Methodology for producing the Northern Ireland Community Needs Index 2022

Introduction

In this paper we outline the methodological approach for developing a **Community Needs Index** for Northern Ireland (NICNI). The NICNI has been constructed using the same methodology, domain structure and geographic unit of analysis as adopted in the 2021 update of the Community Needs Index for England (ECNI 2021); and uses the same component indicators where possible. In this paper, we summarise the steps involved in developing the NICNI.

The indicators

The table below outlines the key socio-economic indicators which have been included in the NICNI. These have been grouped into domains and subdomains:

- Civic Assets: Measures of the presence of key community, civic, educational and cultural assets in and in close proximity to the area
- Connectedness: Measures of connectivity to key services, digital infrastructure, social isolation and strength of the local jobs market
- Active and engaged community: Measures concerning the levels of third sector civic and community activity and low levels of participation and engagement

The table provides an overview of each of these indicators with metadata detailing:

- Source (included URL)
- Timepoints the data is available for
- Geographical unit at which the data is published
- Notes associated with the indicator – including robustness issues to consider when incorporating the data.

Indicator	Details	Source	Date	Granularity	Notes/Caveats
Civic Assets					
CA1: Community organisations	Number of voluntary or community Organisations operating in each neighbourhood. Data is taken from the State of the Sector V audit. State of the Sector V is the latest edition in the State of the Sector research programme which provides a comprehensive picture of the scale and scope of the economic activities of the Northern Ireland voluntary and community sector. State of the Sector V provides high level statistics on the various types of resources available to the sector and the relationship between voluntary and community organisations, government, funders and the general public.	Northern Ireland Community & Voluntary Association (NICVA)	2008	SOA	In June 2008 a total of 6,293 surveys were sent out to organisations to gather information on their activities, staff, organisational remit and their opinions about future developments in the sector. A total of 1,891 organisations responded. Of this number, 124 were either extinct or were not suitable for the purposes of this survey. In the end a total of 1,606 surveys was returned, which is a 25.5% response rate.
CA2: Density of educational assets	This is conceptualised as the number of assets inside the local area or within 1km of the local area boundary, divided by the number of people living in inside the local area or within 1km of the local area boundary. Rate is expressed per 100,000 population The following assets are included: • Pre-school • Nursery School • Primary School • Post Primary School • Special School	Department of Education NI - https://www.education-ni.gov.uk/publications/school-enrolment-school-level-date-202021	2020/21	Point Location	Details are not available on how accessible the assets are to the community.

Indicator	Details	Source	Date	Granularity	Notes/Caveats
CA3: Density of sport and leisure assets	This is conceptualised as the number of assets inside the local area or within 1km of the local area boundary, divided by the number of people living in inside the local area or within 1km of the local area boundary. Rate is expressed per 100,000 population. Data is collected from the Active Places NI - Sports Facilities Database which records key contact, location and facility specification information on sports facilities throughout Northern Ireland.	Active Places Database NI https://www.opendatani.gov.uk/dataset/active-places-ni-sports-facilities-database	2016	Point Location	Details are not available on how accessible the assets are to the community. Some of the facilities identified will have a cost associated with access, which could potentially exclude those on lower incomes in the community.
CA4a: Cultural Deprivation Index	The Cultural Deprivation Index is the overall index for all four types of culture, arts and leisure facilities. The Cultural Deprivation Index which measures the proximity to sport facilities, arts venues, libraries and museums calculated following similar methodology to Proximity to Services Domain in the Northern Ireland Multiple Deprivation Measure.	Department of Culture, Arts and Leisure	2014	SOA	Some of the venues will not be free to enter, which will exclude some sections of the community.
CA4b: Arts Council Funded Activities	Events funded by the Arts Council of Northern Ireland through the Annual Support for Organisations Programme (ASOP) are attributed to one of three broad activity types (Exhibition, Performance or Participation). Additionally, at the Northern Ireland level, events were also categorised as Dance, Drama, Literature, Music, Traditional Arts, Visual Arts or Combined. Postcode data was self-reported by organisations completing the Regularly Funded Organisation (RFO) Survey which is the main mechanism used by the Arts Council to monitor funded activity.	Northern Ireland Arts Council	2010/11	SOA	The 5,716 records relate to 96% of total activity for this period. Of the remaining 4%, activity was either undertaken outside Northern Ireland or the postcode was not valid.
Connectedness					

Indicator	Details	Source	Date	Granularity	Notes/Caveats
CN1: Travel time to key services by public transport	Service-weighted fastest travel time by public transport. The following services are included: • GP premises • Job Centre or Jobs and Benefits Office • Dentists • Post Office • Pharmacists • Supermarket / Food Store • Opticians • Libraries • Day nurseries and Crèches • Council Leisure Centre • Financial Services • Large Service Centres • Other general services: Restaurants, fast-food outlets, pubs, and health & beauty establishments These statistics are derived from the analysis of spatial data on public transport timetables; road, cycle and footpath networks; population and key local services.	Northern Ireland Statistics Research Agency	2017	SOA	Modelling assumptions include a journey to the service between 6am and 10am on a Tuesday and a maximum 20 minute walk to the public transport access point, as well as assumptions for connecting public transport

