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Benchmarking the vitality of shrinking rural regions in Finland

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ABSTRACT

Depopulation, commonly labelled as shrinkage, of rural areas can lead to a self-reinforcing vicious cycle of decreased regional vitality. However, some regions have been able to adapt to shrinkage and maintain their vitality despite the population loss. Thus, they have been able to "shrink smart". While there is a growing interest in this topic and particularly in the policies facilitating adaptation to depopulation, there is no commonly agreed measure to depict smart shrinkage. This paper aims at devising novel metrics for benchmarking the (full) development potential of depopulating rural areas as a way forward in the study of smart shrinkage. The proposed metrics, tested with data from Finnish municipalities, provides a good overview of which regions are doing well in terms of their economy and community vitality despite shrinkage, and helps in the selection of interesting case regions for further in-depth analysis.

1. Introduction

The long-term depopulation of rural areas has profound impacts on their (sustainable) economic, environmental, cultural and social development. Spatial depopulation is often called *shrinkage*. Shrinkage is not a cause but an effect of a variety of factors that can lead to outmigration. These factors include environmental degradation and natural disasters (Ehrenfeucht and Nelson, 2012), deindustrialisation, urbanisation and suburbanisation, globalisation, structural change and natural economic cycles of boom and bust (Hollander and Németh 2011; Wirth et al., 2016), mining towns being the most obvious example (Martinez-Fernandez et al., 2012). Outmigration, coupled with diminishing birth rates (Martinez-Fernandez et al., 2016), has resulted in the ageing of and a decline in the regional population bases of a large share of the rural areas of developed countries, including Finland (Lehtonen and Tykkyläinen, 2010; Makkonen et al., 2022a). Furthermore, a declining population commonly leads to a self-reinforcing vicious cycle of decreased regional competitiveness and attractiveness (Makkonen and Kahila, 2021) and a resultant lowered tax base, deteriorating infrastructure, decline in available services, etc. (Rhodes and Russo, 2013). This loss of *vitality* hinders the ability of the region to provide for the basic needs of its residents and to facilitate their capacity to improve their lives (Drewes and van Aswegen, 2011).

Shrinkage is, therefore, a concern for the remaining population of rural areas and for policymakers involved in rural development. Recently, planning policies aimed at adapting to depopulation have been denoted with a loosely applied umbrella term: *smart shrinkage*. Similarly, regions exhibiting good quality of life (QoL), i.e., in which the population is happy, healthy and able to participate in and enjoy social activities despite population loss, have been designated as being able to *shrink smart*. Since the concept was introduced in the early 2000s, it has received growing academic attention particularly in relation to the (qualitative) evaluation of policies to "right-size" urban infrastructure to the needs of diminishing populations, because most of the smart shrinking literature addresses urban areas. By contrast, the concept has been applied to rural areas only very recently (Zarecor et al., 2021). Therefore, there is a general gap in our knowledge on the specificities of how, or whether, the concept of smart shrinkage can be applied in rural areas and what, if any, are the impacts of such attempts. This research gap motivated us to analyse and discuss *smart rural shrinkage*. Relatedly, since there is no consensus on the exact definition of smart shrinkage (Peters et al., 2018), there is no established way to depict (qualitatively) or measure (quantitatively) the outcomes of smart shrinkage.

The current research that quantitatively designates regions experiencing smart shrinkage is based almost solely on QoL indicators. In order to make progress in the viable metrics of smart rural shrinkage, this paper considers a wide array of societal indicators that are merged into "Economic vitality" and "Community vitality" indices (see also Etuk and Acock, 2017). This is a novel approach, as only recently have such concerns as social and economic sustainability issues emerged in the

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literature on smart shrinkage (Donner-Amnell, 2020). As a remark, sustainability is a complex and overused word that is commonly associated with the environment and climate change. Thus, in this paper sustainability is understood through its social and economic meanings identified by the United Nations Sustainable Development Goals (UN SDGs), referring to a situation, in which future generations have the same or better conditions to meet their social and economic needs as the earlier ones. This paper tackles this evident research gap by incorporating the UN SDGs into the constructed metrics (in detail, see Appendix), which are tested with Finnish rural area data. The main analysis tool is Principal Component Analysis (PCA). Finland was selected as a case country due to its extensive open data availability. Finnish rural areas also provide relatively high living standards in an international context and thus provide an excellent reference for other rural areas located in post-industrialised service economies that are often forgotten (or are assessed only in a minor role) in innovation and development studies.

The paper proceeds as follows: First, a literature review presents the history and definitions of the concept of smart shrinkage, together with an overview of the empirical methods utilised in qualitative and quantitative empirical research on smart shrinkage. Second, the main analytical tool (PCA) is introduced together with the selected indicators for measuring smart shrinkage in the rural areas of Finland. Third, the results section lays out the main findings of the quantitative analysis of this paper, leading to the selection of four regions of which the strategies and implemented development projects were further investigated in order to identify whether their good performance in the quantitative metrics might be explained by the adoption of smart shrinkage policies. The final section summarises the main findings and their implications as well as the main shortcomings and limitations of the paper, paving the way for future research.

2. Literature review

2.1. Smart shrinkage

The concept of smart shrinkage emerged within the planning literature in the early 2000s based on the belief that shrinking regions need planning alternatives that do not rely on pursuing growth but rather on ensuring the well-being of the current population (Hollander, 2011). Considering the contemporary discussion on places and people left behind (Rodríguez-Pose, 2018), such a goal seems indeed reasonable. The background of smart shrinkage research is traceable (largely) to Germany, where reunification in the early 1990s and the subsequent movement of people to the west resulted in the shrinkage of many East German cities. This abrupt change sparked a number of international research projects investigating measures to adapt to depopulation, such as the *Shrinking Cities* (2002–2008) and *Shrink Smart* (2009–2012) projects (Oswalt and Rieniets, 2006; Haase et al., 2016a, 2016b). Another early example of smart shrinkage has been the city of Youngstown, the first US city that purposefully abandoned growth-oriented development strategies in favour of policies adapting to shrinkage (Wiechmann and Pallagst, 2012).

Despite the common roots, there are several different ways and concepts (e.g., *smart decline* and *right-sizing*) to define this change in the planning paradigm from growth-driven optimism towards shrinkage adaptation. Popper and Popper, 2002 were among the first to discuss the topic, and defined smart decline as "planning for less – fewer people, fewer buildings and fewer land uses". Relatedly, right-sizing has been described as the stabilisation of dysfunctional markets by more closely aligning the built environment of a locality with the needs of existing and foreseeable future populations (Schilling and Logan, 2008: p. 454). This means essentially "planning for less". In the social sciences, smart shrinkage is seen as a process of which the outcomes should be measurable. For example, in the context of rural areas Peters et al. (2018) and Zarecor et al. (2021) have stressed that the outcome one should be looking at when assessing smart shrinkage is the QoL of the residents of shrinking regions. Smart shrinkage is a process through which it is "possible for a place to lose population" but "still be a location featuring high QoL" (Hollander, 2011: p. 130). While the terms "shrinkage" and "decline" are often used interchangeably, there is a subtle difference between them. Whereas shrinkage is considered as a neutral term for depopulation, decline is a more multidimensional phenomenon also including economic decline (Peters et al., 2018). However, the varying terms and associated definitions are describing very similar processes: depopulation and the need and measures to adapt to it, and the outcomes of these measures. For the sake of clarity and consistency, we made a decision to use the term smart shrinkage throughout this paper.

