



Multidimensional poverty: an analysis of definitions, measurement tools, applications and their evolution over time through a systematic review of the literature up to 2019

Ida D'Attoma¹ · Mariagiulia Matteucci¹

Accepted: 28 October 2023
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Abstract

The paper provides an overview of definitions, measurements and applications of the concept of multidimensional poverty through a systematic review. The literature is classified according to three research questions: (1) what are the main definitions of multidimensional poverty?; (2) what methods are used to measure multidimensional poverty?; (3) what are the dimensions empirically measured?. Findings indicate that (1) the research on multidimensional poverty has grown in recent years; (2) multidimensional definitions do not necessarily imply to leave behind the dominance of the economic sphere; (3) the most popular methods proposed in the literature deal with the Alkire–Foster methodology, followed by latent variable models. Recommendations for future research emerge: new methodologies or the improvement of current ones are rather relevant; intangible aspects of poverty start to deserve attention calling for new definitions; there is evidence of under researched geographical areas, thereby calling for new empirical works that expand the geographical scope.

Keywords Multidimensional poverty · Multidimensional well-being · Multidimensional inequality · Multidimensional poverty indexes · Systematic literature review

1 Introduction

The human capital is an essential resource for the growth of a country. Individuals or groups who are in poverty have to be helped to improve their conditions in order to experience a dignified life. With this in mind, poverty, its understanding, measuring, and reduction are at the center of socio-economic and political programs of governments in developing and non-developing countries. In particular, the way how it is measured determines the directions of governments' lines of interventions. The other side of poverty is wealth. As

✉ Ida D'Attoma
Ida.dattoma2@unibo.it

¹ Department of Statistical Sciences, University of Bologna, Via delle Belle Arti 41, 40126 Bologna, Italy

reported in Peichl and Pestel (2013, p. 4551) “the rich are an important source of both economic growth and inequality and have considerable economic and political power.” Therefore, in terms of design of public policies it becomes important not only who the poor are but also who the rich are.

We started our review from the belief, not new in the literature (see for example Petrillo 2018), that people well-being is far from being a unidimensional concept based only on the monetary aspects (i.e. income). Instead, other aspects of human life have to be included in order to enrich the idea of well-being.

As a matter of fact, the conceptualization of poverty ranges from income and/or consumption-based definitions to others that consider its multidimensional nature and its many manifestations: lack of productive resources to sustain livelihoods, limited or no access to basic services such as water, health and education, malnutrition, increased morbidity and mortality, living in an unsafe or insecure environment, poor or no housing, lack of participation in social, cultural and political life, social exclusion (Botchway 2013).

Originally, the literature on poverty has dwelt a great deal on the economic dimension as poverty manifestations and measurement were based on the GDP (at a national level) and on the poverty line.

Only recently, poverty has been increasingly conceptualized and measured from a multidimensional perspective in order to provide policy makers and the general public with the necessary tools for effectively monitoring social changes (Iglesias et al. 2017). For instance, policy makers who have often underestimated the need to define poverty multidimensionally (Kana Zeumo et al. 2011), started to consider it as a multidimensional concept. A number of factors made the multidimensional poverty concept appealing to them: (1) different measurements based on single indicators may produce different results (Lister 2004; Barnes et al. 2002) and the consideration of multidimensionality may prevent such a risk when policy makers evaluate policy impacts and targets to reduce poverty, (2) as income-based poverty and multidimensional poverty do not overlap, policies need to be addressed to different aspects of citizens' lives, other than economic wellness.

However, such a relatively new conceptualization is still far from consolidation (Aaberge and Brandolini 2014). Furthermore, how many aspects of multidimensionality are jointly measured remains still an open debate.

Yet this growing literature is highly fragmented and to the authors' knowledge no systematic review has been recently carried out on the concept of multidimensional poverty. It is acknowledged that a systematic literature review is considered the gold standard for evidence assessment and it is “the most efficient and high-quality method for identifying and evaluating extensive literature” (Mulrow 1994). It makes explicit the values and assumptions underpinning a review and enhances the legitimacy and authority of the resulting evidence (Tranfield et al. 2003). Systematic reviews use a rigorous method of study selection and data extraction and typically involve a detailed and comprehensive plan and search strategy derived a priori that reduce selection bias, which is very common in narrative reviews.

Using the systematic literature review (SLR) methodology, the aim of this paper is to identify the main definitions of poverty, to review how the concepts of “multidimensional poverty” and “multidimensional poverty measurement” have been developed, and which are the dimensions considered in empirical analysis, ultimately.

This specific objective leads to the achievement of a more general goal, which is to serve as a bibliometric reference for researchers who will need to deal with the topic of multidimensional poverty in the three areas investigated: definitions, methods, and empirical analysis.

Specifically, the method followed is the SLR procedure as transferred from medicine to business and economics research by Tranfield et al. (2003), employing specific criteria for inclusion and exclusion of articles in and from the review.

Through the SLR we aim at identifying the main definitions of poverty with special emphasis on different aspects encompassed in the definition, the methods proposed in the literature to study the multidimensional concept of poverty, and the dimensions included in the empirical applications.

A total of 229 articles were finally included. The key information related to these articles was stored in a data repository¹ specifically designed for recording their characteristics. After that, the main information has been summarized and discussed. The most relevant findings of the SLR can be outlined as follows. First, the analysis of the definitions of multidimensional poverty showed that only few studies proposed a new definition (10 studies out of 229). Also, most definitions included the income-based poverty as focus. Second, among the new methodological proposals, the relative majority of studies proposed modifications of the Alkire–Foster method (Alkire and Foster 2007, 2009, 2011a) in terms of weighting schemes or methods of identification and aggregation of the dimensions. Only few studies (about 10%) proposed a comparison among different methodological approaches. Last, with reference to empirical applications, it emerged that not all the hypothesized dimensions are jointly considered and there was not observed a uniform geographical coverage of the continents. In this respect, a lack of studies related to USA emerged. Moreover, a certain preference for secondary data was observed with a predominant use of surveys that clearly show the extant need of producing internationally comparable “poverty” data with harmonized questionnaires by country and by year.

The main contribution of the paper is to bring together in one single research the most relevant studies about multidimensional poverty in order to find possible avenues for future research.

The rest of the paper is organized as follows. Section 2 describes the methodology employed to conduct the systematic review; Sect. 3 describes the main characteristics of the studies included in the final data repository and provides the results from an in-depth review of the studies; Sect. 4 summarizes the main findings, discusses and concludes.

2 Methodology of the literature review

According to the Cochrane Handbook (Higgins and Green 2011; Higgins et al. 2020) “A systematic review attempts to collate all empirical evidence that fits pre-specified eligibility criteria in order to answer a specific research question. It uses explicit, systematic methods that are selected with a view to minimizing bias, thus providing more reliable findings from which conclusions can be drawn and decisions made”. The SLR here conducted follows three main stages—planning, executing, and reporting, as described in Tranfield et al. (2003). At the same time, we rely on the methodological guide summarized by Mohamed Shaffril et al. (2021), who have provided an all-encompassing and up-to-date guide to conducting systematic review for non-health researchers.

¹ The data repository is available upon request.

2.1 Planning

2.1.1 Conceptual development and research questions

Scholars and practitioners agree that one indicator alone cannot capture the multiple aspects of the poverty that is undisputedly considered a multidimensional concept (see Kana Zeumo et al. 2011 for a review).

According to the World Bank's (2001) report, poverty is a state of deprivation which encompasses not only material but also non-material aspects. Furthermore, the concept of poverty is evolutive (Kana Zeumo et al. 2011) and its manifestations are related to the structures of the society and to the period in which poverty is discussed. Therefore, defining poverty is not a simple task as various studies do not agree on a common and conclusive definition.

With this in mind, we posit the following research question:

RQ1 What are the main definitions of poverty and related concepts proposed in a multidimensional setting?