Indicator	Details	Source	Date	Granularity	Notes/Caveats
CN2a: Jobs density in the Local Authority	The number of jobs located in the area as a percentage of the working-age population in that area – this is to be used as a measure of economic opportunities locally. Data are taken from the Business Register and Employment Survey (BRES) of approximately 80,000 businesses, weighted to represent all sectors of the UK economy. The BRES definition of an employee is anyone aged 16 years or over at the time of the survey, whom the employer pays directly from its payroll(s) in return for carrying out a full-time or part-time job or for being on a training scheme. This indicator will be calculated at travel-to-work-area (TTWA) level rather than at community-geography level, to reflect the fact that people typically commute outside of their local area to work. TTWAs are a geography created to approximate labour-market areas. In other words, they are designed to reflect self-contained areas in which most people both live and work. The current ONS criteria for defining TTWAs are that at least 75% of the area's resident workforce work in the area, and at least 75% of people who work in the area also live in the area. The area must also have an economically active population of at least 3,500.	Business Register and Employment Survey (BRES) https://www.nomisweb.co.uk/query/construct/summary.asp?mode=construct&version=0&dataset=57	2019	Local Authority	This measure does not take into account the quality of the job, whether they are full or part time, zero hours or temporary or permanent contract or how easily accessible the core of the travel to work area is from the specific community geography area.

Indicator	Details	Source	Date	Granularity	Notes/Caveats
CN2b: Vacancies notified to Job Centres/Jobs and Benefits Offices	Vacancy details are recorded on the Department for Communities Client Management System (CMS) which is installed in the JobCentre/Jobs & Benefits offices throughout Northern Ireland. The data are extracted from CMS each month to form a vacancies database maintained by the Department's Professional Services Unit. The data presented are derived from the vacancies database, and vacancies advertised by other means (e.g. newspapers) are not included in the figures. The statistics therefore do not provide comprehensive measures relating to all vacancies in Northern Ireland. The proportion of vacancies which are notified by employers varies over time according to geographical area. Vacancies notified are all vacancy positions notified and added to Jobcentres / Jobs & Benefits offices of the Department for Communities.	Department for Communities	2020	SOA	This measure does not take into account the quality of the job, whether they are full or part time, zero hours or temporary or permanent contract.
CN3: Households with no car	The proportion of households who do not have a car or van. Figures are based on responses to the 2011 Census car ownership question, which asks for information on the number of cars or vans owned or available for use by one or more members of a household. It includes company cars and vans available for private use. This is included to supplement the accessibility of key services and labour market indicators in this domain, to take account of the additional challenges in accessing services for those without access to private transport.	Census 2011 https://www.nomisweb.co.uk/query/construct/summary.asp?mode=construct&version=0&dataset=621	2011	Output Area	The count of cars or vans in an area is based on details for private households only. Cars or vans used by residents of communal establishments are not counted.

Indicator	Details	Source	Date	Granularity	Notes/Caveats
CN4: Digital exclusion index	The Digital exclusion index is derived from postcode-level data provided by CACI combining information on Broadband speed, Buying online, Managing current accounts online, Mobile phone ownership, Internet usage and People agreeing with the statement "computers confuse me, I will never get used to them". Each indicator is scored between 0 and 1, with higher values meaning greater digital exclusion (e.g. less likely to own a mobile or more likely to have slower broadband). Data is presented as an average LSOA rank across the UK, where a higher value indicates higher digital exclusion (ranked between 1 and 42,616).	CACI/British Red Cross	2020	SOA	
CN5a: Loneliness (People living alone)	Shows the proportion of households that comprise one person living alone (as a proportion of all households). Figures are self-reported and taken from the household composition questions in the 2011 census.	Census 2011 https://www.nomisweb.co.uk/query/construct/summary.asp?mode=construct&version=0&dataset=605	2011	Output Area	This is included as a proxy measure of social isolation.

Indicator	Details	Source	Date	Granularity	Notes/Caveats
CN5b: Loneliness (Loneliness Index – GP Prescriptions for Loneliness)	An outcome-based loneliness index using open prescription data. Open prescription data lists medicines, dressings and appliances prescribed by NHS primary care facilities, including General Practices (GPs), each month. Loneliness Index is created by using GP prescription data to find areas with above-average prescriptions for five conditions where loneliness has been shown to be a risk factor: Alzheimer's, depression, high blood pressure, anxiety and insomnia. An index was created for each condition by standardising the proportion of a practices prescriptions that were given for the condition relative to the levels in other practices (into z scores). The index for each condition had a value that was negative if prescribing was lower than typical and positive if it was greater than typical. The loneliness index is generated by summing together these standardised-scores for each condition.	Office for National Statistics' Data Science Campus /NHS /Red Cross https://github.com/matthewgthomas/loneliness/blob/master/README.md	2019	SOA	These data do not include any information about the person it was prescribed to and are averaged for a whole GP practice.
CN5c: Loneliness Persons aged 16+ 'More often lonely'	People who have self-reported that they feel lonely more often. The analyses are based on the direct measure of loneliness included in the Community Household Survey (CHS). Two years of data is used to boost the sample size.	Continuous Household Survey (CHS) published by Department for Communities https://www.nisra.gov.uk/statistics/find-your-survey/continuous-household-survey	2018 and 2021	Local Authority	The Community Household Survey has a relatively small sample size (approximately 9,000 households across Northern Ireland). Local Authority estimates should be treated with a degree of caution. Multiple years have been used to boost the sample size. However, data for Fermanagh & Omagh is unavailable for 2021 (due to small sample size).