The apparent opposition towards accepting shrinkage has hindered rooting of the concept into actual planning. Accepting shrinkage is easier in regions that have witnessed decline for generations, and for decision-makers who feel that they have exhausted all other alternatives. However, while growth cannot be considered as an everlasting constant, or as a synonym for development, accepting shrinkage appears to be "taboo" amongst policymakers, particularly in regions that have started shrinking more recently (Hartt, 2020). Policymakers are, naturally, worried about their re-election (Grant, 2009), and might thus shun shrinkage in fear of negative political consequences. This usually translates into an over-optimistic tone in regional planning and strategy, even if shrinkage is evident and has lasted for several years and is therefore unlikely to be easily turned back to growth. In regions where shrinkage is not accepted, planning is still based on growth rather than on adaptation to the actual circumstances (Pallagst et al., 2017). This can lead to inefficiency and indebtedness (LaFrombois et al., 2019). Changing the paradigm in planning from growth to adapting to shrinkage is, thus, the first hurdle to cross before regions can start implementing smart shrinkage policies (Hospers, 2014).

The central issue relates to the derogatory connotation of shrinkage: it is considered almost as a synonym for decay (Sousa and Pinho, 2015). However, as discussed by Makkonen and Kahila (2021) in relation to the vitality of rural areas, shrinking regions are not necessarily deteriorating, and neither are they automatically bad places to live for the population that wants to stay in the region. In fact, economic growth in a region does not automatically guarantee the QoL of its residents. In some cases, it may also decrease it. This can take place, for example, through traffic congestions, pollution, an increase in the cost of living, higher crime, or lack of green spaces. By contrast, those residing in shrinking regions can be very content with their lives and the surrounding environment, even without economic growth (Peters et al., 2018). As such, the adoption of smart shrinkage policies as elements of regional planning implies that, rather than trying to reverse depopulation via potentially very expensive and often unsuccessful growth-oriented projects to lure new inhabitants (Hackworth, 2015), the emphasis should be directed towards ensuring the well-being of the current population in order to maintain the region as a good place to live (Panagopoulos and Barreira, 2012). Nonetheless, although the number of regions adopting smart shrinkage policies has slowly increased (Németh et al., 2020), most regions still pursue growth-oriented development strategies (LaFrombois et al., 2019).

According to Hollander and Cahill (2011), the repertoire of smart shrinkage policies includes:

- Deconstructing: right-sizing the regional infrastructure by demolishing vacant buildings and turning them, for example, into green or recreational spaces
- Re-evaluating: reshaping the purpose of the built environment, for example, from former industrial sites into tourist attractions or places for creative industries, or by handing over vacant buildings to local social and cultural associations and organisations for arranging activities and services for the local population

- Re-organising: improving the efficiency of regional administration by addressing the functioning of the regional government
- Imagining: developing the image of the region in a way that takes advantage of local strengths and symbols

Additionally, the subsequent smart shrinkage literature has underlined the importance of:

- Cooperation: developing local services in cooperation with a multitude of public, private and third sector actors and inter-regional cooperation in planning to avoid competition and negative spill-over effects (Panagopoulos and Barreira, 2012; Makkonen and Kahila, 2021)
- QoL initiatives: improving the QoL of the remaining population (Zarecor et al., 2021)
- Immigration policies: implementing active immigration schemes to attract foreign workforce in order to deter the negative consequences of depopulation on local businesses (Runge et al., 2020)

As noted above, the concept of smart shrinkage was coined to tackle the negative consequences of depopulation in cities. Therefore, most of the literature on smart shrinkage has discussed it in relation to urban areas. This poses an evident problem for applying the repertoire of smart shrinkage policies to rural contexts: policies designed for urban planning purposes rarely fit the needs of rural areas without careful reconfiguration. Consequently, Küpper et al. (2018) have stated their scepticism towards the likelihood of successful smart rural shrinkage policies (without the use of external consultants) since rural regions are noted to lack the human capital for adapting (urban) planning and development policies to fit their specific local contexts. Moreover, in rural regions depopulation becomes visible slower than in cities, because the scale of change (population loss) is significantly smaller. Therefore, depopulation might not even be considered as a "crisis" that would need to be tackled (Zarecor et al., 2021). However, recent empirical evidence does suggest that in several countries, such as Finland, the share of shrinking rural regions is much higher than the share of shrinking urban regions (e.g., Makkonen et al., 2022a). Thus, it is important to note that shrinking is very much a rural issue and a key policy concern for rural development (Tietjen and Jørgensen, 2016; Hospers and Syssner, 2018).

A final remark is that smart shrinkage is not a policy panacea that would help all regions (both urban and rural) equally. Every shrinking region has its own history and reasons behind its shrinkage. Therefore, there are no one-right-size solutions in mitigating the potential negative impacts of shrinkage (Hollander and Németh, 2011). Several researchers (Hackworth, 2015; Berglund, 2020) have been very critical towards the concept, and sceptical about the potential of smart shrinkage policies to actually drive a positive change amidst global macroeconomic shocks and national decision-making over which the region itself has no control (Rhodes and Russo, 2013).

2.2. Identifying regions that shrink smart

2.2.1. Identifying shrinking regions

The identification procedures of regions that shrink smart, utilised in previous studies (e.g., Hollander and Németh, 2011; Németh et al., 2020; Zarecor et al., 2021), consists of two phases: 1) detection of regions that are shrinking and 2) evaluation of measures to adapt to the outcomes of shrinkage.

The identification of shrinking regions is commonly made through a statistical outlook on one (or several) of the following indicators (Hollander and Németh, 2011): population loss, employment loss and increase in the count of abandoned buildings. Of these indicators, population is the most widely utilised metric for shrinkage (Németh et al., 2020). There is no common agreement on the specific thresholds that need to be passed for a region to be labelled as shrinking. Moreover, while decline is expected to be "long-lasting", there is no commonly agreed definition of the exact number of years a region must experience depopulation for it to be labelled as shrinking (LaFrombois et al., 2019). Notwithstanding this variety in the utilised indicators, thresholds and timeframes of shrinkage (which gives the term a relatively vague empirical overtone), the main issue is that the examination of basic demographic (and/or economic) indicators allows the researchers to "separate" growing and shrinking regions from each other according to their research agenda. However, the simplification of shrinkage into only two categories (yes or no) does not do justice to all regions. Since the growing–shrinking axis is not a dichotomy but rather a continuum, not all regions can be clearly labelled as either shrinking or growing (Hartt, 2019; Makkonen et al., 2022a). The above controversy also applies in the case of rural and urban areas: the rural–urban axis is also a continuum (or a gradient) rather than a dichotomy (Cloke, 1977). Thus, not all regions can be labelled as purely rural or purely urban.

The second step is to evaluate whether the identified shrinking regions are shrinking smart. There are two different ways of evaluating this: 1) qualitative and 2) quantitative, as follows:

2.2.2. Qualitative evaluation of smart shrinkage

The qualitative evaluation of smart shrinkage has two steps. It starts from an appraisal of whether the regions have accepted that they are shrinking. As stated in Section 2.1, in several cases it is hard for regional authorities to admit that their regions are no longer growing. The step from denial to acceptance is the starting point for implementing smart shrinkage policies. If a region does not accept that it is shrinking, it cannot be planned accordingly. Therefore, researchers have been looking into planning and policy documents to see whether the shrinking regions present accurate depictions of their population (and/or economic) history and base their planning on realistic future projections, or whether the shrinking regions deny or belittle the shrinkage and base their planning on overly optimistic growth trajectories (LaFrombois et al., 2019). The second step is to analyse whether the regions are implementing the policy measures of smart shrinkage discussed in Section 2.1. As a result, a region that shrinks smart is a region that is shrinking in terms of its population (and/or economic) base, has accepted that it is shrinking, and has adopted policy measures to adapt to this shrinkage (Panagopoulos and Barreira, 2012).

