

Gender Dis-Equality and Urban Settlement Dispersion: Indices Comparison

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Abstract. The challenge of "Gender equality" regards different sectors, such as empowerment and working conditions, cultural change, leadership, safety, economic security, health and wellbeing. For this reason, the gender mainstreaming is important for the coordination and integration of all other policies, including urban spatial planning.

Currently, it is fundamental to shift toward gender-sensitive territorial planning, which can be more focused on some specific areas of intervention such as: the localization of amenities, mobility and accessibility, and safety. In this context, the work presented aims to indagate the effect of urban dispersion on women's quality of life. Starting with a discussion related to the characteristics and limitations associated with the use of data from the "Sole 24 Ore" (a national Italian editorial journal), a new women's quality of life index (I_{QLw}) was developed. Subsequently, the I_{QLw} index, which includes demographic and economic factors, was compared with the urban dispersion index through a correlation analysis using LISA index (Local Indicator for Spatial Association).

Indeed, to be able to reach solutions and act toward the achievement of sustainability development goals and to influence changes in a positive way, it is crucial to know the phenomena and measure their dimensions through parameters and indicators useful for supporting transformational policies.

Keywords: Gender inequality · Urban sprinkling · Land planning · Indicator engineering

1 Introduction

"Gender equality", being a fundamental human right, is one of the 17 Sustainable Development Goals of the 2030 Agenda, and the achievement of gender equality is also one of the three cross-cutting priorities in terms of social inclusion in the National Recovery and Resilience Plan [1, 2].

From a study developed by the European Institute for Gender Equality (EIGE) in 2022 [3], it appears that the Gender Equality Index score for the EU is 68.6 points out of 100, with a 0.6-point increase since the 2021 index. In recent years this index has been increasing but this is occurring at a very slow rate in fact the current value is only 5.5 points higher than in 2010, with an average increase of only 1 point every 2 years.

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O. Gervasi et al. (Eds.): ICCSA 2023 Workshops, LNCS 14112, pp. 291–300, 2023.
https://doi.org/10.1007/978-3-031-37129-5_24

Moreover, Gender equality levels change considerably among Member States, from 83.9 points in Sweden to 53.4 points in Greece. In particular, Italy ranks 14th in the EU in the gender equality index with a score of 65.0 points out of 100, so it is 3.6 points lower than the EU [4].

In this context, the promotion of gender equality is crucial and to be effective it must cover several areas, including the legislative one to regulate equal treatment, the strategic one through gender mainstreaming for better integration of all other policies, and the economic one by providing specific funding for the advancement of women [5]. It is all directly and undoubtedly related to Goal 5 Gender Equality but, when analysing the concept in relation to territorial transformations and urban policies, it links indirectly to Goal 11 Sustainable Cities and Communities of the 2030 Agenda.

The challenge of urban regeneration becomes as an objective to the achievement of which different sectoral public policies are required to be coordinated in a coherent and strategic framework of interventions, essential to deal with the consequences related to climate change, political instability, pandemic situation and so on and provide effective solutions. Indeed, all of these are challenges that need for cities to rethink their environmental, economic, social and cultural models [6, 7].

The sustainability of cities is achieved by orienting land use planning toward urban transformation models which must no longer be expansive but based on the regeneration of existing urban fabric, without the consumption of new soil, and in addition they must give attention to climate resilience, use of renewable energy, quality of urban liveability, gender and generational equality and social inclusion [8, 9].

To obtain this, it is also necessary to shift toward gender-sensitive territorial planning, which can be more focused on some specific areas of intervention such as: the localization of amenities, mobility and accessibility, and safety.

How can a dispersed urban context affect women's quality of life? This is the starting question from which the current research developed. In an urban context characterised by dispersed settlement, the location of public services will consequently be dispersed over the territory. This leads to excessive car use and longer travel times to reach workplaces, schools or other amenities [10, 11]. The result is an increase in costs that indirectly affect the quality of life [12, 13]. Moreover, in these contexts, women are disadvantaged by having fewer opportunities to enter into a structured and lasting work context, as the lack of care services such as nurseries or facilities for the aged forces women to stay at home to take care of these tasks. The Italian Institute of statistic in collaboration with Eurostat declares that in Italy there is a very high gap between men and women in the performance of household duties (60% gap) [14, 15].