Indicator	Details	Source	Date	Granularity	Notes/Caveats
AE1: Voter turnout at local elections	Valid votes turnout (%) at the most recent Local Council Elections	Electoral Office for Northern Ireland	2019	District Electoral Area	
AE2a: Volunteering	Respondents who had volunteered in the past year based on self-reported responses from the Continuous Household survey. Data has been gathered for multiple year due to the relatively small sample sizes in each survey:	Health and Social Well Being Survey, Continuous Household Survey (CHS)	2013-2017	Local Authority/Health and Social Care Trust	The Continuous Household Survey is based on a systematic random sample of 9,000 addresses drawn each year from the Pointer list of domestic addresses. The Health and Social Well Being Survey is based on a random sample of 5000 private addresses in Northern Ireland. http://www.csu.nisra.gov.uk/survey.asp46.htm

Indicator	Details	Source	Date	Granularity	Notes/Caveats
AE2b: Strength of local social relationships	Self-reported measures of strength of local social relationships from key surveys. Data has been gathered from multiple sources due to the relatively small sample sizes in each survey: The following indicators are included: 1) Mean score of satisfaction with family life and social life by Local Government District 2014. The mean score is measured on a scale from 1-10 where 1 is very dissatisfied and 10 is very satisfied. 2015/16 2) Effect of 'fear of crime' on quality of life (%) – High.: From the Northern Ireland Safe Community Survey (NISCS) 2011-2018 3) Perceived high level of anti-social behaviour. From the Northern Ireland Safe Community Survey (NISCS) 2011-2018	Continuous Household Survey (CHS), Health and Social Well Being Survey, Northern Ireland Safe Community Survey (NISCS)	2015/16, 2011-2018	Local Authority/Health and Social Care Trust,	Data is derived from sample surveys. The Northern Ireland Crime Survey (NICS) is a representative, continuous, personal interview survey of the experiences and perceptions of crime of adults living in private households throughout Northern Ireland. For NICS 2017/18, the initial sample consisted of 3,375 addresses, randomly selected from the Land and Property Services domestic property database. The Continuous Household Survey is based on a systematic random sample of 9,000 addresses drawn each year from the Pointer list of domestic addresses. The Health and Social Well Being Survey is based on a random sample of 5000 private addresses in Northern Ireland. http://www.csu.nisra.gov.uk/survey.asp46.htm

Indicator	Details	Source	Date	Granularity	Notes/Caveats
AE2c: Low self-efficacy	Self-efficacy is a person's belief about their capabilities to exercise influence over events that affect their lives. People with high self efficacy are often seen as confident in their capabilities and produce sustained efforts to achieve their goals. In contrast, people with low self-efficacy often doubt their capabilities, are less ambitious and give up on their aims when challenged. he tool for measuring self-efficacy is a simple statement based survey tool. It takes the form of five simple statements to which the individual indicates to what extent they agree or disagree on a five point Likert scale. Self-efficacy is then presented as an overall score, minimum 5 and maximum 25, taken from the summed total of the five statement questions. Self-efficacy scores of 70% or more of the total possible score (i.e. 18 to 25) are categorised as high self-efficacy; low self-efficacy is therefore anything under 70% of the total possible score (i.e. 5 to 17).	Continuous Household survey	2020/21	Local Authority level	The Continuous Household Survey is based on a systematic random sample of 9,000 addresses drawn each year from the Pointer list of domestic addresses. Data is missing for Fermanagh & Omagh so NIMD quintile scores are used to determine SOA values in this District.

AE3a: Engagement in Culture, Arts and Leisure	The figures presented have been generated as part of a research project that combined 3 recent years of DCAL modules in the Continuous Household Surveys (CHS) (2011/12, 2012/13, 2013/14, 2014/15 & 2015/16). DfC places questions related to engagement in culture, arts and leisure (CAL) activities annually in the CHS. The CHS is a Northern Ireland wide annual household survey administered by Central Survey Unit, Northern Ireland Statistics and Research Agency. The methodologies of the three surveys were consistent, with each based on a random sample of 4,500 domestic addresses each year, drawn from the Land and Property Services list of addresses. Interviews were sought with all adults aged 16 and over in these households. These three years' data from the CAL modules of the CHS were combined (pooled) together. The findings were based on a pooled sample of 11,068 respondents overall who responded to a DfC module in one of the three annual surveys. Engaged in culture, arts and leisure - Have done at least one of the following in the 12 months prior to the CHS: Participated in sport, participated or attended the arts, used the public library service, visited a museum or science centre, fished in Northern Ireland waters, visited an inland waterway or visited PRONI. Sport participation - Participated in at least one of the following activities in the 12 months prior to the CHS: • Rugby Union or league • American football • Football indoors (INC 5-A-SIDE) • Football outdoors (INC 5-A-SIDE • Gaelic football • Camogie • Hurling • Cricket • Hockey (EXCLUDE ICE, ROLLER OR STREET HOCKEY) • Netball • Tennis • Badminton • Squash • Basketball • Table tennis • Track and field athletics • Jogging • Cycling for recreation • Indoor bowls • Outdoor (lawn) bowls • Tenpin bowling • Swimming or diving • Angling/fishing • Yachting or dinghy sailing • Canoeing • Windsurfing/boardsailing • Keepfit,	Continuous Household Survey (CHS) published by Department for Communities https://www.nisra.gov.uk/statistics/find-your-survey/continuous-household-survey	2011/12, 2012/13, 2013/14, 2014/15 & 2015/16	Local Authority	Percentages presented are weighted averages and have been rounded to the nearest whole number. Bases presented are the unweighted number of respondents. The 2011/12, 2012/13, 2013/14, 2014/15 and 2015/16 continuous household survey methodologies were consistent. In addition to the random selection of the sample in each year, addresses selected in any of the two previous years' surveys are removed from the sample frame. Thus, although exclusion of individuals across multiple years cannot be totally assured the likelihood of obtaining responses from the same individuals across multiple years has been minimised. Analysis of the pooled surveys of the CHS has been weighted for non-response. A chi square goodness-of-fit test showed that the pooled CHS sample was not representative of the population by age and sex when compared with the average of the Mid-year Population Estimates for