The qualitative approach has several limitations. First, strategy and policy documents are often fused with development optimism and "blue skies visioning", rather than being meticulous forecasts of the future state of the region (Makkonen and Inkinen, 2014). Additionally, the term smart shrinkage is not yet widely applied for example in Finland or elsewhere. The mechanical reading of strategy documents does not necessary enable the researchers to identify smart shrinkage policies even if they have been implemented in a specific region. Second, numerous regions use a mixture of growth-oriented and smart shrinkage policies (Kahila et al., 2022). Unfortunately, this is often done in an uncoordinated and ineffective manner (Hollander and Cahill, 2011). As a result, there are (even globally) very few clear examples of regions that have fully embraced smart shrinkage policies. Third, the acceptance of shrinkage does not necessarily mean that the region is implementing planning to adapt to it. Rather, they can still aim at converting the negative trends and implementing growth policies. There is no automatic causal relationship between accepting shrinkage and implementing smart shrinkage policies (LaFrombois et al., 2019). Finally, not all the measures stated in planning or policy documents will eventually see the light of day, i.e., be implemented in practice (Ryan and Gao, 2019). There is a need to move away from the analysis of policy and strategy documents towards investigating actually implemented smart shrinkage projects and their outcomes in order to learn what they mean in practice, and more importantly, how they impact the residents. These questions are normally assessed through in-depth case study settings resulting in the analysis of implemented smart shrinkage projects outside nation-wide comparative research. This creates a need for quantitative data as follows:

2.2.3. Quantitative evaluation of smart shrinkage

The quantitative evaluation of smart shrinkage, in contrast to the qualitative analysis, approaches and accepts shrinkage as a structural condition rather than a problem that needs to be resolved (Zarecor et al., 2021). Researchers are less concerned about whether a region has accepted shrinkage and is implementing smart shrinkage policies, and more concentrated on the outcomes of shrinkage. These outcomes are explored through indicators related to, most notably, QoL. The central question to be answered is whether the QoL of the residents has been decreased by de-population (Hollander, 2011; Peters et al., 2018; Zarecor et al., 2021). As a result, a region may be defined as declining only if it shrinks both in population (and/or economy) and in terms of the QoL of its residents. If the QoL of the residents is not decreasing despite population loss, then the region has been able to shrink smart (Peters et al., 2018).

There are two ways to measure QoL (Diener and Suh, 1997; Cummins et al., 2003): 1) objective and 2) subjective. The objective approach measures the circumstances for achieving high QoL. That is, does a region possess such economic, environmental, social and cultural conditions that its population could be expected to be "well-off". Being well-off, however, is not the same as well-being. Therefore, the subjective approach scrutinises the actual experience of well-being; whether individuals feel happy and healthy. While the subjective approach has merits in describing in detail the actual experienced QoL of a population, data availability issues limit its usability in comparative rural and regional studies. National well-being surveys usually cover only a small sample of the total population of the country, with the result that the number of respondents from a single rural area is very often close to zero. Therefore, this type of data is normally collected via ad hoc surveys, which are costly and rarely cross-comparable. As a result, researchers are often "restricted" to focus only on a specific case study region. Thus, despite its limitations of not being directly related to actual experienced QoL, the objective approach is widely used in comparative research settings, such as the one applied in this paper. Additionally, policymakers are mainly concerned with creating opportunities for individuals. As such, the objective approach has high policy relevance (Costanza et al., 2007). There is, however, no agreed set of objective indicators to measure QoL. As a result, researchers commonly apply summary indices that take into account a variety of potential QoL measures and statistically deduce which of them are the most relevant for the purposes of the study (Giannias et al., 1999).

In summary, although the quantitative way to evaluate smart shrinkage does offer tools for comparative research, it does not reveal very much about the causes or policies behind an observed good or bad QoL performance. Evidently, quantitative analyses rarely reveal exactly what the region (its government and other organisations/individuals) has done right to achieve a good score *vis-á-vis* the analysed phenomenon, and as an example, a high QoL performance can be a result of factors unrelated to smart shrinkage. There is a need for mixed-methods research combining qualitative and quantitative approaches to explore both the attitudes towards and policies for adapting to shrinkage, as well as their outcomes (Zarecor et al., 2021).

3. Data and methods

3.1. Finnish rural regions and shrinkage

In Finland, municipalities have traditionally had a greater role in local development than regions (provinces), as they have been in charge of a wide range of economic and community vitality-related functions. These functions comprise the provision of employment services, business promotion, healthcare and social services, education and culture, as well as environmental and technical infrastructure services. Note however that the upcoming social- and healthcare reform will change the regional responsibilities for service provision in Finland in the near future.[1] In addition to government support, the municipalities have the right to levy their own municipal taxes to cover the costs of providing these services (Makkonen and Kahila, 2021). This is the main reason why municipalities were selected as a suitable regional unit for this study.

As indicated in Section 2.2.1, rather than being a dichotomy, the rural–urban axis is a continuum (or a gradient). Therefore, the Finnish Environment Institute (SYKE) has proposed a categorisation consisting of several different types of rurality and urbanity and labelled the Finnish rural areas according to this categorisation into 1) sparsely populated rural areas (SPAs), 2) rural heartland areas (RHAs) and 3) rural areas close to urban areas.[2] The categorisation by SYKE was utilised here to conduct the analysis separately for the first (SPAs) and the second (RHAs) category, in order to acknowledge that shrinking might not be experienced equally across different types of "rurality". The third category, however, consists of rural regions that are surrounding larger cities and are part of their employment areas. Thus, they grow or shrink mainly due to the development or decline of the central urban municipality. In such context, the adaption of smart rural shrinkage policies is less relevant (than in the case of SPAs and RHAs) as such a rural community is, in fact, a functional part of the commuting area of the close by city. Moreover, according to recent figures from Statistics Finland, more than half of the Finnish municipalities belonging to this group are growing in terms of population. In other words, at least in Finland, rural communities that are located close to a city are more likely growing than shrinking in terms of their population. For these reasons, the third category was omitted from the analysis.

As indicated in the introduction, this paper deviates from the existing measuring schemes of smart shrinkage, focusing on QoL indicators, and devises new metrics for benchmarking the (full) development potential of shrinking rural areas. Instead of studying policy documents and the perceptions of planners and decision-makers (Hoekstra et al., 2020; Syssner and Meijer, 2020), or focusing only on QoL indicators (Peters et al., 2018; Zarecor et al., 2021), the economic development potential (Economic vitality) of Finnish regions is assessed in tandem with demographic change, QoL indicators and environmental, cultural and social sustainability (Community vitality). In this way the metrics are able to distinguish regions that are doing well in terms of both economic and community development, despite their negative population growth trends. As a "robustness check", the strategies and implemented projects of selected regions ranking high on the constructed indices were assessed to indicate whether the regions are applying smart shrinkage policies. This should provide tentative evidence concerning the fitness of the proposed metrics. That is, are the constructed indices suitable for identifying regions that shrink smart?

While labelling a region into a shrinking or a growing one might not do justice to those regions that are somewhere in between growth and shrinkage (Makkonen et al., 2022a), for the sake of simplicity a decision to use a simple two-category approach was made. By utilising population statistics (as is done in the majority of research into smart shrinkage; Németh et al., 2020), the regions are labelled as growing or shrinking based on figures from the two most recent years (2018–2019) that correspond to the remainder of the dataset (see Section 3.3). While this two year "threshold" can be criticised as a relatively short time-period for examining shrinkage, it is commonly used particularly when the focus is not strictly on the severity or degree of depopulation but rather on identifying examples of good practices (Hollander and Németh, 2011). Similarly, while acknowledging that shrinking only by a

[1] See: https://soteuudistus.fi/en/frontpage.

[2] See: https://www.ymparisto.fi/en-US/Living_environment_and_planning/Updated_urbanrural_classification_Finlan(57443).

few persons is naturally different from shrinking by a large proportion of the population, a decision was made not to apply any minimum threshold (such as faster than average population loss; Peters et al., 2018) for shrinkage.