Urban dispersion has made the management of time between work (and study), recreational activities and relationships among individuals even more complex. Scattered sites of interest over a wide, networked territory require multiple movements, and this necessity results in a constantly moving and consequently accelerated lifestyle, particularly for women [16]. For these reasons, it is essential to act by redefining cohesion and inclusion mechanisms centered on both social and occupational homogeneity and women's and neighborhood networks [17].

To be able to reach solutions and act toward the achievement of sustainability goals and to influence changes in a positive way, it is necessary to know the phenomena

analysed and measure their dimensions through parameters and indicators useful for supporting transformational policies [18]. In this way it also would be possible to monitor their progress. One of the objectives of the work presented, in fact, was to analytically assess Italian women's quality of life so that it could then be compared with the urban dispersion index to highlight potential relationships, based on the first results obtained from previous research developed by the same authors [19].

The article will deal with the following aspects: critical analysis of the Italian women's quality of life indices proposed by the "Sole 24 Ore" (a national Italian editorial journal) in the last two years 2021 and 2022; description of the dataset used for the analysis; new women's quality of life index composed of six indicators and more related to economic aspects; description of the main results obtained; comparison of the new index calculated with that of the "Sole 24 Ore" and with the phenomenon of settlement dispersion; conclusions and future developments.

2 The Italian Woman's Quality of Life Indices, Criticisms and Comparison

As mentioned in the introduction, in the previous paper [19] the authors carried out an analysis from "Sole 24 Ore" data to investigate the influence of urban settlement dispersion on women's quality of life. Currently, an update of the "Sole 24 Ore" data (published to 2022) is available [20], so it would have been very interesting to make a comparison with the previous year, but it was not possible. The issue is that the two datasets, which were produced only one year apart, are not directly comparable with each other because the parameters used to calculate the total index are not always the same. As shown in Table 1, out of 12 indicators 4 have changed (accounting for one-third of the total) between 2021 and 2022.

Table 1. Differences between 2021 and 2022 of the "Sole 24 Ore" Women's quality of life indices.

	"Sole 24 Ore" 2021 Women's quality of life	"Sole 24 Ore" 2022 Women's quality of life
1	life expectancy at birth	life expectancy at birth
2	women's employment rate	women's employment rate
3	youth employment	youth employment
4	gender employment gap	gender employment gap
5	number of women-owned businesses	number of women-owned businesses
6	women administrators in businesses	women administrators in businesses
7	women administrators in municipalities	women administrators in municipalities
8	gender violence	gender violence
9	gender pay gap	number of paid working days
10	job non-participation rate	women graduate
11	performance in sports	women in sport
12	Olympic performance	Inadequate numeracy skills

Therefore, the two indices of women's quality of life cannot be compared in their total value but only by extracting those that have remained unmodified. This operation, however, is not easily done because the "Sole 24 Ore" makes available only the summary data download. In addition, among the indicators, which were changed in the year 2022, some are not very significant for the aim of evaluating women's quality of life, such as:

i) inadequate numeracy skills because it measures women's STEM skills but it based on tests taken in junior high school where women's age is not comparable to the other indicators;
ii) women in sports which is too generic with respect to the indicators used by the Council of Europe to assess the presence of women in sport. One among many is the indicator of "Women in decision-making positions of national sport federations" or "Proportion of women and men in decision-making positions in continental confederations of Olympic sports" [21]
iii) number of paid working days which is definitely less significant than the gender pay gap (measured in 2021) and which gives better information about the gender gap. In fact, the 2021 indicator was more comparable with the indicator used by the European commission: "gender pay gap".

The definition of indices, useful for comparing the phenomena investigated and assessing their variability in both time and space, characterizes many fields that use spatial analysis. However, the selection and the elaboration of indices must be precise and homogeneous so that the developed analyses are comparable [22].

On the other hand, the main problems are often related both to the different definitions, that cause confusion and difficulties in reporting the results obtained, and to the heterogeneity of the data by which the indicators are calculated (such as in the case of the "Sole 24 Ore" data).

3 Dataset

All data used for this analysis are open data freely downloadable from national reference sites. The data are aggregated by provincial territories, are all divided by gender and age classes and in some cases, approximations have been made to the data due to the different nomenclature and association of the Italian provinces. The data needed to compose the women's quality of life index were downloaded from different sources and for 4 years: 2018, 2019, 2020 and 2021. In particular: socio-demographic data on population, employment rates, life expectancy at birth are derived from the database of the Italian Statistical Institute (ISTAT [23]); data concerning the number of enterprises were downloaded from the open data explorer site of the chamber of commerce [24].

