Regional Research Performance towards Sustainable Development Goals

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Sustainable Development Goals (SDGs) represent a universal call to action to end poverty, protect the planet, and ensure prosperity for all by 2030. Adopted by all United Nations Member States in 2015, the SDGs consist of 17 interlinked global goals that are part of the 2030 Agenda for Sustainable Development. The goals are designed to address the root causes of poverty and inequality, while also tackling pressing global challenges such as climate change, environmental degradation, and peace and justice. While advancement towards these goals have been made, sufficient progress had been achieved for only 35% of the targets as of 2025 (United Nations Department of Economic and Social Affairs, 2025). Despite such conditions, there has been a lack of understanding over the role of universities, which can be transformative for not only at the national level, but for their regions as well.

Over recent decades, the role of universities has evolved from traditional knowledge producers to active agents of societal transformation, integrating education, research, and community engagement to address complex global challenges (McCowan, 2023). At the regional level, the influence intensity of universities can change based on the setting. Universities can play transformative role in the development trajectories of peripherial regions (Cinar & Coenen, 2023). In other cases, regions themselves can direct universities towards the needs of their locality as well (Thomas et al., 2023). In this regard, localities are places where tangible steps are taken and results are obtained in light of the globally designated SDGs. Different localities can bring variety in perspectives which would, in turn, provide an increased variety of solutions (Komiyama & Takeuchi, 2006). Universities can act as agents to identify the connections between the global goals and local needs and problems, gather data at the local level or apply new measurement methods to address local needs. However, inquiries into the connections between universities and the SDGs are still in its early phases (Chankseliani & McCowan, 2021).

Within this scope, this study aims to examine the specialization and diversification composition as well as regional performance of Turkey's 26 NUTS 2 regions in terms of scientific knowledge production towards SDGs, based on the number of scientific publications and citations. Both publication and citation data for the 2015-2025 period are obtained from the Scopus database, which are classified according to SDGs. The data was classified according to the first 16 of the 17 SDGs at the database. The SDG 17 has not been included yet in the service due to difficulties in its quantification at the database end. As there had been closures of a few universities over the years in Turkey, only the universities in the Higher Education Council database as of 2025 are included. In addition, vocational colleges and universities with no publications (recently founded or non-operational) are also excluded from the dataset. As a result, 200 universities were included in the process. While the measurements with publication data used 2015-2025 period,

2015-2020 period is preferred for citations due to citations' maturity window (Wang, 2013). These data are gathered at the institutional level which is, then, aggregated to the NUTS 2 level regions. Location quotient, relative diversification and shift-share are used to gain the required insight into the structural composition and performance of the regions.

Location quotient had been used in the extent of bibliometrics as Activity Index for publications and Attractivity Index for citations (Frame, 1977). Over the years, different modifications have been made on the formula, although with no fundamental changes (Roussea & Yang, 2012). An important shortcoming of the use of location quotient with the present data is the size problem. Spatial entities with small size variables lead to unstable LQ scores under minimal changes to those variables, when compared to those with moderate or large sized entities (Pominova et al., 2022). Thus, instead of the use of a more disaggregated level (i.e. NUTS 3), the study aggregates the institutional level to NUTS 2 level regions to obtain more accurate LQ among the regions. Relative Diversification Index (RDI) is used to measure the diversification (Duranton & Puga, 2000). Lastly, shift-share is used to measure the regional performances towards SDGs. Dynamic approach is preferred in the use of shift-share to avoid missing structural changes between the study periods.

Specializations in SDG themed publications reveals there are smaller number of specialized regions in the goals 1, 3, 5, 9 and 10. Regions with larger share of longstanding universities, compared to those with universities founded recently, display specialization in these goals. Most specializations are observed in the SDG 6, 12 and 15. The same pattern is observable in citations to a certain extent. However, even fewer regions are observed in the extent of the SDGs 3 and 16. Again, the regions with already large publication and citation bases display concentration in such fields. High diversification scores for a few regions beyond the traditionally leader regions are observed, among which TR52 (Konya Subregion) is a notable example in the extent of publication data.

The results highlight the rise of new centers beyond the traditionally leading regions as well as newcomers with positive regional performance. Istanbul, Ankara and Izmir, as the three leading regions with the highest numbers of publications and citations have mixed results in their regional shift according to shift-share analysis. While Istanbul's results show positive regional performances in both publication and citations in moderate amount of SDGs, the results for Ankara only shows that positive performance in citations in the half of SDGs. In comparison, Izmir performs below its expected levels in both variables. Compared to these existing centers, new centers with a respectable publication and citation size are observed in the results. TR52 (Konya Subregion) and TR81 (Zonguldak Subregion) show positive regional shift in both publications and citations for large number of SDGs. Newly emerging regions such as TRA2 (Ağrı Subregion) and TR63 (Hatay Subregion), which possess relatively lower number of publications and citations, also show positive scores.

Identification of regions' scientific knowledge activity and attractivity as well as their regional performance according to SDGs can lead to further enlighten the officials on their regions' needs

and enable formulating stronger connections between their research capability and the implementation processes afterwards. Regions face to face with certain SDG challenges can guide or be guided by national higher education authorities (as in the case of Turkey) towards corresponding capabilities by research fundings, relevant staff positions or relevant university-industry collaborations. One potential area to strengthen the connection between scientific research and practice can be the greater adoption of the SDGs at the regional development agencies' level. Either through the structure of funding programmes or establishing links between the SDGs and the regional plan' goals and strategies, improvements in university-government-industry connections can be achieved.

Overall, the study uses a data which recently became available and addresses the less explored role of universities' contributions towards the SDGs in the extent of their research activities. An important limitation for such an analysis is the case in question. While shares of international publications are on an increasing trend in Turkey, the larger share of scientific activity is still domestic. Therefore, the use of global databases may not reveal the complete picture in this extent. Future studies can further fine-tune the identification of research capabilities by applying different methods or reveal new areas of research by the use of this data.

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