3.2. Principal component analysis and "robustness check"

As is evident from the literature discussing the measurement of smart shrinkage (see Section 2.2.3), it is a latent phenomenon that cannot be directly assessed by a single indicator. Rather, attempts to quantitatively evaluate smart shrinkage would benefit from the utilisation of multivariate analysis that can be used to calculate weights for a composite index including several indicators (increasing explanatory power in comparison to single indicators). The utilisation of multivariate analysis for this purpose has a long and established tradition within the literature on economic geography when it comes to topics such as regional development and innovativeness (Makkonen and Inkinen, 2015), but has not yet been widely applied to analyse smart shrinkage.

From the "family" of multivariate analyses, Principal Component Analysis (PCA) was selected due to its objectivity in calculating weights for the different indicators that are included in the index. Further benefits of the PCA are that it compresses (as far as possible) the variation of the included indicators into the first (principal) *component* (on which the indices are based) and that it does not require the utilised data to be normally distributed, as is rarely the case with regional data (cf. Zipf's law). PCA allows for calculating Principal Component Scores (PCSs), based on weights (*loadings* indicating the correlation between an individual indicator and the principal component) and initial values of the included indicators, for each unit in the analysis. That is, the PCSs will indicate how well/poorly an individual region is doing in terms of the measured phenomenon. The PCSs are normally distributed around a mean value of zero. The calculation of the weights is based on correlation/covariates between the included indicators. The PCSs for individual regions are calculated via a process similar to regression analysis by utilising these weights (Jolliffe, 2002).

Generally, PCA fits well with our intention of building a pair of indices – Economic and Community vitality (for indicator selection see Section 3.3) – for the purposes of identifying places that shrink smart. By combining the PCSs of the Economic and Community vitality indices, the regions can be "placed" into a fourfold table (following Peters et al., 2018) and it is possible to label the rural areas as follows (Fig. 1):

1. Areas doing badly in both indices: declining countryside
2. Areas doing well in terms of economic but not in terms of community vitality: adaptive countryside
3. Areas doing well in terms of communality but not in terms of economic vitality: sustainable countryside
4. Areas doing well on both indices: adaptive and sustainable countryside

The fourth category of this typology assisted us in selecting regions for further investigation through a standard content analysis. The content analysis was performed in order to investigate whether the strategies and implemented projects (identified from the minutes of the meetings of the municipal councils) of the selected regions include policies related to smart shrinkage. This analysis works as a "robustness check" to evaluate whether the metrics were suitable for identifying regions that would also fit the qualitative definition of smart shrinkage (see Section 2.2.2).

3.3. Economic and community vitality: indicator selection and data sources

As argued in Section 2.1, shrinkage is not necessarily the same as decline. Therefore, in order to "separate" the regions that are truly declining from those that are just shrinking (or shrink smart) a set of common regional indicators was applied. These indicators (employment, stock of enterprises, etc.) correspond to UN SDGs 1 and 8 (Appendix) and describe the state of the local economy. They are the building blocks of the first index, namely "Economic vitality".

According to existing international evidence, economic factors alone do not determine the well-being of the residents of shrinking areas (Zarecor et al., 2021). Therefore, economic indicators comprise only one axis investigated in this paper. In addition, there is a need to look at softer aspects of development. Following the ideas of Peters et al. (2018), the constructed dataset includes indicators related to QoL as well as security, community participation and social capital – which are all deemed as important facets of QoL (Meijer and Syssner, 2017; Peters et al., 2017, 2018; Zarecor et al., 2021) – into the analysis. As noted in Section 1, social and economic sustainability issues have recently started to gain momentum as an important aspect of smart shrinkage. Therefore, after carefully evaluating the existing list of sustainability indicators in Finland,[3] suitable indicators corresponding to several UN SDGs (Appendix) with good data coverage were selected into the analysis. These indicators are the building blocks of the second index, namely "Community vitality".

The laborious data collection process included gathering, coding and recalculating (e.g., normalisation per population) indicators from the databases of several Finnish authorities: Statistics Finland, Natural Resources Institute Finland, Finnish Environment Institute, Carbon Neutral Municipalities Network, Finnish Transport and Communications Agency, Education Statistics Finland, Finnish Institute for Health and Welfare and Association of Finnish Local and Regional Authorities. The data was collected for the year 2019 (or closest available year – i.e., in most cases 2018), which at the time of data collection was the most recent year available with good data coverage. The full indicator descriptions are listed in Appendix (Tables 4 and 5).

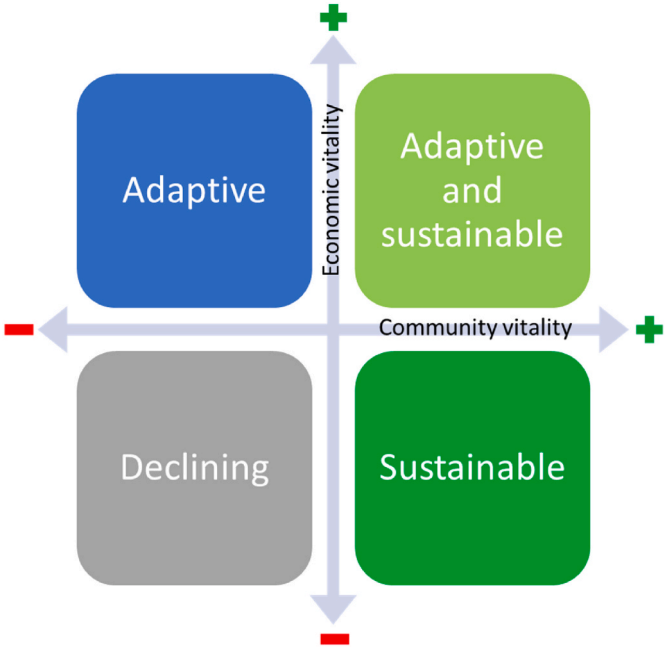

Fig. 1. Smart shrinkage based on the Economic and Community vitality indices.

[3] See: https://www.stat.fi/tup/kestavan-kehityksen-yk-indikaattorit-agenda2030_en.html.

Table 1
Results of the Principal component analysis for Sparsely populated areas (N = 77).

Economic vitality			Community vitality		
Variables	Communalities	Loadings	Variables	Communalities	Loadings
Labour force	0.762	0.871	Municipal spending on education and culture	0.737	0.748
Workplaces	0.766	0.866	Elderly living at home	0.586	−0.658
Employment rate	0.780	0.838	Fine particle concentration	0.756	−0.629
At-risk-of-poverty rate	0.734	−0.786	Morbidity	0.755	−0.622
Housing stock, dwellings	0.503	0.694	Lowest income category	0.765	−0.575
			Voting	0.609	0.570
			Social exclusion	0.665	−0.551
KMO		0.814			0.698
Bartlett's Test		<0.001			<0.001
Eigenvalue (% of variance)		3.911 (48.9%)			4.571 (28.6%)

Table 2
Results of the Principal component analysis for Rural heartland areas (N = 100).

Economic vitality			Community vitality		
Variables	Communalities	Loadings	Variables	Communalities	Loadings
Employment rate	0.861	0.842	Youth unemployment	0.677	0.820
Labour force	0.724	0.825	Voting	0.581	−0.759
At-risk-of-poverty rate	0.635	−0.796	Social exclusion	0.544	0.725
Housing stock, dwellings	0.758	0.766	Morbidity	0.703	0.689
Workplaces	0.611	0.722	Lowest income category	0.728	0.557
			Elderly living at home	0.494	0.520
			Energy consumption	0.696	−0.507
KMO		0.679			0.752
Bartlett's Test		<0.001			<0.001
Eigenvalue (% of variance)		3297 (55,0%)			3977 (30,6%)

4. Results

The analyses were carried out separately for two types of "rurality" identified by SYKE: 1) SPAs and 2) RHAs (see Section 3.1.). As the utilised approach is exploratory, the initial solutions included several indicators that did not meet the requirements set for PCA and were therefore removed from the analysis until a solution satisfying all the preconditions for a successful PCA was obtained. Following Maskey et al. (2018) and Tabachnick and Fidell (2007), only loadings that can be considered most significant for the interpretation (above the threshold of 0.5) of the results are reported.