For the phase of comparing the quality of life of women with the spatial dynamics of urban transformation, the data of settlement dispersion on a provincial basis calculated with Moran's index was used; its methodology is reported in the report of the Institute for Environmental Protection and Research (ISPRA 2021) on the paper by Saganeiti et al. [25].

4 Index of Women's Quality of Life

The women's quality of life index (I_{QLw}) proposed in this research is a socio-economic one since it includes demographic and economic factors such as employment rates or the number of enterprises in the study area considered. The index is the composition of 6 indicators all normalized between 0 and 1 and it is expressed by the following formula:

$$I_{QLw} = LEx_w + EmplR_w + YEmplR_w + EntPC_w - \left(GAP_{empl} + GAP_{ent}\right) \quad (1)$$

where:

LEx_w is the indicator of life expectancy at birth for women, measured at age 0. The higher the value of the indicator, the higher the age corresponding to life expectancy and consequently the better the quality of life.

$EmplR_w$ is the indicator of the employment rate of women for the age group considered to be 'active age', i.e. that in which one is able to work: 15 to 64 years. The higher the value of the indicator, the better the quality of life.

$YEmplR_w$ is the indicator of the youth employment rate for women for the 15–34 age group, which includes the social class of young people and young adults as defined by ISTAT. The higher the value of the indicator, the better the quality of life.

$EntPC_w$ this indicator expresses the number of women enterprises per capita i.e. per female residents of working age (15–64 years) in each province. Women's enterprises are defined as: cooperatives or partnerships with at least 60% female members and/or joint stock companies at least two-thirds of whose shares and members of the boards of directors are women. The higher the value of the indicator, the better the quality of life.

GAP_{empl} is the indicator of the employment gap between the employment rate of women and the employment rate of men. Like the other indicators, its (normalised) value range is between 0 and 1, but as the indicator increases, the quality of life decreases. In fact, a high value of the gap, e.g. 0.35, means that the value of the employment rate for women is 35 percentage points away from that of men. Inversely, a gap of 0 reflects gender equality.

GAP_{ent} is the indicator of the enterprise gap between the number of women's enterprises and the number of other enterprises generally composed of men. Since this is also a gap, like the previous one, it should be read the other way around, i.e. as the value of the indicator increases, the quality of life decreases, since the gap between the number of women's enterprises and the number of men's enterprises widens.

As mentioned, the women's quality of life index is composed of 6 normalized indicators (0–1) that can have both negative and positive values, and because of this, the I_{QLw} has a range of values between -2 and 4. Thus, when the index increases, the value of women's quality of life increases.

5 Women Quality of Life Results

In this work, I_{QLw} was calculated for the different Italian provincial territories and for 4 years: 2018, 2019 2020 and 2021. Between the two extreme dates, 2018 and 2021, the value of the variance of the index increases for the various provinces (+6%), thus not showing a homogeneous growth trend of the various indicators composing it. The maximum values diverge from the higher range of the index (+4) by an average of 1.4 points while the minimum values diverge by an average of 0.9 points. This shows how the index value for all provinces is shifted more towards its lower limit: −2, representing a lower quality of life for women. The graph in Fig. 1 shows the distribution of index values for the 4 years analysed (y-axis).

