The *Within Limits Integrated Assessment Model* (WILIAM) has been developed under the LOCOMOTION H2020 project (<https://www.locomotion-h2020.eu/>). WILIAM is a system dynamics policy-simulation model which was designed to address a series of common and relevant limitations in the field of IAMs, following the motivation to develop the MEDEAS models (Capellán-Pérez et al., 2020). System dynamic (SD) IAMs potentially excel in capturing complex feedback loops and nonlinear relationships among social, economic, and environmental variables. WILIAM comprises 8 integrated modules of earth and human systems: (1) demography, (2) society, (3) economy, (4) finance, (5) energy, (6) materials, (7) land and water, and (8) climate. Figure XX shows the structure overview with the main linkages between modules. WILAM starts to run in 2005 and is typically run until 2060, although the simulation horizon may be extended to 2100 when focusing on long-term strategic sustainability analyses. WILIAM is a multiregional model with 9 global regions (some modules reaching higher disaggregation for the EU27 member states). It blends top-down and bottom-up modelling approaches, interdisciplinary knowledge such as input-output with system dynamics as well as lifecycle approaches, and allows to explore long-term socio-ecological transition pathways' social, economic, and environmental implications, considering planetary limits and socio-economic constraints. This comprehensive integration is particularly relevant when modelling disruptive scenarios involving significant shifts in economic structure, social values, norms, and individual behaviour. The validation of the models has been carried out following several of the usual validation procedures of models in system dynamics (uncertainty, sensitivity, robustness and stability analyses (Sterman, 2020; Barlas, 1996). The historical data, although the available series are short, has been used for a first validation, and the results have been also compared with

other models. A detailed description of the model is available in D9.2 (de Blas et al., 2021).

**References**:

Capellán-Pérez, I., Blas, I. de, Nieto, J., Castro, C. de, Miguel, L.J., Carpintero, Ó., Mediavilla, M., Lobejón, L.F., Ferreras-Alonso, N., Rodrigo, P., Frechoso, F., Álvarez-Antelo, D., 2020. MEDEAS: a new modeling framework integrating global biophysical and socioeconomic constraints. Energy Environ. Sci. 13, 986–1017. <https://doi.org/10.1039/C9EE02627D>

J. D. Sterman, Business dynamics: systems thinking and modeling for a complex world, Irwin/McGraw-Hill Boston, 2000, vol. 19.

Y. Barlas, Syst. Dynam. Rev., 1996, 12, 183–210.

de Blas et al, 2021. Interim synthesis of the model, selected results and scenario analysis (LOCOMOTION DELIVERABLE https://www.locomotion-h2020.eu/ No. D9.2). LOCOMOTION h2020, Valladolid, Spain.