The final iterations of the analyses conducted passed the most common tests for the suitability of PCA. These include the following criteria (see Jolliffe, 2002):

- Eigenvalues (>1, indicating how well the principal component explains the variance of the included indicators);
- Communalities (>0.3, indicating how well the produced components explain the variation of a single indicator);
- The Kaiser-Mayer-Olkin test (>0.6, based on the ratio between correlation and partial correlation between the indicators) and;
- The Bartlett's test ($p < 0.05$, based on the presence of statistically significant correlations between the indicators).

The Economic vitality indices logically underline the role of employment, labour force, number of workplaces, at-risk-of-poverty rates and growth in housing stock as being of key importance for the vitality of both sparsely populated areas (Table 1) and rural heartland areas (Table 2).

In the case of the Community vitality index for the SPAs, indicators such as "municipal expenditure on education and culture" and "voting" are positively related to the index (Table 1). Indicators such as fine particulate matter concentration, low incomes, morbidity and social segregation are negatively loaded to the index, meaning that high scores on these indicators reflect negatively on the measured aggregate termed here as Community vitality. In other words, the results are significantly logical, underlining the suitability of the PCA approach in building the index. Nevertheless, there is an exception that requires further explanation: "the share of elderly people living at home" was expected to indicate good health among the elderly. However, on the basis of additional investigation with data from Statistics Finland, it became evident that the indicator is highly correlated with the overall number of elderly people living in the region. In effect, the indicator is a measure of the ageing of the population, and therefore is negatively correlated to the index.

The PCA results for RHAs deviate from those produced for the SPAs: youth unemployment has the highest loading in the Community vitality index for RHAs (Table 2). This underlines the rationality for conducting the analysis separately for different types of "rurality". Another notable aspect is that the indicators describing negative developments (e.g., morbidity) have positive loadings and vice versa (e.g., voting): the index is in fact describing "ill-being" rather than "well-being". Therefore, the scale of the index is reversed in Fig. 2b in order to indicate that lower PCSs are preferable. Surprisingly, "energy" has a negative loading to the index. However, when considering the research stating that energy use indicates wealth creation (Ferguson et al., 2000), the results can be interpreted through the positive connection that wealth creation can have on many of the indicators of UN SDG 10 (reduced inequalities). Moreover, the indicator does not differentiate between green and dirty energy production – thus, it is rather "blind" in terms of indicating environmentally sustainable development.

In sum, the results of the PCA are rational and there are reasonable explanations behind the more surprising results. The results nonetheless underline the weaknesses of the PCA, as the associations are not always intuitively clear: the direction of the association does not indicate anything about the causal relationship between the measured phenomenon and individual indicators. It merely tells whether the indicator is negatively or positively correlated with the values of the index. Thus, it should be underlined that this paper is not trying to explain any causal relationships between the inspected indicators but, rather, proposes a novel methodology for selecting regions that have potentially been able to shrink smart for further inspection.

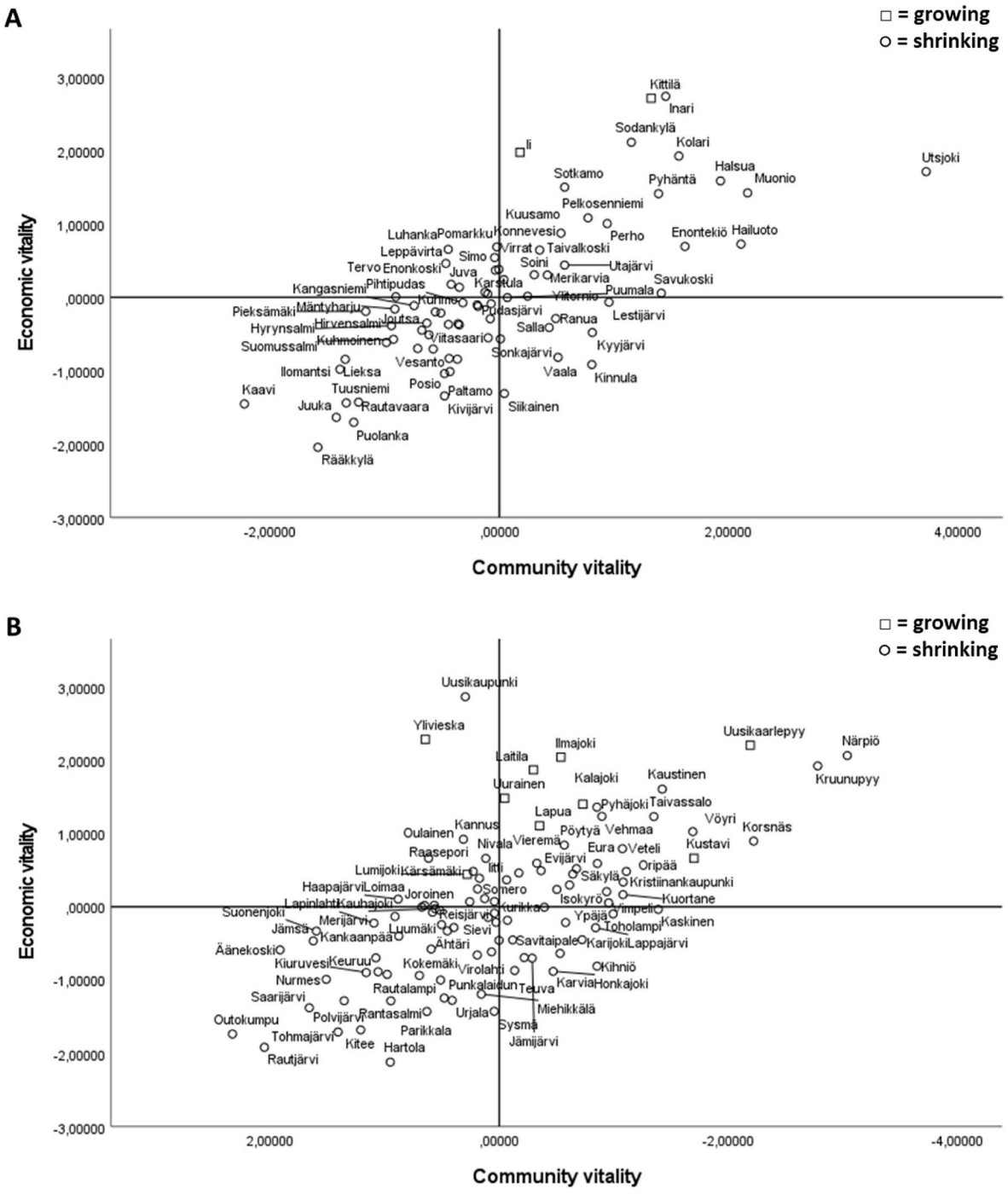

Fig. 2. Principal component analyses of the Economic and Community vitality indices for A) Sparsely populated rural areas and B) Rural heartland areas.

Table 3
Summary of smart shrinkage policies in the selected regions.