Poverty measurement is a crucial task. Indeed, only through its measurement authorities and policy makers are able to quantify its extent, intensity, and potential effect so as to gauge subsequent actions. We start from considering that the operationalization of a multidimensional poverty concept has to deal with different theoretical and methodological choices (see Dewilde 2004). Therefore, technically speaking, the problem becomes how to construct a multidimensional index. With this in mind, we posit the following research question:

RQ2 What are the methods proposed to measure the multidimensional poverty concept?

Poverty can be declined with respect to several dimensions: income, human rights, food, education, health to cite the most common. However, in empirical contexts it may be difficult to effectively measure all the dimensions as assumed in conceptual frameworks. We expect that the literature review will reflect the fact that the notion of poverty has gradually been enlarged from an income-based to a multidimensional concept, and in the same fashion of Dewilde (2004), that the operationalization of the concept has not followed the same development. To put it differently, we might expect a mismatch between the dimensions conceptually developed and the number of dimensions empirically measured. In light of this view, we posit the following research question:

RQ3 What are the dimensions measured in empirical works?

2.2 Executing

2.2.1 Identification of studies and data collection

2.2.1.1 Selection of keywords We selected keywords that in our conceptual view were relevant for finding articles addressing the afore mentioned research questions and that were

Table 1 Databases and search options

Databases	Search options
Scopus	Time span: all years up to 2019 Language: English Document type: Article Source type: Journals Search in: Article title, Abstract, Keywords
Web of Science (WoS)	Time span: all years up to 2019 Language: English Document type: Article Search in: Topic Citation databases: Science Citation Index Expanded (SCI-EXPANDED), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), Emerging Sources Citation Index (ESCI)

We decided to exclude reviews as our study is not aimed at studying ‘meta-review’ (Closs et al. 2016), namely a systematic review of reviews

specific enough to avoid the inclusion of non-relevant publications and formulated in order to avoid the exclusion of potentially relevant and insightful works.

The chosen keywords, namely, ‘multidimensional inequality’, ‘multidimensional poverty’, ‘multidimensional well-being’, and ‘multidimensional wellbeing’, all refer to the broad concept of poverty. The concept of poverty from a stand-alone viewpoint (e.g., income-only poverty) was not considered. It is worth to note that in the selection of keywords, we did not differentiate among terms that describe methodology (e.g., ‘measures’, ‘indicators’) or terms addressing the type of investigation (e.g., ‘case study’, ‘empirical’, ‘theoretical’, ‘analysis’).

2.2.1.2 Selection of databases Like in other studies (e.g., Dangelico and Vocalelli 2017; Vivas and Barge-Gil 2015) we chose the following databases for this research: (a) Elsevier Scopus and (b) Clarivate Analytics Web of Science (WoS). Descriptions of the search options are provided in Table 1.

All databases were searched using the four abovementioned keywords. Table 2 reports the number of results obtained for each keyword within each database. Specifically, in the last two rows, the total numbers of retrieved studies within each database and across keywords (total, net of duplicates) are reported.

2.2.2 Selection of studies

Once the results of the searches reported in Table 2 were collected and the duplicated studies, within and across databases, were discharged, we obtained a list of 669 results that were archived in a Microsoft Excel file. In a SLR it is critical to operationally define which types of studies to include and exclude (Uman 2011). To this end, we decided to include studies that were clearly able to satisfy at least one of the three research questions (RQ1–RQ2–RQ3) reported in Sect. 2.1. In particular, we included studies which provide a new definition of poverty in a multidimensional setting, propose a new method to study multidimensional poverty, or deal with a real-data application to support evidence on this topic. The exclusion criteria were defined as follows:

Table 2 Keywords employed in the literature search and number of results for each database (14 January 2020)

Keywords	Scopus	WoS	Scopus + WoS
'Multidimensional inequality' ^a	91	72	163
'Multidimensional poverty'	443	398	841
'Multidimensional well-being'	68	59	127
'Multidimensional wellbeing'	20	16	36
Total	622	545	1167
Total (<i>net of duplicates</i>) ^b	608 (net of duplicates within SCOPUS across keywords)	531 (net of duplicates within WOS across keywords)	669 (net of duplicates across databases and across keywords)

^aIn WoS, TS= 'Multidimensional inequality' finds records of articles containing the exact phrase "Multidimensional inequality" in a topic field

^bDuplicates may be found within the same database as different keywords may select the same studies

1. studies that did not strictly focus on the concept of multidimensional poverty as they did not propose a definition, a new method, or an application to real data on this topic;
2. studies that dealt with “multidimensional inequality” only from a mathematical point of view;
3. studies that dealt with economic or income aspects of poverty only, and therefore were not strictly considering a multidimensional concept;
4. studies that focused on well-being from a medical point of view only;
5. studies that did not focus on individuals or households, but, for example, on firms;
6. studies that dealt with specific categories of subjects only (e.g., patients, children, females, people with disabilities, aging population, workers, ...) as the main focus of the systematic review is on households or individuals in general and not on specific categories of the population;
7. studies where multidimensional inequality was studied in relation to other aspects (e.g., mental health, gender) or as their determinant;
8. theoretical studies investigating the statistical and mathematical properties of inequality measures already proposed in the literature, as their focus was not on proposing a new definition, method or an application to real data;
9. studies that dealt with applications in a very limited geographical area (e.g. small rural areas of a specific region of a country, very small sample size);
10. studies whose abstract did not clear up the focus of the study;
11. studies where the dimensions considered were not clearly defined;
12. reviews.

In this phase, it was important to balance sensitivity (retrieving a high proportion of relevant studies) with specificity (retrieving a low proportion of irrelevant studies). A total of 314 potentially relevant articles has been retrieved once the title and abstract were reviewed according to the above-mentioned inclusion and exclusion criteria.

2.2.2.1 Study quality assessment Once a comprehensive list of abstracts has been retrieved and reviewed, the 314 articles were fully analyzed and their quality was assessed. More precisely, as 14 full-text files were not available and 3 studies were written in Spanish or German,² a number of 297 studies were fully read. The final sample was reduced to a total of 229 articles (see a list of the studies in “Appendix”). The steps of the study selection process are reported in Fig. 1.

As shown in Fig. 1, we identified 608 records from Scopus and 531 from WoS, net of duplicates within each database. After removing duplicates, 669 abstracts were screened, which resulted in removing 355 records with not relevant abstract, leaving to 314 potentially relevant records to be screened by the lead authors. Of these 314 records, 68 not relevant, 14 with a not available full-text, and 3 not written in English articles were excluded, thus leaving a final sample of 229 studies to be included in the systematic review for data extraction.

The reason to exclude some articles was that they did not match any of the specified inclusion criteria, but matched at least one of the exclusion criteria, although this was not clear from the abstracts. Among the exclusion criteria previously defined, the top motives for the exclusions were:

² Although these articles have an abstract written in English, the main text was not written in English.