	aerobics, yoga, dance exercise • Martial Arts (INCLUDE SELF DEFENCE) • Weight training\lifting\body building • Gymnastics • Snooker, pool, billiards • Ice skating (IF ROLLER EXCLUDE) • Darts • Golf, pitch and putt, putting (EXCLUDE CRAZY/MINIATURE GOLF) • Skiing • Horse riding (EXCLUDE POLO) • Motor sports • Shooting • Boxing • Other Arts participation – Participated in at least one of the following arts activities in the 12 months prior to the CHS: • Ballet • Other dance (not for fitness) • Sang to an audience or rehearsed for a performance (not karaoke) • Played a musical instrument to an audience or rehearse for a performance • Played a musical instrument for own pleasure • Written music • Rehearsed or performed in play/drama • Rehearsed or performed in opera/operetta • Painting, drawing, printmaking or sculpture • Photography as an artistic activity (not family or holiday snaps) • Made films or videos as an artistic activity (not family or holiday) • Used a computer to create original artworks or animation • Textile crafts such as embroidery, crocheting or knitting • Wood crafts such as wood turning, carving or furniture making • Other crafts such as calligraphy, pottery or jewellery making • Written any stories or plays • Written any poetry				Northern Ireland in 2011, 2012, 2013, 2014, 2015 and 2016 (NISRA). As a result, weights were produced for age and sex combined for each of the new district councils based on the average of the mid-year population estimates for the corresponding years. Non-response weighting sometimes increases standard errors and sometimes decreases them, although the impact tends to be fairly small, i.e. the adjustment may be less or greater than 1, but will generally be reasonably close to 1. In the case of the DCAL module of CHS, the values of the adjustment for all three weighting systems are so close to one, it is not necessary to take account of this in the calculation of standard error and confidence intervals. While weighting for non-response (also called post-stratification) should reduce bias, it must be acknowledged that it will not eliminate bias. The reasons individuals choose to take part in surveys are complex and depend on lots of factors specific to the individual. As a

Indicator	Details	Source	Date	Granularity	Notes/Caveats
					result, the non-response biases in surveys are likely to be complex. Post-stratification works on the assumption that, by aligning the survey to the population along a small number of dimensions such as age and gender, many of these complex biases will reduce. However, it would be misleading to suggest that they will be eliminated.
AE3b: Leisure Time Outdoors	Frequency of persons aged 16 and over spending leisure time outdoors by Local Government District 2014 based on self reported responses from the Continuous Household Survey (CHS). CHS is one of the largest continuous surveys carried out in Northern Ireland. It is based on a systematic random sample of 9,000 addresses and the questionnaire consists of both a household and individual interview with each person aged 16 and over.	Continuous Household Survey (CHS) published by Department for Communities https://www.nisra.gov.uk/statistics/find-your-survey/continuous-household-survey	2015/17	Local Authority	The CHS is based on a systematic random sample of 9,000 addresses drawn each year from the Pointer list of domestic addresses. The sample size is relatively small in some Local Authorities.

Indicator	Details	Source	Date	Granularity	Notes/Caveats
AE4: Charities	Registered charities from Charity Base from the Charities Commission for Northern Ireland Figure is expressed as a rate per 100,000 population.	Charities Commission for Northern Ireland	2021	Postcode	This is based on the location of organisations rather than on their area of operations (some will have a global focus). Larger charities ae excluded from this measure. This indicator is included in this theme to capture the level of third sector activity in the local area. Organisations with an exclusively national or international focus have been excluded, to ensure only organisations with a local focus are included.
AE5: National Lottery Community Fund	Combined total of grants made to local projects and organisations by the National Lottery Community Fund between 2004 and 2021 per 1,000 population (£). Figures are taken from data on grants made to projects and organisations in local areas in the UK by the Big Lottery Fund, from grants data published by Big Lottery in conjunction with the 360Giving initiative. Big Lottery used the 360Giving standard to produce a file of all the grants made in 2004-2022.	National Lottery (through 360 Giving) https://grantnav.threesixtygiving.org/	2004-2022	Ward level	Included in the active/engaged community theme to capture the level of third sector activity in the local area.