	Does the municipality accept that it is shrinking or does it still pursue growth?	Examples of smart shrinkage policies
Hailuoto	Does not expect to grow significantly (Managed growth)	Implements re-evaluation policies
Halsua	Aims at slowing down depopulation but does not expect to reverse it back to growth	Implements re-organisation and cooperation policies
Pyhäntä	Does not expect to grow significantly (Managed growth)	Focuses on improving the QoL of its residents
Närpiö	Recognises that it will not grow via natural population growth or domestic in-migration	Active immigration policies

Small rural communities are often lacking in the regional analysis and it is difficult to obtain generalizable qualitative results due to the varying locational contexts. However, the following brief insights will indicate characteristics of these locations and thus provide a starting point for their future investigation. To this end, the PCA does help us to identify several interesting cases for further analysis (Fig. 2). In the case of the SPAs, since most of the municipalities that can be labelled as adaptive and sustainable (Fig. 2a) are from northern Finland, the probable explanation for their good performance on the Economic vitality index is the key role that tourism plays in their economy (Saarinen, 2003). Therefore, the selected regions were picked outside the most obvious "high flyers" of northern Finland. The selected municipalities

were Hailuoto, Halsua, and Pyhäntä (see Makkonen et al., 2022b for details):

- **Hailuoto** is an island (ca. 200 km^2) situated in the Bay of Bothnia with a population of ca. 950 inhabitants. It is accessible from the Finnish mainland only via a ferry. Hailuoto states in its strategy that it aims at a managed growth in population. That is, it aims to attract only some in-migration but does not expect to grow significantly. The municipality has active aims in repurposing (i.e., re-evaluating) existing buildings for new uses together with architects from a nearby university. Additionally, sustainability ranks high in the agenda of the municipality, explaining its good performance in the Community vitality index.
- **Halsua**, situated in Central Ostrobothnia, is a small municipality (ca. 400 km^2) with a population of ca. 1100 inhabitants. It aims at breaking the growing trend of depopulation in its strategy. That is, not necessarily reversing it but slowing it down. The means for accomplishing this are mainly very traditional (marketing, cheap land prices, etc.). However, the municipality is among the forerunners in providing a good coverage of fast broadband network in rural Finland. The aim of the investments in broadband networks has been to lure teleworkers and new digital service firms to move to the municipality. At the same time, the municipality is re-organising its administration by service digitalisation and cooperating with local third sector associations and the neighbouring municipalities for improved efficiency and decreased operating costs.
- **Pyhäntä**, situated in Northern Ostrobothnia, has a population of ca. 1600 inhabitants and a land area of ca. 800 km^2. The strategy of Pyhäntä aims at managed and sustainable growth (as in Hailuoto). Noticeably, increasing the QoL of its population is among the key targets of Pyhäntä. The formulation of the municipal strategy was partly based on a survey directed at the local inhabitants, enabling their participation in strategic development work. As such, the strategy underlines the importance of QoL both directly and via community participation. The policies and projects implemented by the municipality follow the focus laid out in the strategy.

In the case of the RHAs (Fig. 2b), the municipality of Närpiö appears to be the clearest example of an adaptive and sustainable region (see Makkonen et al., 2022b for details):

- **Närpiö** has a population of ca. 9500 inhabitants and a land area of nearly 1000 km^2. It is situated in the Southern coast of Finland. Närpiö has realised early on that natural population growth and domestic in-migration will not be sufficient to ensure the vitality of the region. Therefore, Närpiö has been active in its immigration policies, taking in refugees already from the late 1980s onwards, which was and still is rather uncommon among Finnish rural areas. The aim of this activity has been to secure the availability of labour to work in the gardens and greenhouses for which the municipality is famous in Finland. The immigration policies have succeeded: the immigrant workers have had a definite invigorating impact on the vitality of the municipality[4]. The strategy of Närpiö includes concrete actions to facilitate integration between foreign-born persons and the local population, in both directions, which helps to build social capital and consequent QoL.

In sum, the constructed indices presented in Fig. 2 provide a basis for selecting interesting regions for a closer look. The purpose of presenting some general remarks on these locations was to test the feasibility of the indices, to underline their suitability as potential case study locations and to provide a research agenda for future qualitative in-depth studies. As shown in Table 3, the selected regions have indeed accepted (at least to some degree) that they are shrinking. Similarly, while relying on traditional growth-oriented policies, they also implement at least some clear examples of smart shrinkage policies suited to smaller populations.

5. Discussion and conclusions

This paper set out to propose a novel metric to evaluate smart rural shrinkage, i.e., to identify those rural regions that, while shrinking in terms of their population, have still been able to maintain a good performance in other sustainability, socio-economic and QoL indicators relating to regional vitality. Finland was utilised as the case study location to test the proposed metric. Municipalities were selected as an appropriate regional scale, and data corresponding to this regional aggregation was collected from a multitude of Finnish statistical authorities. By utilising the Finnish regional typology of rural regions, the analyses were conducted separately for SPAs and RHAs. Two separate indices were constructed (with the help of PCA) for both "rurality" types. These indices describe the Economic and Community vitality of Finnish rural regions. Based on the results of the PCA (and a regional typology guiding the identification of those regions that have been able to adapt to shrinkage), four case study regions were selected for further analyses. The conducted qualitative "robustness check" of the strategies and implemented projects of the case study regions verified that the proposed indices help in pinpointing interesting case study locations, in terms of smart shrinkage and regional vitality, for further analysis. Naturally, one could argue that there might be something "interesting" (experiments, policy innovations, etc.) taking place in any one of the Finnish regions facing depopulation. However, the indices do help in identifying the regions that appear to be doing relatively well and those that are doing relatively poorly in terms of other measures than strict population trends. Thus, they will help further research into smart shrinkage when considering whether to focus on the best-in class, mediocre or worst-off class performers on the economic–community development axis measured here.

The local options to develop shrinkage strategies and implementable policies (identified from the minutes of the meetings of the municipal councils) illustrate that some aspects of smart shrinkage policies are adopted in Finnish rural regions (see Table 3). However, as expected (based on Section 2.1), they mainly utilise a limited mix of smart shrinkage policy tools and still have an observable goal leaning towards traditional growth-orientation in their development work (see also Kahila et al., 2022). Local level development and critical research-based assessment of regional realities may be proposed. This requires more detailed and contextual consultation and research tailored for the needs of each region. As these are often expensive, the need for inter-regional collaboration and networking in policy development, and in possible future procurements, is stressed. The quantitative PCA analysis identified similar regions (for groupings, see Figs. 1 and 2) that could consider working together in the future.

This paper has limitations that, hopefully, will pave the way for further research. First, the indicators utilised in this paper are objective. That is, they relate to the factors that enable a shrinking place to retain its vitality. However, they do not necessarily reveal anything about the actual experienced well-being of the residents (ESPON, 2021). Collecting survey data from a selection of case study regions would be a natural starting point to investigate whether the objective indicators utilised in this paper can predict the actual subjective well-being of the residents of shrinking regions. Second, as smart shrinkage has also raised severe criticism, this paper is wary of "taking sides" on the debate of the pros and cons of smart shrinkage policies, due to the relatively thin empirical evidence base that the concept is based on. In other words, the developed metrics are traditional in the sense that they confirm results obtained in several earlier regional analyses of economic and social indicator covariances and correlations. It is also recognised that causal relationships between smart shrinkage policies and economic, QoL and

[4] As clearly stated by Närpiö's municipal director in an interview by the Finnish Broadcasting Company (YLE), see: https://yle.fi/a/3-8275212.

community vitality outcomes are complex. They are also in several cases dependent on the context: straightforward interpretations of cause-and-effect are therefore, if not impossible, exceedingly difficult to draw. This approach is, first and foremost, intended to help researchers in identifying potential regions that shrink smart, for the benefit of further case and comparative studies in the topic. A much more extensive body of empirical evidence is needed to determine and generalise the degree of impacts that smart shrinkage policies have on rural areas.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix

Table 4
Variables used for building the Economic vitality index based on the United Nations Sustainable Development Goals (UN SDGs).