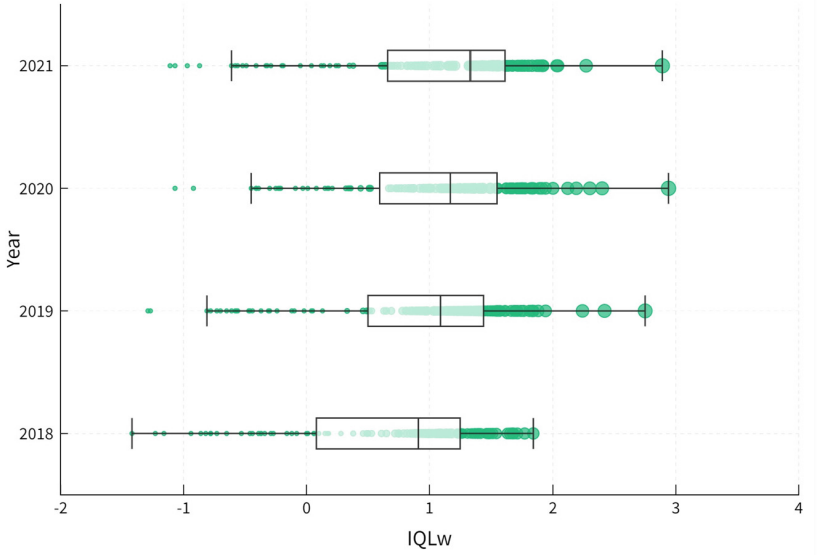

Fig. 1. Boxplot of the women's quality of life index for all provinces in different years.

The dots represent the provinces, the x-axis shows the index value, the rectangular boxes on each series are representative of the three quartiles. The positive aspect is that, albeit very slowly, the median value of the index is moving more and more towards the high values.

The maps in Fig. 2 show, in green shading, the values of the women's quality of life index by province. It is evident that the highest values are always concentrated in the provinces of central Italy. The lowest values of the index are instead distributed in the provinces of the south and in the region of Sicily with small variations over the 4 years. For the geographical repartition of the various provincial territories, see Fig. 3.

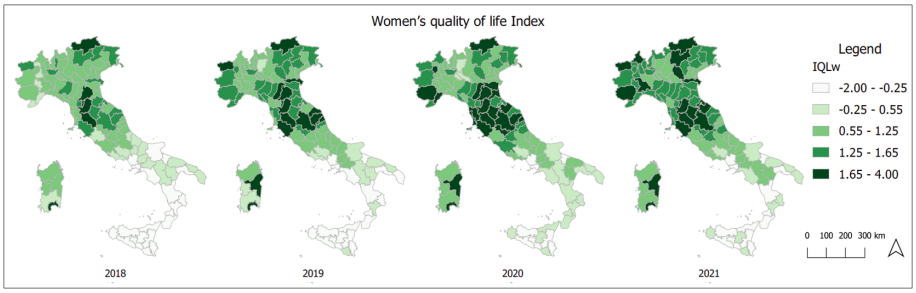

Fig. 2. Maps of woman's quality of life Index for years 2018, 2019, 2020 and 2021 for all provincial territory.

The boxplots in Fig. 3 represent the index of women's quality of life divided by the 5 geographical repartitions of the Italian territory: North-West, North-East, Centre, South and Islands (represented in the map in the center of Fig. 3). Each boxplot refers to an analysed year: 2018, 2019, 2020 and 2021. The provinces belonging to the northern and central repartitions have a much smaller variance (between 0.10 and 0.20) than those belonging to the southern and island repartitions (variance between 0.28 and 1.10).

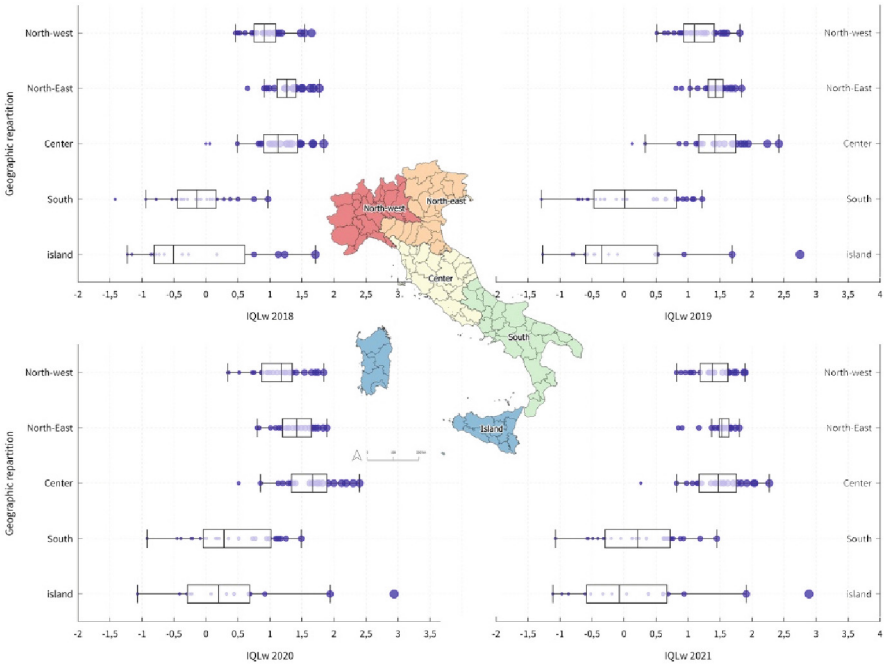

Fig. 3. Boxplot of the women's quality of life index for the geographic repartition in the four years. In the middle f picture there is a map of the geographic repartitions of Italy.