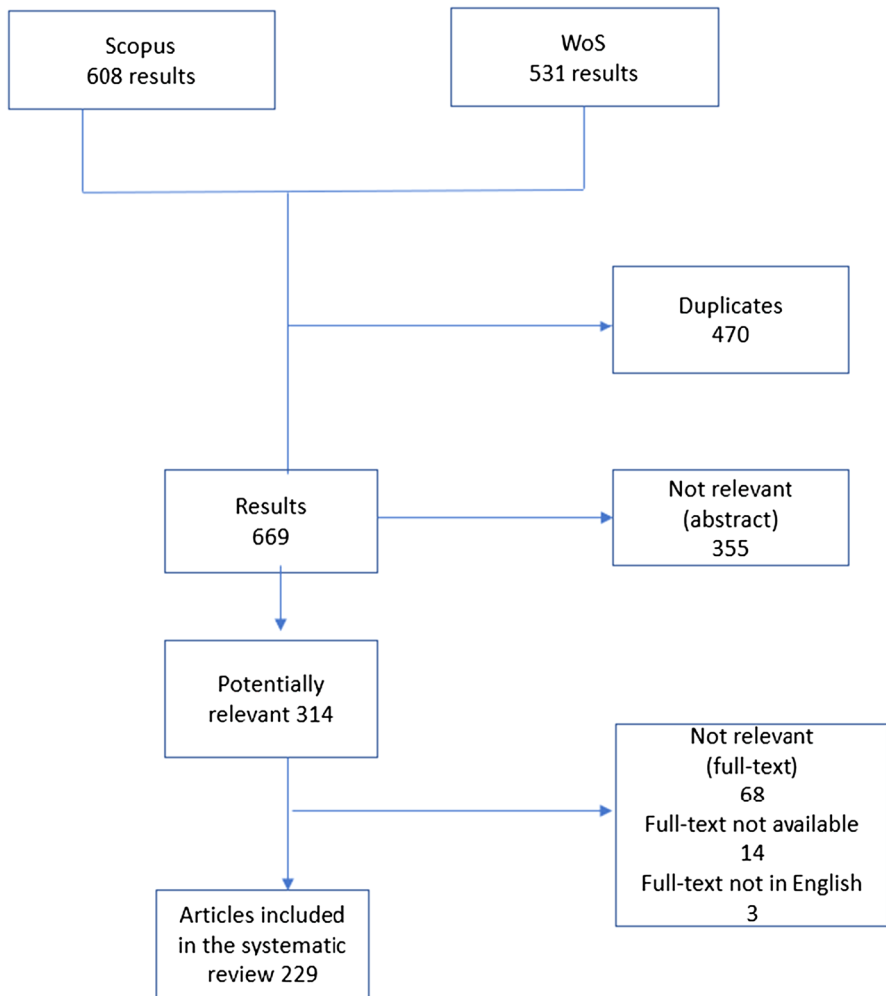


Fig. 1 Steps of the study selection process

- the study was theoretical only (21 records; 25%);
- the study did not answer to any of the three research questions and therefore does not strictly focus on multidimensional poverty (15 records; 18%);
- the full-text was not available (14 records; 16%).
- the study investigated multidimensional inequality in relation to other aspects (e.g., mental health, gender) or as their determinant (11 records; 13%);
- the geographical area or the sample size were very limited (11 records; 13%);
- the study focused on females or children only (4 records; 5%);
- the dimensions of poverty considered in the study were not made explicit (3 records; 4%);
- the language was not English (3 records; 4%);
- the only dimension considered was income (2 records; 2%);
- the study was a review (1 record; 1%).

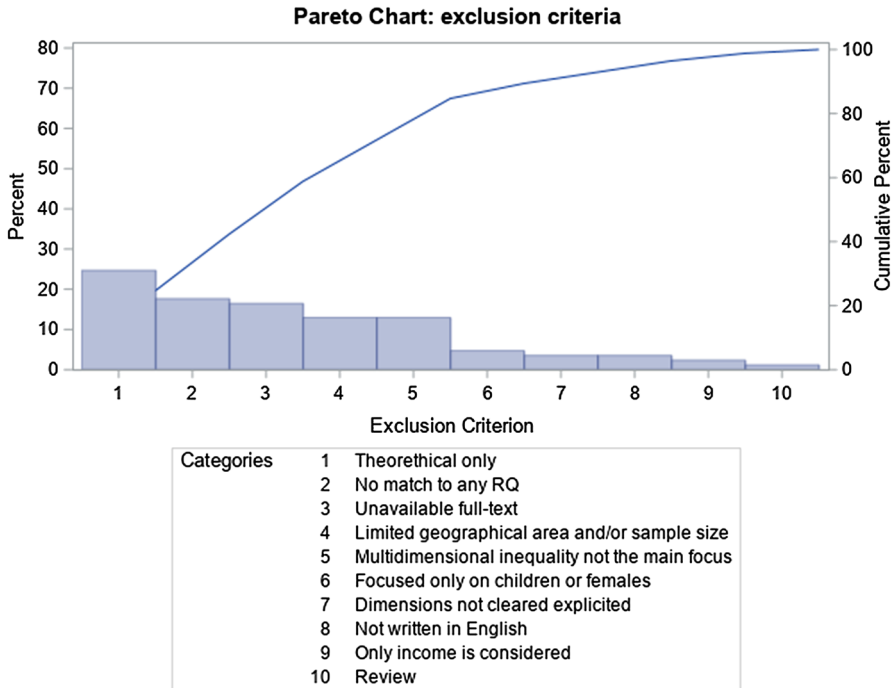


Fig. 2 Pareto Chart representing the main exclusion criteria

The Pareto chart (Fig. 2) reports the top motives of exclusions along with their cumulative frequencies.

Apart from the fact that the study ‘only theoretical’ was the main exclusion criterion, the Pareto chart makes clear that ‘theoretical only’, ‘no match to any RQ’, ‘unavailable full-text’, ‘limited geographical area and/or sample size’ and ‘multidimensional inequality not the main focus’ together represent the 80% of the exclusion criteria.

2.2.2.2 Data extraction and data repository Three types of information from each article were retrieved and stored in the data repository: (1) general information from the articles (authors, year, journal name, title, bibliographic database, keyword matching), (2) information about the matching with the three research questions (definition, method, application), and (3) information about the application, if any. For empirical applications, we reported the following details: methods of analysis, sample description (size, statistical units), geographical area (country or other), years covered, data collection type (cross sectional or longitudinal), data source (primary or secondary, source name), data representativeness (national, country comparisons), dimensions considered (economic/income, education, health, living standards, others), number and name of dimensions, number of indicators, main findings.

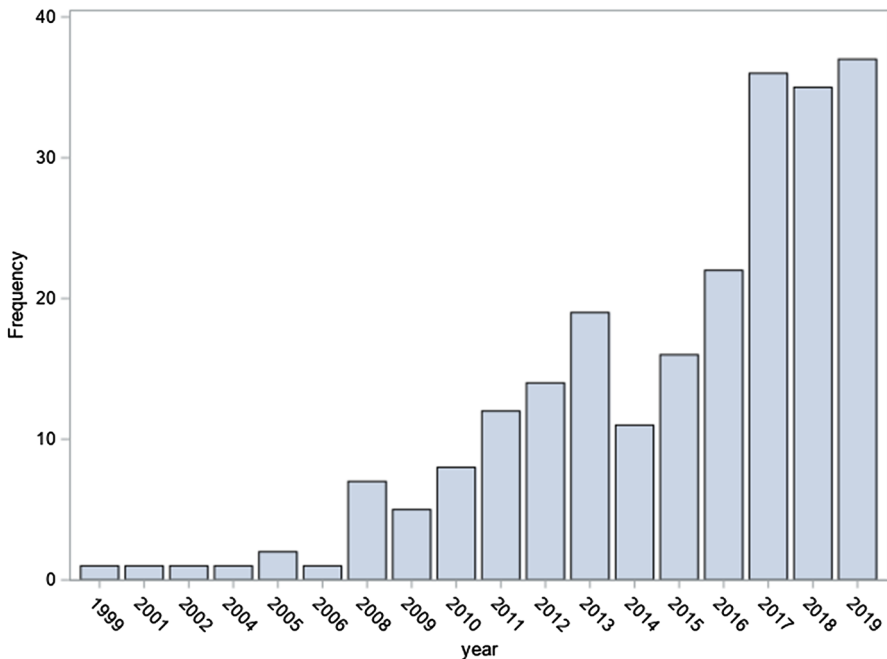


Fig. 3 Publications per year

3 Reporting

3.1 Characteristics of studies included in the review

Figure 3 shows the distribution of studies over time and lead us to conclude that research associated with multidimensional poverty has grown in recent years. The year distribution of the sample is from 1999 to 2019. Over 60% of the sample is from studies published between 2015 and 2019.

The first study included in the review dates back to 1999. Until 2006 there has been a quite constant and limited number of studies, while after 2006 there has been an increase in the number of studies with a picking up speed starting from 2013 and a peak in 2019. Hence, most of the articles are recent, thus evidencing an increasing interest for poverty as a multi-dimensional concept in the literature.