Variable	Description	Year	Source
UN SDG 1: NO POVERTY			
Social assistance	Gross expenditure (€) measured as social assistance per capita during the calendar year	2019	THL
At-risk-of-poverty rate	Share of people living in households with low incomes	2018	StatFin
UN SDG 8: DECENT WORK AND ECONOMIC GROWTH			
Employment rate	Share of employed people aged 15 to 64	2018	StatFin
Workplaces	Change in the number of persons working in the municipality (%)	2010–2018	StatFin
Stock of enterprises	Change in enterprise openings and closures (%)	2013–2018	StatFin
Agriculture and horticulture	Change in enterprise openings and closures within agriculture and horticulture (%)	2010–2019	LUKE
Housing stock, free-time residences	Change in the housing stock of free-time residences (%)	2010–2019	SYKE
Housing stock, dwellings	Change in the housing stock of dwellings (%)	2010–2019	SYKE
Holiday residents	Share (of the total population) of holiday residents by municipality	2018	StatFin
Workplace self-sufficiency	Ratio between the number of people working in the area and the employed labour force living in the area	2018	StatFin
Commuting distance	Average commuting distance (km) between the place of residence and the workplace	2017	SYKE
Private sector	The share of persons working in the municipality that are employed by the private sector	2018	StatFin
Labour force	Change in the number of people aged 18 to 74 in employment (%)	2010–2018	StatFin

THL = Finnish Institute for Health and Welfare; StatFin = Statistic Finland; LUKE = Natural Resources Institute Finland; SYKE = Finnish Environment Institute.

Table 5
Variables used for building the Community vitality index based on the United Nations Sustainable Development Goals (UN SDGs).

Variable	Description	Year	Source
UN SDG 3: GOOD HEALTH AND WELL-BEING			
Elderly living at home	Share of people aged 75 and over who live at home	2019	THL
Morbidity[1]	Index describing the ill health of the population	2017	THL
Health and welfare coefficient[2]	Index describing the health and welfare coefficient on a scale of 0–100	2018	THL
Suicide investigations	Number of suicide investigations conducted by the police per population	2019	StatFin
UN SDG 4: QUALITY EDUCATION			
Highly educated	Share of people aged 20 to 64 with a tertiary level degree	2018	StatFin
Doctorates	Share of people with a doctorate level degree from the population of highly educated	2018	StatFin
Accessibility of primary schools	Share of primary school students with school trip less than 5 km	2015	SYKE
Municipal spending on education and culture	Municipal spending on education and culture (€/inhabitant)	2019	AFLRA
UN SDG 5: GENDER EQUALITY			
Women in municipal councils	Share of women elected for municipal councils	2017	StatFin
Income inequality	Relationship between the income of women and of men	2018	StatFin
Highly educated women	Share of women from the population of highly educated	2018	StatFin
Segregation, women	Share of women working in female-dominated sectors	2018	StatFin
Segregation, men	Share of men working in male-dominated sectors	2018	StatFin
UN SDG 7: AFFORDABLE AND CLEAN ENERGY			
Energy consumption	Overall energy utilisation (MWh/inhabitant)	2018	HINKU
Consumer electricity consumption	Energy use by households (MWh/inhabitant)	2018	HINKU
UN SDG 9: INDUSTRY, INNOVATION AND INFRASTRUCTURE			
Broadband	Share of households with broadband coverage (>100 mbit/s)	2018	Traficom
Business promotion	Municipal spending on business promotion (€/inhabitant)	2019	AFLRA

(*continued on next page*)

Table 5 (*continued*)

Variable	Description	Year	Source
UN SDG 10: REDUCED INEQUALITIES			
Lowest income category	Share of people belonging to the lowest (10%) income category	2019	StatFin
Gini coefficient	Gini coefficient	2019	StatFin
Social exclusion	Share of people aged 18 to 24 at risk of social exclusion (not working, not studying, not in national service)	2017	THL
Youth unemployment	Share of unemployed young people aged 18 to 24	2019	THL
Transition from school to further education	Direct transition to further studies of completers of the 9th grade of comprehensive school	2018	Vipunen
UN SDG 11: SUSTAINABLE (CITIES AND) COMMUNITIES			
Overcrowding	Share of overcrowded households	2019	StatFin
Municipal spending on environmental services	Municipal spending on environmental services (€/inhabitant)	2019	AFLRA
Fine particle concentration	Annual average of concentration of fine particles in outdoor air	2015	THL
Public transport	Share of people having access to (profitable) public transportation	2019	SYKE
UN SDGs 12 & 13: RESPONSIBLE CONSUMPTION AND PRODUCTION & CLIMATE ACTIONS			
Waste	Does the municipality have goals to reduce municipal waste (yes/no)?	2019	THL
Carbon emissions	Does the municipality have goals to reduce carbon emissions (yes/no)?	2019	THL
Greenhouse gas emissions	Greenhouse gas emissions per inhabitant	2018	SYKE
HINKU municipality	Does the municipality belong to the "Towards Carbon Neutral Municipalities" (HINKU) -network (yes/no)?	2019	HINKU
UN SDG 16: PEACE, JUSTICE AND STRONG INSTITUTIONS			
Crime	Offences against life and health recorded by the police per population	2019	StatFin
Sexual offences	Number of sexual offences reported by the police per population	2019	StatFin
Voting	Voting turnout in municipal elections	2017	StatFin
Youth in municipal councils	Share of youth elected to municipal councils	2017	StatFin

AFLRA = Association of Finnish Local and Regional Authorities; HINKU = Carbon Neutral Municipalities Network; Traficom = Finnish Transport and Communications Agency; Vipunen = Education Statistics Finland.

[1] See: http://raportit.kela.fi/approot/lisatied/NIT079A_en.html.

[2] See: https://sotkanet.fi/sotkanet/en/metadata/indicators/5340.

References

Berglund, L., 2020. Critiques of the shrinking cities literature from an urban political economy framework. J. Plann. Lit. 35 (4), 423–439.

Cloke, P., 1977. An index of rurality for England and Wales. Reg. Stud. 11 (1), 31–46.

Costanza, R., Fisher, B., Ali, S., Beer, C., Bond, L., Boumans, R., Danigelis, N., et al., 2007. Quality of life: an approach integrating opportunities, human needs, and subjective well-being. Ecol. Econ. 61 (2–3), 267–276.

Cummins, R., Eckersley, R., Pallant, J., Van Vugt, J., Misajon, R., 2003. Developing a national index of subjective wellbeing: the Australian unity wellbeing index. Soc. Indicat. Res. 64 (2), 159–190.

Diener, E., Suh, E., 1997. Measuring quality of life: economic, social, and subjective indicators. Soc. Indicat. Res. 40 (1–2), 189–216.

Donner-Amnell, J., 2020. Vitality and sustainable development outside growth regions? Case studies from Jämtland, Sweden and Kainuu, Finland. Terra 132 (3), 115–131.

Drewes, J., van Aswegen, M., 2011. Determining the vitality of urban centres. In: Brebbia, C.A. (Ed.), The Sustainable World. WIT Press, Southampton, pp. 15–25.

Ehrenfeucht, R., Nelson, M., 2012. Recovery in a shrinking city: challenges to rightsizing post-Katrina New Orleans. In: Dewar, M., Thomas, J. (Eds.), The City after Abandonment. University of Pennsylvania Press, Philadelphia, pp. 133–150.

ESPON, 2021. Quality of Life Measurement and Methodology: Final Report. ESPON, Luxembourg.

Etuk, L., Acock, A., 2017. Toward a rural community vitality measurement practice. Community Dev. 48 (1), 141–153.

Ferguson, R., Wilkinson, W., Hill, R., 2000. Electricity use and economic development. Energy Pol. 28 (13), 923–934.

Giannias, D., Liargovas, P., Manolas, G., 1999. Quality of life indices for analysing convergence in the European Union. Reg. Stud. 33 (1), 27–35.

Grant, J., 2009. Theory and practice in planning the suburbs: challenges to implementing new urbanism, smart growth, and sustainable principles. Plann. Theor. Pract. 10 (1), 11–33.

Haase, A., Bernt, M., Großmann, K., Mykhnenko, V., Rink, D., 2016a. Varieties of shrinkage in European cities. Eur. Urban Reg. Stud. 23 (1), 86–102.

Haase, A., Rink, D., Grossmann, K., 2016b. Shrinking cities in post-socialist Europe: what can we learn from their analysis for theory building today? Geogr. Ann. B 98 (4), 305–319.

Hackworth, J., 2015. Rightsizing as spatial austerity in the American rust belt. Environ. Plann. 47, 766–782.