The same is true for the median value of the index, which tends to increase for all the repartitions over the years but remains higher in the northern and central repartitions than in the southern and island one. In the last three years Cagliari has been the province with the highest quality of life index for women, but for the geographical repartition of the islands but also in general it is an outlier. Certainly, in the province of Cagliari compared to the other provinces of the islands, policies have been implemented to decrease the gender gap. The city of Cagliari, in particular, has a gender equality board to promote the implementation of gender strategies [26].

6 Discussions and Future Developments

The above results show that the index of women's quality of life, with the exception of a few provinces, is higher in the provinces of northern and central Italy than in the provinces of the south and the islands. The southern provinces are also those characterised by often low-density and dispersed urban transformation associated in some cases with the urban sprinkling phenomenon [25, 27, 28].

The relationship between women's quality of life and urban dispersion was analysed with the LISA index (Local Indicator for Spatial Association), a spatial correlation index [29, 30]. This index was applied in previous research developed by the same authors [19]. In this case, the urban dispersion index at the national level is compared with the LISA cluster map of the "Sole 24 Ore" index of women's quality of life and with the LISA cluster map of the index of women's quality of life developed in this article (see Fig. 4). Both refer to data from 2021 and produce different results.

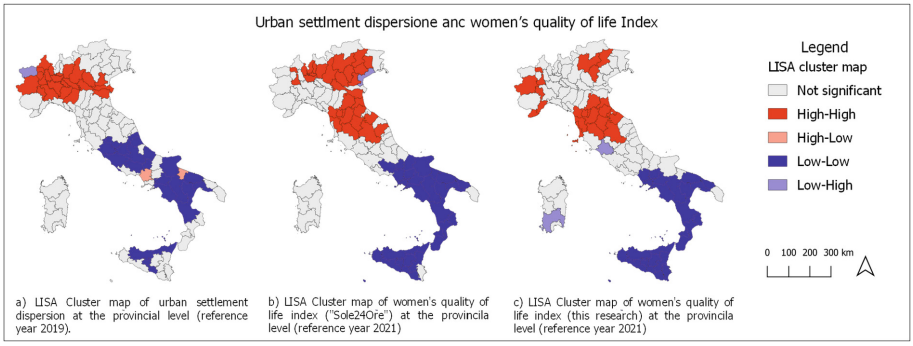

Fig. 4. LISA cluster map of urban settlement dispersion and index of women's quality of life of "Sole 24 Ore" and of this research (year 2021).

It should be specified that LISA statistical analysis applied to the urban dispersion index returns low values (Low-Low) for territories affected by high settlement dispersion and high values (High-High) for territories characterized by compact urbanization.

It is evident how in all three maps a clear distinction emerges between the provinces of northern and central Italy and those of the south. Two clearly separate clusters are formed where the blue colour corresponds to low values of both the index of women's

quality of life and the urban dispersion index. Conversely, the red colour corresponds to high values of both the index of women's quality of life and the urban dispersion index.

The southern Italian provinces characterized by high settlement dispersion are also those where the quality of life index is lowest. The contrary is not true. It is not possible to affirm, even in general terms, that provinces with higher quality of life indices have a more compact urbanized form. This does not allow us to answer the research question of this article exhaustively, but it does allow us to open up some insights for further developments. The index introduced is powerful in monitoring the phenomenon on a territorial and temporal scale since it is composed of indicators that are regularly collected from institutional sources. It also makes it possible to identify the areas characterized by lower values of the quality of life in which to deepen the analyses in order to identify their relationship with the spatial distribution of the urbanized area. In fact, the analysis at the provincial level provides a first view of the phenomenon analyzed. Within the same province there are often different dynamics of territorial transformations from more compact forms to more dispersed forms and different urban policies.

Funding. This research is funded by the University Research Project for Basic and Initial Research 2022 (University of L'Aquila): "Gender dis-equality e dispersione insediativa" (Gender dis-equality and urban dispersion).

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