Table 3 reports the name of the main journals where the reviewed studies were published. The journal that published most of the studies included in the review is “Social Indicator Research” (23% of studies), followed by “World Development” (4.8%) and by “The Journal of Economic Inequality” (4.4%). Interestingly, about 36% of the studies (82 out of 229) have been published in journals that host only one paper of this review. The journals publish work related to the economic, statistical, and social fields, mainly.

Table 3 Number of articles included in the review per each journal

Publication name	Number of articles
Social Indicators Research	53
World Development	11
The Journal of Economic Inequality	10
Review of Income and Wealth	8
International Journal of Social Economics	6
Journal of International Development	4
The Journal of Development Studies	4
Empirical Economics	3
Forum for Social Economics	3
Journal of Human Development and Capabilities	3
Journal of Public Economics	3
Poverty & Public Policy	3
Quality & Quantity	3
Revista de Administracao Publica	3
Social Choice and Welfare	3
The Pakistan Development Review	3
African Development Review-Revue Africaine De Developpement	2
Applied Economics	2
CEPAL Review	2
Ecological Indicators	2
Economic Modelling	2
Economica	2
Fiscal Studies	2
International Journal of Recent Technology and Engineering	2
Journal of Policy Modeling	2
Socio-Economic Planning Sciences	2
Sustainability	2
The Journal of Socio-Economics	2
Others (one article per journal)	82
Total	229

3.2 What is known about the multi-dimensional concept of poverty

Articles included in the review were classified into three different clusters (C1, C2, C3) according to the research questions they have addressed: (1) RQ1: what are the main definitions of poverty and related concepts in a multidimensional setting? (C1, 10 articles); (2) RQ2: what are the methods to measure the multidimensional poverty concept? (C2, 116 articles); and (3) RQ3: what are the relevant dimensions measured in empirical works? (C3, 214 articles). Table 4 reports the classification of the studies according to the three research questions. As can be noticed, the three clusters of studies examined were not mutually exclusive, as some of them (around 45%) addressed more than one research question. More in detail, as reported in Table 4, 111 studies answer to RQ3 only, 94 studies involve both methods and applications to real data (i.e., they satisfy both RQ2 and RQ3),

Table 4 Number of articles included in the review for different combinations of the research questions

RQ	Number of studies
RQ1-2-3	7
RQ1-2	1
RQ1-3	2
RQ2-3	94
RQ1	0
RQ2	14
RQ3	111
Total	229

14 studies satisfy RQ2 only, 7 studies satisfy all the RQs, 2 studies provide both a definition of multidimensional poverty and an empirical application (RQ1 and RQ3), and only 1 paper has been classified as proposing both a definition and a method (RQ1 and RQ2).

In “[Appendix](#)”, the full list of articles included in the review is reported.

In the following sections, the evidence coming from the studies belonging to the three clusters are described (Table 5).

3.2.1 What are the main definitions of poverty and related concepts in a multidimensional setting?

About 4% of the articles from the review were classified into C1 (10 articles). Out of the ten articles from C1, three defined the poverty as a multidimensional concept with a clear mention of the dimensions to be considered in addition to economic and monetary dimensions. Two articles considered more than one dimension, but still limited the definition to the economic and material spheres only (e.g., Annoni et al. 2015). The remaining definitions went beyond the material and economic spheres and included intangible or fuzzy dimensions like, for instance, ‘achievements’, ‘quality of life’, ‘living right’.

What emerged from the above definitions was that the consideration of more than one dimension did not necessarily imply to overcome the dominance of economic and material aspects in the conceptualization of poverty. Nevertheless, new dimensions belonging to the non-material sphere complemented the material ones.

3.2.2 What are the methods to measure the multidimensional poverty concept?

Among the selected studies, 116 have been classified in cluster C2 as they answer the RQ2 research question by discussing methods to measure the multidimensional poverty concept. These studies proposed a new method or an alternative version (or improvement) of an existing method to investigate the multidimensionality structure of poverty, inequality, or well-being from an original point of view.

Examining the methods, 105 articles have been classified as reporting a single method, 10 articles using two methods, and 1 article as reporting a comparison of three methods. Table 6 shows the list of studies and their classification, where the studies reporting more than one method are identified by a star (see the note to Table 6). The second column of Table 6 shows the 11 studies that explicitly mention the Sen’s capability approach (Sen

Table 5 Summary of CI articles: main definitions of poverty and related concepts

Author(s)	Year	Definition of poverty
Abraham and Kumar	2008, p. 80	"Poor are those who are farthest away from the highest possible level of achievement (or represent the worst level of achievement)"
Alkire and Santos	2014, p. 252	"Person's inability to meet the minimum international standards in indicators related to the Millennium Development Goals and to core functioning"
Annoni et al	2015, p. 536	"Poverty as a human condition of economic deprivation, thus limiting the concept to economic and material deprivation with respect to the broader concept of Quality of Life"
Belhadji and Limann	2016, p. 995	"Deprivation as a degree providing a quantitative expression to its intensity for individuals."
Gigliarano and Mosler	2009	Multidimensional polarization in terms of monetary and non-monetary attributes (like wealth and education) besides income. Polarization as a function of inequality between groups, inequality within-group and relative group size
Hick	2016	Poverty as Capability Deprivation is built around the two concepts of material poverty and multiple deprivation, where material poverty is defined as 'inadequate material living standards arising because of a lack of resources' (Hick 2014: 307) and multiple deprivation is defined as 'the enforced experience of low living standards' (Hick 2014: 310)
Iglesias et al	2017, p. 851	Multidimensional well-being conceptualized as composed of four dimensions: work-life balance, financial situation, employment situation, educational and occupational positioning
Mideros	2012	Multidimensional poverty defined using a rights-based approach, where the good living right (economic, social and cultural rights) are used to define dimensions of well-being
Peichl and Pestel	2013	An individual is considered multidimensionally as dimension-specific rich when its achievement in a particular dimension exceeds the respective cut-off. Then, the dimension-specific rich individuals are defined to be affluent in a multidimensional sense when the total number of affluent dimensions is greater than or equal to a certain threshold
Rao and Min	2018, p. 231	Decent living Standards (DLS) as a starting point for comprehensively specifying the material constituents of a multidimensional poverty indicator. DLS as a "lowest common denominator of basic material requirements that are instrumental (but not sufficient) to achieve physical, and to an extent social, dimensions of human wellbeing, whether conceived as basic needs or basic capabilities, and independent of peoples' values or relative stature in society"

Only where available, we reported the exact definition of poverty. In the remaining cases, we reported an approximate definition on the basis of the information available in the text of the reviewed study. The list of studies mentioned here can be found in "[Appendix](#)".

Table 6 Summary of C2 articles

Method	Capability approach	Author(s)	Year
Alkire–Foster method		Alkire and Foster	2011a
		Alkire and Santos	2014
		Alkire and Seth	2013
		Alkire et al.	2015
		Alkire, Apablaza et al.	2017
		Antoniades et al.	2019
		Bennett and Mitra	2013
		Berenger	2019
		Cavapozzi et al.*	2015
		Datt	2019a
		Datt	2019b
		Dehury and Mohanty	2017
		Espinoza-Delgado and Klasen	2018
		Gallardo	2019
		García-Pérez et al.	2017
		Goli et al.	2019
		Hasan and Ali	2018
		Hick	2016
		Hull and Guedes*	2013
		Idrees and Baig	2017
		Iglesias et al.*	2017
		Madden*	2015
		Mitra	2018
		Mitra and Brucker	2017
		Mitra et al.	2013
		Nicholas et al.	2019
		Nowak and Scheicher	2017
		Pattanaik and Xu	2018
		Saleem et al.	2019
		Sanogo	2019
		Santos et al.	2019
		Suppa	2018b
		Terzi	2013
Wagle	2014		
Latent variable models and methods	Yes	Berenger et al.*	2013
		Betti et al.*	2015
		Chowdhury and Mukhopadhaya	2012
		Chowdhury and Mukhopadhaya	2014
		Coromaldi and Zoli	2012
		Djossou et al.	2017
		Iglesias et al.*	2017
		Li et al.*	2019
		Ivaldi et al.	2016
		Moonansingh et al.	2019