Indicator	Details	Source	Date	Granularity	Notes/Caveats
AE6: Grant funding per head from major grant funders	Combined grant funding from grant giving organisations whose data has been subject to the 360giving standard (per head of population). The following organisations are included: Wolfson Foundation, Esmée Fairbairn Foundation, Halifax Foundation for Northern Ireland, Andrew Lloyd Webber Foundation, The Tudor Trust, The Henry Smith Charity , Paul Hamlyn Foundation, The Leathersellers' Company Charitable Fund, Department for Business, Energy and Industrial Strategy, Department for Digital, Culture, Media and Sport, A B Charitable Trust, John Moores Foundation, Department for Digital, Culture, Media & Sport, Nationwide Foundation, Access to Justice Foundation, Trusthouse Charitable Foundation, Ministry of Defence, The Clothworkers Foundation, John Ellerman Foundation, Unbound Philanthropy, National Churches Trust, The Pilgrim Trust, Coop Foundation, Woodward Charitable Trust, Co-operative Group, The Joseph Rank Trust, Department for Culture, Media and Sport, Rank Foundation, the Trussell Trust, Nesta, Pears Foundation , National Emergencies Trust, The Foyle Foundation, Three Guineas Trust, Wates Foundation, The AIM Foundation, The Dunhill Medical Trust, Department for Work and Pensions, LandAid Charitable Trust, Lloyd's Register Foundation, Armed Forces Covenant Fund Trust, Department for Transport, True Colours Trust, The Road Safety Trust, Nuffield Foundation, Home Office, The MSE Charity, The Rayne Foundation, The Fore, Calouste Gulbenkian Foundation, UK Branch, Department for Education, The Bishop Radford Trust, HM Revenue & Customs, Department for Environment, Food and Rural Affairs, Pears Foundation, Joseph Levy Foundation	360 Giving Grant Nav data https://grantnav.threesixtygiving.org/	Up to 2022	Postcode level	Data are based on the location of grant recipients rather than the location of their beneficiaries. This is indicator is included in this theme to capture the level of third-sector activity in the local area. Grants above £1m excluded to ensure capturing local initiatives rather than national activity. Measure expanded to include all Grant Funders which have a nationwide focus (e.g. not focused in one region of the country only) where geographic information supplied.

Indicator	Details	Source	Date	Granularity	Notes/Caveats
AE7a: SME lending by banks	Total value of lending to SME businesses from key financial lenders (Barclays, CYBG, Lloyds Banking Group, HSBC, Nationwide Building Society, Royal Bank of Scotland and Santander UK in Great Britain).	UK Finance	June 2020	Postcode sector	Take four quarters of lending data at postcode sector level. The data is modelled from postcode sector to Output Areas using a weighted lookup built from the numbers of shared postcodes between a postcode sector and Output Area in combination with the working age population per Output Area. Data is then aggregated to local area level to get total value of SME lending at local area level.
AE7b: Small businesses: Local Business Units with 0-4 employees	Small businesses: VAT registered local businesses with 0-4 employees per 10,000 population	Inter Departmental Business Register (IDBR)	2020	Local Authority	

Producing the NICNI

Step 1 Convert indicator data to SOA level

Each of the indicators in the NICNI is published at a different geographical level – however, in order to align with ECNI we intend to produce the NICNI at Super Output Area (SOA) level.

SOAs are the preferred unit of measure because:

- They only change after every census, so they are more consistent over time. Even with changes made due to the census, about 95% will remain the same. They therefore represent a more stable geography than wards.
- They are generally all the same size but are sufficiently large enough that they are comparable to the average ward sizes.
- They now have neighbourhood names (not just codes) so are more identifiable. They are also increasingly used to disseminate statistics releases
- The list of 'left-behind' SOAs can still be linked to wards and local authorities. With SOAs, you might see more wards that are either fully or partially identified as 'left behind'.
- They nest directly with smaller statistical geographies such as Output Areas without requiring a best-fit lookup.

We therefore need to convert each of the underlying indicators to SOA geography for inclusion in the NICNI.

The table below outlines our approach to converting indicators to SOA level:

Geography	Indicators	Approach to conversion
Postcode/Point Location	Density of educational assets Density of sport and leisure assets Grant funding per head from major grant funders Charities	Use the ONS Postcode directory https://geoportal.statistics.gov.uk/datasets/ons-postcode-directory-may-2021/about - to aggregate Postcode data to SOA level.
Output Area	Households with no car People living alone Language Barriers	Use an Output Area to SOA Lookup table to aggregate data from Output Area to SOA level.
LSOA	Travel time to key services by public transport/walk Jobs Density in the local area Self-reported levels of loneliness Civic participation Strength of local social relationships Leisure and cultural participation CDRC Residential Mobility Index	
SOA	Community organisations Cultural Deprivation Index Arts Council Funded Activities Travel time to key services by public transport Vacancies notified to Job Centres/Jobs and Benefits Offices Digital exclusion index Loneliness Index	Use the Output Area to DZ Lookup table to apportion data to Output Area. Use Output Area to SOA Lookup table to aggregate data from Output Area to SOA level.

