Dimension	***Research and development***
Sub-dimension	***Network of collaborations***
Indicator name	***R5: Strategic position in the network of collaborations***
Rationale	It assesses the strategic position of the geographical area in the AI R&D network of collaborations, and hence its influential capacity. The more central an area is (in terms of network of collaborations) the more it is in a dominant position with respect to information exchanges.
Definition	Weighted Betweenness Centrality (Brandes, 2001), normalised in the interval [0,1], in the overall R&D Network. To determine the weight of collaborations, the fractional counting is considered. The geo-based network (i.e., one node per area) is computed based on the peer-to-peer collaborations among players (which are considered depending on their location). The weight of connections is based on fractional counting. Each collaboration has a weight that equals one divided by the binomial coefficient determined with n=number of players involved in that activity, and k=2. This, the sum of all fractions adds up to 1.
Unit of measurement	Real positive number
Geographical coverage	World
Geographical granularity	Macro areas (top countries plus world regions), EU27 Member States
Breakdown	Potential additional breakdown: Type of R&D activity: patent applications, frontier research publications, and EU-funded projects FP7-H2020 (where relevant).
Data source(s)	JRC AI TES Dataset 2020, available at https://data.jrc.ec.europa.eu/collection/id-0126 See description of the dataset in indicator G1.
Reference date	Period 2009-2020 (one value for the entire period)
Known limitations	
References and Comments	We chose Betweenness centrality instead of other centrality measures, such as, e.g., Closeness (which is related to efficiency, as it measures the ability of a node to be directly connected with the rest of the network), due to the interest in showing R&D hubs. As we consider R&D activities, in which the circulation of information is the key point for the creation of innovation (Lane & Maxfield, 2005), betweenness is more able to reveal where the important hubs are located. Indeed, betweenness is related to the ability of being in a crucial position, i.e., having a key role in "connecting" nodes, which implies to be able to "control" exchanges between other nodes. Reference: Samoili S., Righi R., Cardona M., López Cobo M., Vázquez-Prada Baillet M., and De Prato G., TES analysis of AI Worldwide Ecosystem in 2009-2018, EUR 30109 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-16661-0, doi:10.2760/85212, JRC120106. https://publications.jrc.ec.europa.eu/repository/handle/JRC120106 Brandes, U., A Faster Algorithm for Betweenness Centrality. Journal of Mathematical Sociology 25(2) (2001):163-177. Lane, D.A., Maxfield, R.R. Ontological uncertainty and innovation. Journal of Evolutionary Economics, 15, 3–50 (2005)