Table 6 (continued)

Method	Capability approach	Author(s)	Year
		Noglo	2017
		Ntsalaze and Ikhide	2018
		Pasha	2017
	Yes	Phan and O'Brien	2019
		Quadrado et al.*	2001
Fuzzy theory		Belhadj	2011a
		Belhadj	2011b
		Belhadj	2012
		Belhadj	2013
		Belhadj and Limam	2012
		Berenger and Celestini	2006
		Betti et al.*	2015
		Betti et al.*	2018
		Ciani et al.	2019
		Hull and Guedes*	2013
		Pham and Mukhopadhaya	2018
	Yes	Rippin	2016
Gini index		Banerjee	2010
		Banerjee	2018
		Ciommi, Gigliarano et al.*	2017
		Decancq and Lugo	2012
		Gajdos and Weymark	2005
		McGillivray and Markova	2010
		Mussard and Alperin	2008
		Poppitz*	2019
Generalized mean aggregation		Decancq	2017
		Pinar	2019
		Seth	2009
		Seth	2013
Partial orderings/dominance techniques		Annoni et al.	2015
		Arndt et al.	2016
		Duclos et al.	2011
		Duclos et al.	2018
		Iglesias et al.*	2017
		Madden*	2015
Other	Yes	Aristei and Perugini	2010
		Betti et al.*	2018
		Bellani	2013
		Berenger et al.*	2013
		Bosmans et al.	2015
		Bosmans et al.	2018
		Bossert et al.	2013
		Calvo	2008
		Cavapozzi et al.*	2015

Table 6 (continued)

Method	Capability approach	Author(s)	Year
		Chakravarty et al.	2008
		Ciommi, Gigliarano et al.*	2017
		Croci Angelini and Michelangeli	2012
		de la Vega et al.	2010
		Decancq et al.	2009
		Decancq et al.	2017
		Decancq et al.	2019
		Deutsch and Silber	2005
	Yes	Döpke et al.	2017
	Yes	Durand	2015
		Esposito and Chiappero-Martinetti	2010
		Esposito and Chiappero-Martinetti	2019
		Gigliarano and Mosler	2009
		Greco et al.	2019
		Grosse et al.	2008
		Guo et al.	2018
	Yes	Kana Zeumo et al.	2014
		Kobus and Kurek	2019
		Krishnakumar and Nogales	2019
		Li et al.*	2019
		Lucchini et al.	2018
		Maasoumi and Racine	2016
		Maasoumi and Xu	2015
	Yes	Mauro et al.	2018
	Yes	Merz and Rathjen	2014
		Najera	2017
		Najera Catalan et al.	2019
		Otoiu et al.	2014
		Peichl and Pestel	2013a
		Pomati and Nandy	2019
		Poppitz*	2019
		Quadrado et al.*	2001
		Rao and Min	2018
		Rodero-Cosano et al.	2014
		Rohde and Guest	2018
		Savaglio	2011
		Tsui	1999
	Yes	Vizard and Speed	2016
		Yang	2018
		Zhong	2009

*Means that the article reports more than one method and it is therefore repeated in the table, e.g. the paper by Cavapozzi et al. (2015) is classified under both the “Alkire–Foster method” and the “other” categories. The list of studies mentioned here can be found in “Appendix”

1985) as theoretical framework of reference in their research. According to this approach, multidimensional well-being should be understood in terms of peoples' capabilities to achieve valuable functionings (beings and doings), emphasizing their freedom to choose and achieve well-being. As a matter of fact, this approach has been developed as an alternative approach to the traditional "welfarist" approach focusing on the utility only. The capability approach represents a general principle and therefore needs to be operationalized through a specific method.

As can be seen in Table 6, the most frequently used methodology in the literature is the Alkire–Foster (AF) method (Alkire and Foster 2007, 2009, 2011a) and its extensions, which have been employed in 34 studies overall (about 29% of all the studies). Among these, 30 studies use the AF method only while 4 studies report the use of different methods, besides the AF one. The AF method builds on the Foster–Greer–Thorbecke (FGT) poverty measures (Foster et al. 1984) with the aim of constructing a multidimensional index of poverty (MPI). By adopting a flexible approach, different dimensions of poverty are identified as different types of deprivations. The method is based on the counting approach as it counts the weighted number of dimensions in which people suffer deprivation by defining proper cut-offs.

The main innovations introduced by the studies using the AF method deal with the following issues: weighting schemes, methods of identification and aggregation of the dimensions. In fact, as reported in Mitra et al. (2013), "the Alkire Foster method is sensitive to the selection of dimensions and the methods used to derive rankings and weights". In Datt (2019), alternative weighting schemes, methods of identification and aggregation are proposed, finding evidence that the contribution of different dimensions involved in the estimation of multidimensional poverty may vary depending not only on the weighting schemes, but also on the interaction between them and the choices made in terms of identification and aggregation of dimensions. A new strategy for deriving weighting schemes comes from Cavapozzi et al. (2015), who proposed a hybrid approach based on the hedonic regression, where value judgements about the dimensions are combined to statistical evidence. With respect to the identification of the dimensions, a modification of the MPI was proposed by Nowak and Scheicher (2017) to include individuals who are extremely poor in only few dimensions and the differences with the respect to the original formulation have been showed in an empirical setting. Alkire et al. (2017), followed by Nicholas et al. (2019), combined the classical counting approach of the AF method (Alkire and Foster 2011a) for the analysis of multidimensional poverty at single time points, and the duration approach of Foster (2009) for over time analysis. In particular, Nicholas et al. (2019) showed that a large proportion of poverty may be attributed to over time deprivations. Finally, most studies propose modifications to the original formulation of the MPI based on the AF method by testing them in empirical settings (see, e.g., García-Pérez et al. 2017; Goli et al. 2019).

The second most commonly employed method is based on latent variables. Indeed, 15 articles (about 13%) have proposed latent variable models, such as factor analysis, or methods based on the concept of latent variables, such as principal component analysis or multiple correspondence analysis. In particular, one third of these studies use factor analysis, either in its confirmatory or exploratory version (see, e.g., Betti et al. 2015; Iglesias et al. 2017), one third use multiple correspondence analysis (see, e.g., Berenger et al. 2013), 4 of them use principal component analysis (see, e.g., Li et al. 2019) while, in the remaining study, latent class analysis based on discrete latent variables is proposed (Moonansingh et al. 2019). The aim of these studies has been to build a synthetic multidimensional measure of poverty or well-being, where each dimension is conceived

as a latent, non-observable, construct. Particularly worthy of note is the fact that about half of the studies using latent variable models or methods are published in the journal “Social Indicators Research” (7 articles out of 15).

The third most frequently proposed method to study multidimensional poverty is the fuzzy theory (12 articles, 10%). Specifically, the fuzzy set theory is used to propose new weighting schemes for the poverty dimensions (see, e.g., Belhadj 2012, 2013) and to overcome the classical notion of binary poverty (poor or not poor) by using fuzzy measures (Behlhadj and Limam 2012; Betti et al. 2015).

A total of 8 articles (6.9%) use the Gini index and its generalization to the multidimensional case for studying multidimensional poverty (see, e.g. Banerjee 2010). In this field of literature, the Gini coefficient is used to measure the extent of inequality.

Moreover, the stochastic dominance and partial order theory have been proposed in 6 studies (about 5%) for synthesizing multidimensional data as opposed to the classical approaches based on composite indicators, such as the AF method or factor analysis. In particular, the posetic (partially ordered set) approach has been proposed in this field to deal with the issues of weighting and aggregating for ordinal data (Iglesias et al. 2017) by following the proposal of Fattore (2016) and Fattore et al. (2012). Interestingly, the studies by Fattore (2016) and Fattore et al. (2012) have not been included in the list of studies of our systematic review, despite they developed the initial proposal based on the posetic approach. Specifically, Fattore (2016) has not been included due to the choice of the research keys, which omitted the word “deprivation” while Fattore et al. (2012) is not a journal article.