	Small businesses Green assets (Area of public green space) Average distance to nearest Park, Public Garden, or Playing Field Loneliness Index – GP Prescriptions for Loneliness	
Ward	National Lottery Community Fund	Use the ONS Postcode directory https://geoportal.statistics.gov.uk/datasets/ons-postcode-directory-may-2021/about - to create an SOA to Ward lookup table. Apportion Lottery data to SOA using a population weighted apportioning technique – using 2020 Mid year population estimates to weight the dataset.
Electoral District	Voter turnout at local elections	Use SOA boundaries directly
Local Authority	Jobs density in the Local Authority Persons aged 16+ 'More often lonely' Respondents who had volunteered in the past year Mean score of satisfaction with family life and social life Effect of 'fear of crime' on quality of life Perceived high level of anti-social behaviour Low self-efficacy Engagement in Culture, Arts and Leisure Leisure Time Outdoors	Apportion data from relevant ward to Output Area – using the appropriate Ward to Output Area look-up table – Output Area to Higher Area Index and apply Ward level scores to each Output Areas. Aggregate from Output Area to SOA using the Output Area to SOA Lookup table.
Postcode Sector	SME lending by banks	
Health and Social Care Trust	Proportion of adults that stated they had given unpaid help in last 12 months Contact with Neighbours: 1+ per week Meeting with Friends: 1+ per week Meeting with Family: 1+ per week	Apportion data from relevant ward to Output Area – using the appropriate Ward to Output Area look-up table – Output Area to Higher Area Index and apply Ward level scores to each Output Areas. Aggregate from Output Area to SOA using the Output Area to SOA Lookup table.

Step 2 Quality Assurance of the data

The next step is to comprehensively check the distributions of all indicators at SOA level to ensure that all indicators have passed the relevant fitness tests and are suitable for further analysis for the purpose of the NICNI. These tests include excluding indicators with high numbers of zeros or equal upper limit e.g. 100% values which would distort the Index.

Step 3 Applying shrinkage to improve the robustness of indicators

Where a rate or other measure of community need for an SOA is based on small numbers, the resulting estimate may be unreliable, with an unacceptably high standard error. The technique of shrinkage estimation is used to 'borrow strength' from larger areas to increase the reliability of small area data; the impact of shrinkage will tend to move an SOA's score towards that of their parent higher-level area. Shrinkage moderates the levels of unreliability in the dataset and reduced the impact of chance fluctuations from year to year. Such scores occur most commonly where numbers are small at SOA level and the event is thus relatively rare. This may be the case for the indicator as a whole or only for particular SOAs. In shrinkage estimation the score for a small area is estimated as a weighted combination of that small area's score and the mean value for a larger area from which the smaller areas within the larger area borrow strength. The 2020 Local Authorities will be used as the larger area. SOAs within a single Local Authority share issues relating to local governance. To a certain extent, they may also share issues relating to labour market sub-climates. Shrinkage will be applied to all indicators with the exception of those published at Local Authority or Health and Social Care Trust (see table in Step 1 above).

Step 4 Ensuring that all indicators are "pointing in the same direction"

In order to combine the indicators into domains, it is necessary for each of the indicators to be orientated in the same direction. However, for some of the indicators included in this measure, a *high* value indicates *low* levels of need on the NICNI – for example an area with a high levels of grant funding would be measured as having low levels of need. By contrast, for other indicators, a high score denotes high levels of need – for example areas with high travel times to key services. It is necessary therefore to 'reverse the polarity' for some scores to ensure that a high value is negative for all indicators – so they can be consistently combined.

Step 5 Producing composite indicators

A small subset of the indicators will be amalgamated to provide composite indicators before combining with the other indicators to create a domain scores.

The following indicators will be grouped together:

Original indicators	Combined indicator
• Cultural Deprivation Index • Arts Council Funded Activities	Cultural assets
• Jobs Density in the Local Authority • Vacancies notified to Job Centres/Jobs and Benefits Offices	Jobs access

• People living alone • GP Prescriptions for Loneliness • Persons aged 16+ 'More often lonely'	Social isolation[1]
• Engagement in Culture, Arts and Leisure • Leisure Time Outdoors	Leisure participation
• Volunteering • Strength of local social relationships • Low self-efficacy	Civic participation
• Small businesses: Local Business Units with 0-4 employees • Small businesses: SME lending by banks	Small businesses

Before combining each of the individual indicators to produce an overall composite indicator, the indicators will first have shrinkage applied (to reduce any standard errors associated with small numbers), the indicators will then be standardised (by ranking and transforming to a normal distribution) – as each of the composite indicators are on a different scale (step 6 below describes the standardisation process in more detail). Note: Where there are more than two component indicators in a composite indicator – indicators will be checked for positive correlation and provided indicators are positively correlated, the weights of each component indicator will be determined using factor analysis (see step 8 below); where there are two indicators in a composite indicator, each indicator will be assigned an equal weight of 0.5.

Step 6 Standardisation

When combining measures, it is important to ensure that indicator scores are comparable and that the weighting of domains is not distorted by the fact that some of the indicators may have very different distributions. The indicators in the NICNI are based on different metrics and each indicator in the Index needs to be standardised to ensure that each indicator has a common distribution, so that indicators can be combined, without one indicator dominating due to a much larger distribution. Indicators will be standardised by ranking each of the indicators and then transforming to a normal distribution.

Step 7 Creating subdomains

The *Connectedness* and *Active and engaged community* domains will be split into subdomains. The principal reason for doing this is to reflect the character of the domains - as both sets of domains contain two conceptually distinct subsets of indicators.