Hartt, M., 2019. The prevalence of prosperous shrinking cities. Annals of the American Association of American Geographers 109 (5), 1651–1670.

Hartt, M., 2020. Shifting perceptions in shrinking cities: the influence of governance, time and geography on local (in)action. Int. Plann. Stud. 25 (2), 150–165.

Hoekstra, M., Hochstenbach, C., Bontje, M., Musterd, S., 2020. Shrinkage and housing inequality: policy responses to population decline and class change. J. Urban Aff. 42 (3), 333–350.

Hollander, J., 2011. Can a city successfully shrink? Evidence from survey data on neighbourhood quality. Urban Aff. Rev. 47 (1), 129–141.

Hollander, J., Cahill, B., 2011. Confronting population decline in the Buffalo, New York region: a close reading of the "Erie-Niagara framework for regional growth". J. Architect. Plann. Res. 28 (3), 252–267.

Hollander, J., Németh, J., 2011. The bounds of smart decline: a foundational theory for planning shrinking cities. Housing Policy Debate 21 (3), 349–367.

Hospers, G.-J., 2014. Policy responses to urban shrinkage: from growth thinking to civic engagement. Eur. Plann. Stud. 22 (7), 1507–1523.

Hospers, G.-J., Syssner, J., 2018. Dealing with Urban and Rural Shrinkage: Formal and Informal Strategies. LIT Verlag, Zürich.

Jolliffe, I., 2002. Principal Component Analysis. Springer, New York.

Kahila, P., Hirvonen, T., Jolkkonen, A., Kurvinen, A., Lemponen, V., Makkonen, T., Rautiainen, S., et al., 2022. Mitä on älykäs sopeutuminen? Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja (42), 2022.

Küpper, P., Kundolf, S., Mettenberger, T., Tuitjer, G., 2018. Rural regeneration strategies for declining regions: trade-off between novelty and practicability. Eur. Plann. Stud. 26 (2), 229–255.

LaFrombois, M., Park, Y., Yurcaba, D., 2019. How U.S. cities plan for change: comparing population projections and planning strategies in depopulating U.S. cities. J. Plann. Educ. Res. https://doi.org/10.1177/0739456X19854121 (in print).

Lehtonen, O., Tykkyläinen, M., 2010. Self-reinforcing spatial clusters of migration and socio-economic conditions in Finland in 1998–2006. J. Rural Stud. 26 (4), 361–373.

Makkonen, T., Inkinen, T., 2014. Spatial scaling of regional strategic programmes in Finland: a qualitative study of clusters and innovation systems. Nor. Geografisk Tidsskr. 68 (4), 216–227.

Makkonen, T., Inkinen, T., 2015. Geographical and temporal variation of regional development and innovation in Finland. Fennia 193 (1), 134–147.

Makkonen, T., Kahila, P., 2021. Vitality policy as a tool for rural development in peripheral Finland. Growth Change 52 (2), 706–726.

Makkonen, T., Inkinen, T., Rautiainen, S., 2022a. Mapping spatio-temporal variations of shrinkage in Finland. Fennia. https://doi.org/10.11143/fennia.119495 (in print).

Makkonen, T., Jolkkonen, A., Kurvinen, A., Lemponen, V., 2022b. Sopeutuvat innovatiiviset maaseudut. Spatia raportteja 2022 (2).

Martinez-Fernandez, C., Wu, C.T., Schatz, L.K., Taira, N., Vargas-Hernández, J.G., 2012. The shrinking mining city: urban dynamics and contested territory. Int. J. Urban Reg. Res. 36 (2), 245–260.

Martinez-Fernandez, C., Weyman, T., Fol, S., Audirac, I., Cunningham-Sabot, E., Wiechmann, T., Yahagi, H., 2016. Shrinking cities in Australia, Japan, Europe and the USA: from a global process to local policy responses. Prog. Plann. 105, 1–48.

Maskey, R., Fei, J., Nguyen, H., 2018. Use of exploratory factor analysis in maritime research. Asian Journal of Shipping and Logistics 34 (2), 91–111.

Meijer, M., Syssner, J., 2017. Getting ahead in depopulating areas: how linking social capital is used for informal planning practices in Sweden and The Netherlands. J. Rural Stud. 55, 59–70.

Németh, J., Hollander, J., Whiteman, E., Johnson, M., 2020. Planning with justice in mind in a shrinking Baltimore. J. Urban Aff. 42 (3), 351–370.

Oswalt, P., Rieniets, T., 2006. Atlas of Shrinking Cities. Hatje Cantz, Berlin.

Pallagst, K., Fleschurz, R., Said, S., 2017. What drives planning in a shrinking city? Tales from two German and two American cases. Town Plan. Rev. 88 (S), 15–28.

Panagopoulos, T., Barreira, A.P., 2012. Shrinkage perceptions and smart growth strategies for the municipalities of Portugal. Built. Environ. 38 (2), 276–292.

Peters, D., Fisher, H., Zarecor, K., 2017. Shrink Smart Small Towns: Communities Can Still Thrive as They Lose Population, vol. 486. Iowa State University Extension and Outreach Publications.

Peters, D., Hamideh, S., Zarecor, K., Ghandour, M., 2018. Using entrepreneurial social infrastructure to understand smart shrinkage in small towns. J. Rural Stud. 64, 39–49.

Popper, D., Popper, F., 2002. Small can be beautiful: coming to terms with decline. Planning 68 (7), 20–23.
Rhodes, J., Russo, J., 2013. Shrinking smart? Urban redevelopment and shrinkage in Youngstown. Urban Geogr. 34 (3), 305–326.
Rodríguez-Pose, A., 2018. The revenge of the places that don't matter (and what to do about it). Camb. J. Reg. Econ. Soc. 11 (1), 189–209.
Runge, A., Runge, J., Kantor-Pietraga, I., Krzysztofik, R., 2020. Does urban shrinkage require urban policy? The case of a post-industrial region in Poland. Regional Studies, Regional Science 7 (1), 476–494.
Ryan, B., Gao, S., 2019. Plan implementation challenges in a shrinking city. J. Am. Plann. Assoc. 85 (4), 424–444.
Saarinen, J., 2003. The regional economics of tourism in Northern Finland: the socio-economic implications of recent tourism development and future possibilities for regional development. Scand. J. Hospit. Tourism 3 (2), 91–113.
Schilling, J., Logan, J., 2008. Greening the Rustbelt: a green infrastructure model for right sizing America's shrinking cities. J. Am. Plann. Assoc. 74 (4), 451–466.
Sousa, S., Pinho, P., 2015. Planning for shrinkage: paradox or paradigm. Eur. Plann. Stud. 23 (1), 12–32.
Syssner, J., Meijer, M., 2020. Innovative planning in rural, depopulating areas: conditions, capacities and goals. In: Hagen, A., Higdem, U. (Eds.), Innovation in Public Planning. Palgrave Macmillan, Cham, pp. 151–169.
Tabachnick, B., Fidell, L., 2007. Using Multivariate Statistics. Pearson Education, Boston.
Tietjen, A., Jørgensen, G., 2016. Translating a wicked problem: a strategic planning approach to rural shrinkage in Denmark. Landsc. Urban Plann. 154, 29–43.
Wiechmann, T., Pallagst, K., 2012. Urban shrinkage in Germany and the USA: a comparison of transformation patterns and local strategies. Int. J. Urban Reg. Res. 36, 261–280.
Wirth, P., Elis, V., Müller, B., Yamamoto, K., 2016. Peripheralisation of small towns in Germany and Japan: dealing with economic decline and population loss. J. Rural Stud. 47, 62–75.
Zarecor, K., Peters, D., Hamideh, S., 2021. Rural smart shrinkage and perceptions of quality of life in the American Midwest. In: Martinez, J., Mikkelsen, C., Phillips, R. (Eds.), Handbook of Quality of Life and Sustainability. Springer, Cham, pp. 395–415.