In addition, a number of 4 studies (3.4%) use generalized mean aggregation as method for building multidimensional measures of well-being or poverty (see, e.g., Pinar 2019).

The 49 remaining studies (about 42%) use different methods from the ones reviewed above (“other”). The “other” category contains less common methods that are used in less than 4 studies. Among these methods, we find clustering (Kana Zeumo et al. 2014), structural equations and causal theory (Rodero-Cosano et al. 2014), spatial Bayesian models (Greco et al. 2019), and axiomatic approaches (Decanq et al. 2009; Croci Angelini and Michelangeli 2012).

To sum up, about half of the studies included in this SLR (116 out of 229) have been classified as proposing a method to synthesize multidimensional poverty or well-being. This means that introducing a new methodological approach or improving current approaches used in the literature is rather relevant in this research field. Despite the AF method is predominant, a number of different and minor approaches have been proposed which borrow from different research fields. Another interesting aspect that clearly emerges from the findings of this review is that most studies (about 90%) include an empirical application to show the effectiveness of the proposed method in practice. The presence of empirical results enriches the study of multidimensional poverty and well-being with data-based socio-economic interpretations. Finally, another finding is that most studies use a single methodological approach to analyze poverty data. Comparisons among different methods are rather uncommon and involve about 10% of the studies only.

3.2.3 What are the dimensions measured in empirical works?

A total of 214 articles (93.45% of the sample) were classified as C3.³ The dimensions of poverty considered in the studies reviewed are reported in Fig. 4. The first most frequently

³ The table with the summary of C3 articles is available upon request.

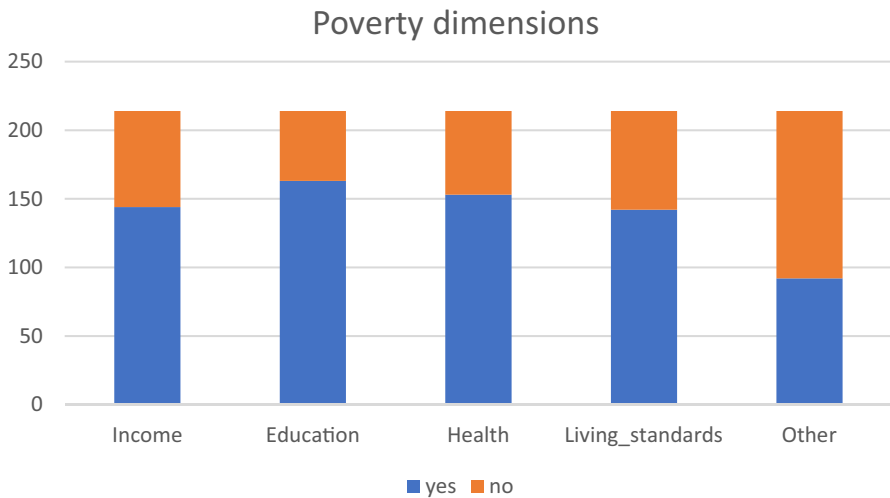


Fig. 4 Poverty dimensions considered in the studies reviewed

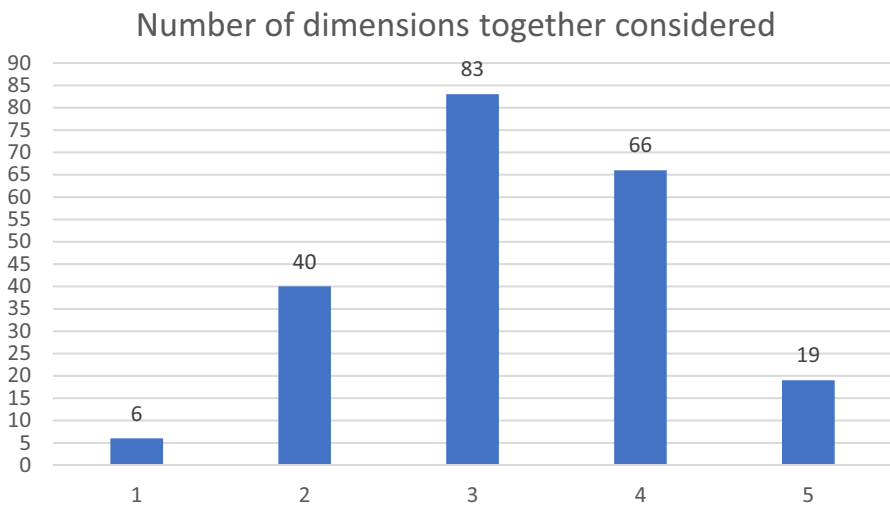


Fig. 5 Number of dimensions together considered in the articles reviewed

dimension considered was ‘education’, followed by the second most frequently dimensions ‘health’ and ‘income’.

The dimensions reported in Fig. 4 are not mutually exclusive. This becomes clearer from Fig. 5 that reports the number of dimensions together considered in the studies reviewed. Only 6 studies out of 214 focused on a single dimension of poverty. The fact that they were included as considering poverty multidimensionally depends on the number of sub-items considered to measure the single dimension or in the case of the dimension ‘other’. In fact, under that category there may fall more than one dimension, such as ‘life satisfaction’, ‘civic engagement’, ‘women empowerment’, to cite a few. Moreover, 83 articles (around

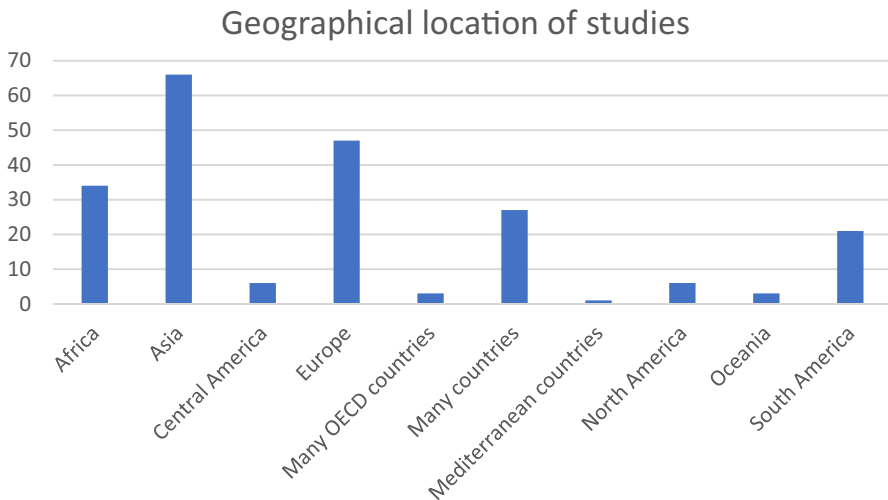


Fig. 6 Geographic location of studies distributed by continent

39%) considered three dimensions and only around 9% considered all dimensions. Focusing on articles that considered three dimensions, we observed that the most frequent combination of poverty dimensions was “Education, Health, Living Standards” (37 studies out of 83, about 44.5%) followed by the combination “Income, Education, Health” (15 studies out of 83, about 18%), while the less frequent combination was “Education, Health, Other” (2 studies out of 83, about 2.4%).