[1] Factor analysis is used to weight this indicator (see explanation below)

The *Connectedness* domain explores connectivity both in terms of, on the one hand access to services, and on the other hand wider measures of connectivity such as access to transport, digital connectivity and isolation which do not necessarily have strong associations with the more physical concepts of connectivity. We therefore propose grouping the domain into two subdomains:

Subdomain	Indicators
Physical connectivity	Travel time to key services by public transport Jobs access
Wider connectivity	Households with no car Digital exclusion index Social isolation

The Active and engaged community domain consists of measures concerning self-reported participation and engagement on the one hand, alongside measures of the strength of the community sector. Again, it makes conceptual sense to group these into separate subdomains as follows:

Subdomain	Indicators
Civic participation	Voter turnout at local elections Self-reported measures of community and civic participation Leisure participation Barriers to participation
Civic activity	Charities Big Lottery funding per head Grant funding per head from major grant funders Small businesses

An additional advantage of grouping indicators into subdomains is that it makes it possible to apply empirical weights to the indicators using factor analysis (explored in the weighting section below) – one of the key blockers of running factor analysis on the domains as a whole is that, within the Connectedness and Active and Engaged domains, the respective underlying indicators do not have a close association/a common underlying factor which explains their distribution. Grouping the indicators into smaller subdomains where indicators share the same factors enables factor analysis to be run to apply weightings to the majority of indicators.

Step 8 Weighting indicators

A statistical technique called Maximum Likelihood Factor Analysis is used to determine the weights of the indicators within each domain/subdomain. Factor analysis works most effectively where there is a single overwhelming factor which explains the performance on a set of indicators within a domain and where indicators within a domain exert an influence on one another. The outcome of applying factor analysis is that not all indicators in the domain will have equal weights, with the weights affected by the extent to which each of the indicators within a domain measure the underlying aspect that the domain is trying to capture. A key advantage of using factor analysis, is that it takes into account 'double-counting' within domains. We have run correlation analysis on the NICNI to determine the associations between indicators within each domain/subdomain. Following the outcome of this research we have applied factor analysis to the *Civic assets* domain, the *Physical connectivity* subdomain, the *Civic activity* subdomain and the *Civic participation* subdomain of the NICNI. For the *Wider connectivity* subdomain each of the indicators will be assigned an equal weighting as each of the component indicators do not have close associations.

Step 9 Combining indicators to form subdomains and domains

The weighted and standardised indicators have then been combined to form subdomain scores (in the case of indicators in the *Active/engaged community* and *Connectedness* domains) and domain scores (in the case of the Civic assets domain – which does not contain any subdomains). The combination process involves summing each of the weighted indicator scores (the standardised indicator scores * weight) together for all the indicators within a domain/subdomain.

The subdomains are then standardised (using the exponential transformation method outlined in step 10 below) and then added together to form domain scores.

Step 10 Standardising domains

The three domain scores are then combined to produce the overall Northern Ireland Community Needs Index (NICNI).

However, each of the domains are on a different scale to one another, two will be produced from combined subdomain scores, while the *Civic assets* domain will be produced from combined weighted indicators. It is therefore necessary to standardise the domain scores before combining. As with the 2019 English Community Needs Index, the method of standardisation that has been adopted is to transform the domains to a specified **exponential distribution** using an Exponential Transformation function. The exponentially transformed subdomain/domain scores are then combined to form an overall 'community need' measure at SOA level.

The Exponential Transformation method of standardisation differs from the normal distribution method as it gives more emphasis on the most deprived end of the distribution and so facilitates identification of the areas with the highest levels of need. This was the method of standardisation applied in the Indices

of Deprivation in order to control cancellation effects e.g. high levels of deprivation in one domain are not completely cancelled out by low levels of deprivation in a different domain and ensures that areas that perform particularly badly on a particular aspect of community need are moved closer to the high end of the community need spectrum even when they show positive outcomes on other indicators.

Step 11 Weighting domains

The final stage for producing the Community Needs Index is to assign weights to the three domains that have been created – to apply to the domain scores before importing. It is important to note that all potential combinations of domains involve weights. If, after standardisation, the domains are simply added together, this gives each domain an equal weight. Our approach is for the weights to be explicit and based on clear criteria. We are committed to a procedure of combining Domain Indices in such a way that the weighting of the indices is explicit. Part of this commitment to transparent weights involves the standardisation of the Domain Indices as outlined above. This ensures that the domains can be combined without 'hidden' weights. Having standardised the domains, we are then able to choose explicit weights. We have adopted the same approach to weighting domain as agreed for the English CNI 2019.

Step 12 Creating a Northern Ireland Community Needs Index (NICNI)

Once the preferred approach to producing domain weights is agreed, the domains can be combined to produce the overall Northern Ireland Community Needs Index (NICNI). The combination process involves summing each of the weighted standardised domain scores (the exponentially transformed domain scores * weight) together to produce an overall NICNI score. This score is then ranked across all SOAs in Northern Ireland in order to combine with the Northern Ireland Multiple Deprivation Measure 2017 (NIMDM2017) score (step 13 below) to identify 'left-behind' areas.

