabilities and to what extent our results can modify these perceptions.

The consortium is already thinking about how to follow up on this knowledge base (update needs, margins of improvement, connection with existing international flow models such as FABIO, etc.).