The next descriptive analysis concerns the place where empirical studies refer to. The countries with the greatest number of studies were China (13), Pakistan (12) and India (11). Distributed by continent (Fig. 6), the studies were mainly made in Asia (30.84%, 66), in Europe (21.96%, 47) and in Africa (15.89%, 34). For some studies (9.35%, 20), the continent could not be clearly identified since the ‘many countries analysed’ may belong to different continents. Only six studies (2.8%) were found to refer to North America, in particular to the United States of America (USA). As the most powerful economy in the world, with one of the highest rates of poverty in the developed world, and an extreme extent of income and wealth inequality when compared to other industrialized countries, we could have expected the country to be one of the main fields of research. However, the USA does not predominate in empirical studies of multidimensional poverty. In this respect, the information presented in Fig. 6 gives researchers an important opportunity for empirical investigation on multidimensional poverty in the USA, as few relevant studies were identified in recent years in this review. On the other hand, Asian and European researchers in poverty wishing to study empirically the multidimensional poverty shall benefit of the various studies published on Asian or European countries for comparative purposes in order to provide more robust conclusions.

As a matter of fact, as shown in Fig. 7, apart from the categories ‘many OECD countries’, ‘Mediterranean countries’, ‘many countries’, within the same continent only few studies (e.g., related to Europe and South America) involve more than one country. This evidence calls for comparative studies among countries on multidimensional poverty.

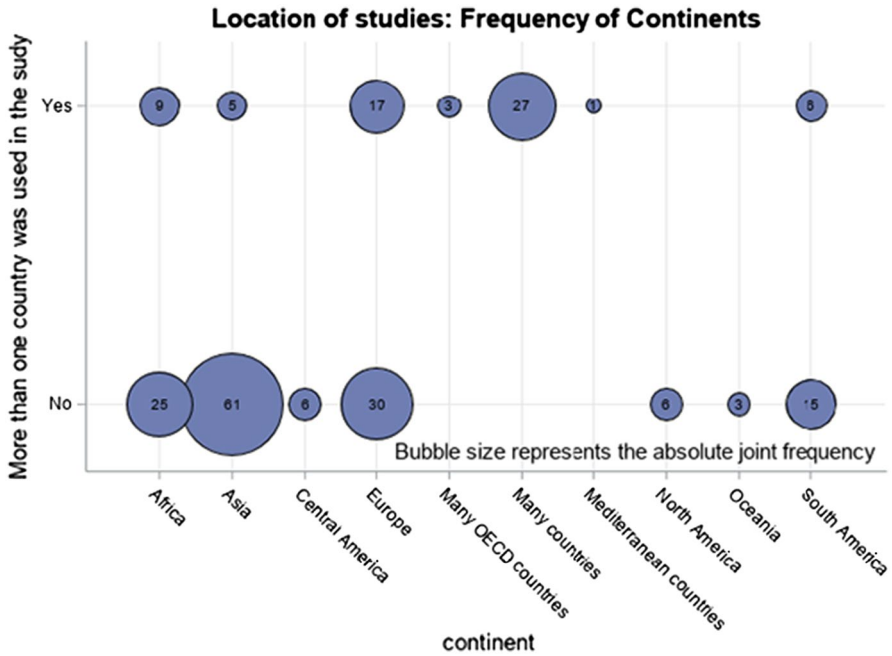


Fig. 7 Country comparison by continent

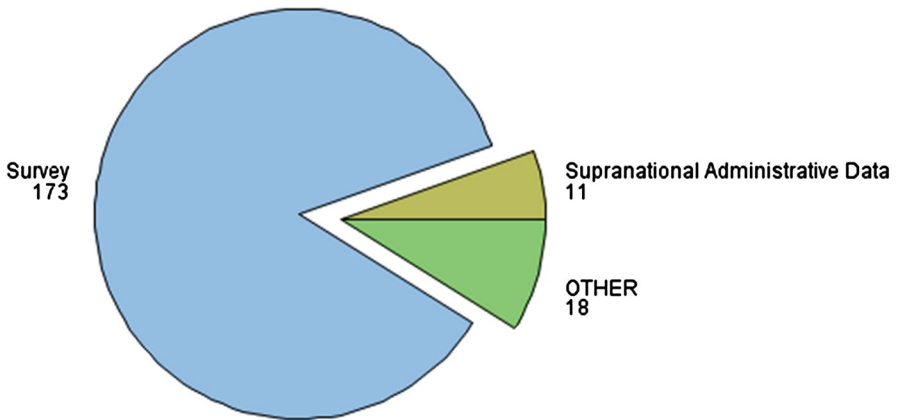


Fig. 8 Secondary data type

Aiming to help future research on this subjects, the main data sources used by authors were also checked. A marked preference for secondary data (202 out of 214) was observed (Fig. 8).

Among secondary data type, it is evidenced that the use of surveys is still predominant. Notwithstanding the era of big data, survey research is still needed. Future works might

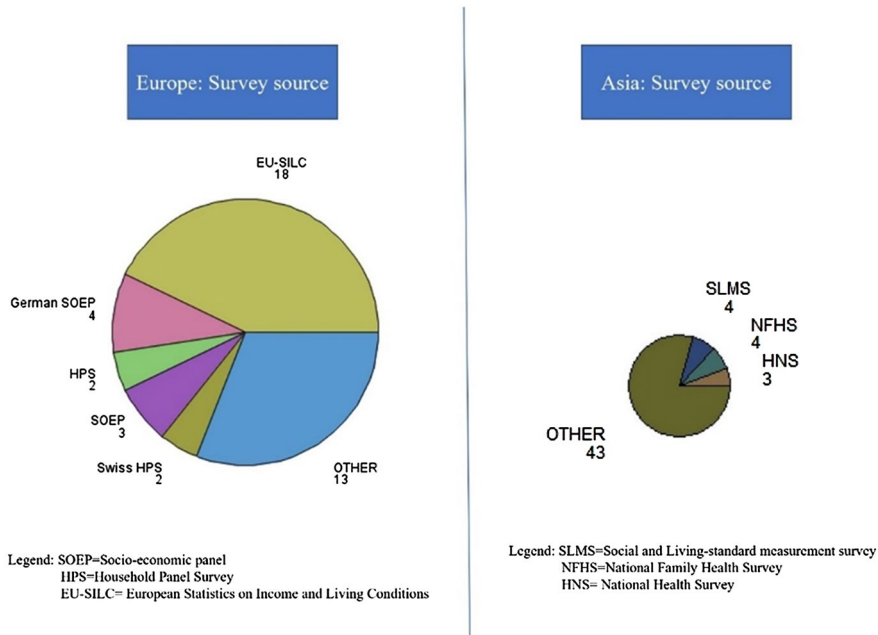


Fig. 9 Survey source in the two most researched continents

explore the way how the two data sources may be used together in order to provide richer dataset and enhance poverty measurement.

Figure 9 focuses on the most researched continents, namely Asia and Europe, and for each one considers the main survey source. It clearly emerges that in Asia there is a fragmented use of surveys, while in Europe the use of EU-SILC data is predominant as it is a cross-sectional, longitudinal, harmonized survey with a full coverage of all European Union member states.

Moreover, from Fig. 10 another issue emerges: the inadequate timeliness, namely the period between the year when the study has been published and the reference period of the survey wave. However, it is acknowledged that such a weakness is common to all empirical studies that make use of secondary data produced by Bureaus of Statistics. This finding emerged from the SLR paves the way for future research that might experiment the combined use of traditional data sources (e.g., surveys, census and administrative data) and modern big data. Both data sources can significantly reduce the cost of reporting and improve the timeliness, as the data collection is less time and resource intensive than for conventional data.

4 Discussion and conclusions

The purpose of this paper was to provide a systematic framing of the literature on multi-dimensional poverty and related concepts until 2019. In particular, the review was conducted by querying the Scopus and the Web of Science databases, according to the keywords ‘multidimensional poverty’, ‘multidimensional inequality’, ‘multidimensional well-being’, and ‘multidimensional wellbeing’. A number of 669 studies was found, which was reduced to 314 after the abstract review. Next, the analysis of the full-text studies

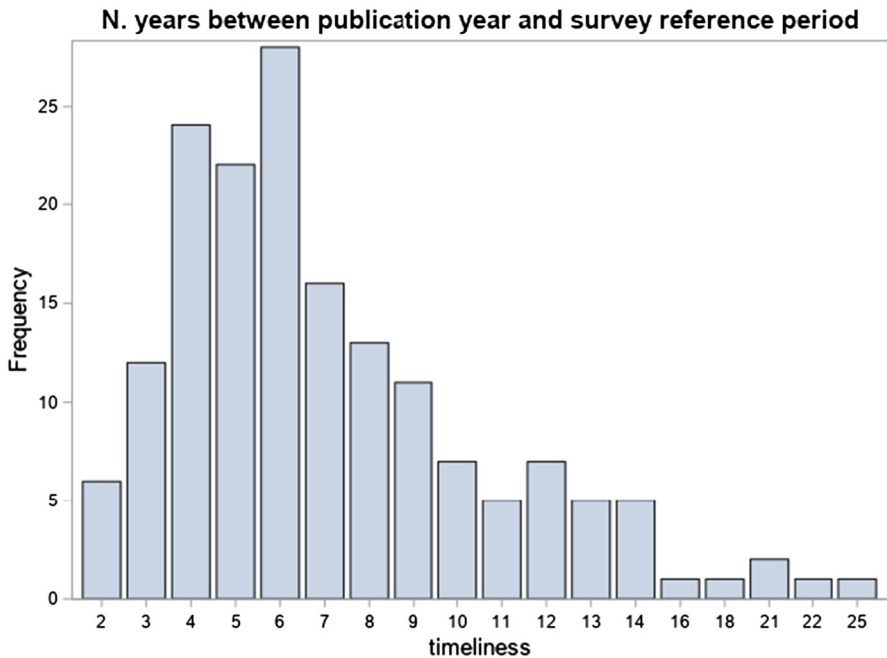


Fig. 10 Timeliness of reviewed surveys

brought to the final number of 229 articles included in the review. Three main research questions were formulated to select and to analyze the studies, related to the definition of multidimensional poverty, the introduction of methods to synthesize and measure the multidimensional poverty, and the use of different dimensions in empirical applications.

The current work found that the amount of scientific literature devoted to enlarge the study of poverty or well-being from an income-based only perspective to a multidimensional one, has increased in the last few years, and especially from 2017 to 2019. In particular, besides the economic dimension, other three important poverty-related dimensions clearly emerged from the review: education, health, and living standards. However, one interesting finding is that the definitions of multidimensional poverty proposed in the literature often move around the income/consumption dimension, which has been considered as the main, most important conceptualization of poverty.

Another important issue which emerged from this study is that several different methods have been employed in the reviewed studies such as the fuzzy theory, the Gini index, and models and methods based on latent variables, but the most frequently used approach relies on the well-established Alkire–Foster method. In fact, the framework developed under the AF method for the measurement of multidimensional deprivations has turned to be very flexible so that it is currently used for large scale studies such as the computation of the multidimensional poverty index (MPI) by the United Nations, based on the three dimensions of health, education, and standard of living. Despite the primacy of the AF method, some limitations have been raised in the literature. Likely the main practical limitation is that the method requires that the data are available from the same survey and linked at the individual or household level (Alkire and Foster 2011b). Consequently, different data sources cannot be used, thus limiting the applicability of the method and,

for example, the number of countries that could be compared within this framework. The investigation of multidimensional poverty measures based on the AF method requires efforts in collecting data uniformly and systematically. From the methodological point of view, as discussed in Sect. 3.2.2, the limitations identified in the literature are concerned with the sensitivity of the AF method to the methods of identification and aggregation of the dimensions and the weighting schemes. The authors of the AF method themselves identified some common misunderstandings of their approach in Alkire and Foster (2011b). In particular, they clarify that the method is sensitive to the joint distribution of deprivations, unlike other unidimensional or marginal methods, and that this is a distinctive feature of their proposal. The method represents a general framework for poverty measurement in a multidimensional perspective and should be operationalized by making proper choices which depend on the objectives of the single empirical studies.

The SLR here conducted allows us to conclude that the multidimensionality is not an unambiguous concept. Various dimensions may contribute to its definition and, notwithstanding we can observe frequently common dimensions (e.g., economic, health, education, living standards), their combined use is not obvious nor the items used to measure each specific dimension. On the empirical side, we found that some countries are under researched (e.g., USA). On the other hand, some geographical area, namely Asia or Europe, shall benefit of a vast empirical literature. Notwithstanding the high number of studies in these areas, a lack of comparative studies clearly emerged and paves the way for future research. Moreover, a predominant use of surveys for data collection was observed that take along with it the often-inadequate timeliness issue. Future works might experiment the combined use of traditional surveys and new data sources based, for example, on big data.

It should be noted that the current literature review has some limitations. The most important one lies in the choices made during the systematic review design. Firstly, the review was solely restricted to the two “Scopus” and “Web of Science” databases since they represent the two biggest bibliographic databases covering literature from almost any discipline. Then, the research was limited to journal articles only. As a consequence, working papers, conference proceedings, books or book chapters, even if consistent with the research keys, were omitted from the results (for instance, the following references Alkire and Foster 2007, rev 2008, 2009; Fattore et al. 2012; Foster 2009; Sen 1985, were not caught by the queries). Thirdly, efforts were focused on articles published in English while articles published in other languages (despite the abstract in English) were excluded, as their inclusion may have increased challenges with respect to time and expertise in non-English languages, thus conducting to a knowledge loss. However, we are aware of the fact that limiting the SLR to English-only studies may increase the risk of bias. Future works may consider the inclusion of non-English studies in order to prevent such a risk.

An additional limitation is the time range of the systematic review, as the last publication year recorded is 2019. This choice is motivated by the fact that the following year 2020 has been characterized by the spread of the COVID-19 pandemic. We believe that the difficult epidemiological situation, still affecting people’s life, may have deeply changed the impact of the different dimensions of poverty and gave much importance to dimensions such as psychological well-being, social exclusion, and technological and digital gaps. Future works might explore emerging issues related to poverty.

A natural progression of this work is to conduct a post-COVID systematic review of the literature including studies from 2020 onwards, considering a time horizon after the initial year of the COVID-19 pandemic of at least five years, and to compare the findings with the current ones.

Moreover, a limitation concerns the search method, which was through “keywords” (see Sect. 2.2.1). It is likely that some relevant articles that used different words in the title, abstract, keywords or topic were omitted from the systematic review. An example is the paper by Fattore (2016), cited in Sect. 3.2.2, which title contains the word “deprivation” instead of “poverty”, “well-being”, or “inequality” and was therefore excluded from the results. Future research might consider additional keywords such as: “social exclusion”, “deprivation”, “vulnerability”, “inequality of opportunity”, or “quality of life”. Moreover, future works might make use of text mining techniques to analyse in deep the occurrence of words in the definition and conceptualization of poverty in order to extrapolate the main dimensions considered behind the well-known group of four: health, economics, education, and living standards.

No less important, a limitation might lie in the fact that we do not suggest what is the best way to treat poverty from a multidimensional perspective, but simply analyse the trend of consideration of multidimensionality in scientific publications. After all, a systematic review has precisely the goal of bringing order in scientific publications by soughing and describing, in this particular case, the characteristics of the multidimensional poverty related papers in the considered period. In this respect, one might object that the adoption of a systematic review does not allow us to critically interrogate the extant literature, but solely to summarize/systematize extant knowledge. Consequently, future research avenue might opt for embracing a methodological approach that better suits a critical evaluation, like for instance the *problematizing review* (Alvesson and Sandberg 2020).

Appendix

List of articles from the literature review

Abraham, R.A. and Kumar, K.S.K. (2008) Multidimensional poverty and vulnerability. *Economic and Political Weekly* 43(20):77, 79-87.

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Funding Open access funding provided by Alma Mater Studiorum - Università di Bologna within the CRUI-CARE Agreement. The authors have not disclosed any funding.

Declarations

Conflict of interest The authors declare that no funds, grants, or other support were received during the preparation of this manuscript. The authors have no relevant financial or non-financial interests to disclose.

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