Step 13 Identifying 'left-behind' areas

'Left-behind' areas are conceptualised as SOAs in Northern Ireland, which have high levels of need on both the NICNI and the Northern Ireland Multiple Deprivation Measure 2017 (NIMDM2017). Stages 1-12 are concerned with producing an *SOA* level Northern Ireland Community Needs Index. The next step is to match this data against the Northern Ireland Multiple Deprivation Measure 2017 (NIMDM2017)– in order that both Indices can be analysed together to identify left-behind areas.

In line with the approach taken in the England CNI 2019, we have identified areas as 'left-behind' if they rank among the 10% of SOAs in Northern Ireland with the highest levels of Community Need among the 10% with the highest needs on the NIMDM2017.

Appendix A: Factor Analysis methodology

Factor analysis is used as a method for combining indicators, by finding appropriate weights for combining indicators into a single score based on the inter-correlations between all the indicators.

Factor analysis is only used in domains where 'latent variables' are hypothesised to exist and where the indicator variables are 'effect indicators', i.e. indicators that are influenced by the latent variable.

There are many candidates in terms of types of factor analysis. Two of the main contenders are maximum likelihood factor analysis (as used in the current and previous versions of the Indices of Deprivation) and Principal Components Analysis. The distinction between maximum likelihood factor analysis and Principal Components Analysis is a technical one. In brief, the assumptions underpinning Principal Components Analysis are that the indicators going into the analysis are perfectly reliable and measured without error. Maximum likelihood factor analysis requires no such assumption.

The process of combining indicators using factor analysis comprised three stages:

All indicators were converted to the standard normal distribution.

The standardised scores were factor analysed (using the Maximum Likelihood method), deriving a set of weights.

The indicators were then combined using these weights.

Appendix B: Exponential transformation

In order to combine the domains into an overall measure of need, the domain scores first need to be standardised. Any standardisation and transformation should meet the following criteria:

- Standard distribution. It must ensure that each domain has a common distribution, so that domains can be combined, without one domain dominating due to a much larger distribution.
- Identify areas of need. It must facilitate the easy identification of the areas with highest levels of need.
- Scale independent. It must not be scale dependent (in other words confuse population size with level of need).

One possible standardization approach involves each of the domain scores being ranked, and then the ranks are transformed to an exponential distribution. The exponential distribution has a number of properties that satisfy the criteria above.

Standard distribution

The exponential distribution transforms each domain so that they each have a common distribution, the same range and identical maximum / minimum values. The process starts by ranking the scores in each domain to standardise the domain scores (from 1 for the lowest need to 1,279 for the highest need), before applying the exponential transformation procedure to create a standardised domain score ranging from 0 (lowest need) to 100 (highest need).

Cancellation

The exponential transformation procedure gives control over the extent to which lack of need in one domain cancels or compensates for high need in another domain. It allows precise regulation, although not elimination, of these cancellation effects. The scaling constant (23) used produces roughly 10 per cent cancellation. This means that in the extreme case, an SOA which was ranked most deprived on one domain but least deprived on another would overall be ranked at the 90th percentile in terms of levels of need. This compares to the 50th percentile if the untransformed ranks or a normal distribution had been used instead.

Identify deprived areas

The exponential transformation effectively spreads out that part of the distribution in which there is most interest - that is the ‘tail’ which contains the areas with the highest levels of need in each domain. The scaling constant ensures that the most deprived 10 per cent of areas cover 50 per cent of the distribution of scores (in other words, scores between 50 and 100 after exponential transformation).

Scale independent

The transformation is not affected by the size of the SOA's population.

The exponential transformation calculation

The transformation used is as follows:

> For any SOA, denote its rank on the domain R, scaled to the range [0,1]. R=1/N for the least deprived and R=N/N (in other words R=1) for the most deprived, where N=the number of SOAs in Northern Ireland.
>
> The transformed domain score X is given by:
>
> $$X = -23 \ln\left(1 - R\left(1 - \exp^{-100/23}\right)\right)$$
>
> where 'ln' denotes natural logarithm and 'exp' the exponential or antilog transformation

Appendix C: Shrinkage

Improving the reliability of small area data values using shrinkage estimation

The shrinkage technique is designed to deal with the problems associated with small numbers in an SOA. In some areas – particularly where the at-risk population is small – data may be 'unreliable', that is more likely to be affected by sampling and other sources of error.

The technique of shrinkage estimation (in other words empirical Bayesian estimation) is used to 'borrow strength' from larger areas to avoid creating unreliable small area data. Shrinkage estimation involves moving SOA scores towards another more robust score, often relating to a higher geographical level. All SOA scores will move somewhat through shrinkage, but those with large standard errors (in other words the most 'unreliable' scores) will tend to move the most. The SOA score may be moved towards a 'higher need' or 'lower need' score through shrinkage estimation. Without shrinkage, some SOAs would have scores which do not reliably describe the community need in the area due to chance fluctuations from year to year.

It could be argued that shrinkage estimation is inappropriate for administrative data which are, in effect, a census. This is not correct. The problem exists not only where data are derived from samples but also where scans of administrative data effectively mean that an entire census of a particular group is being considered. This is because such censuses can be regarded as samples from 'super-populations', which one could consider to be samples in time. All the data from administrative sources and the 2011 Census are treated as samples from a super-population in this way, and the shrinkage technique was applied to indicators which use this data. The exceptions are the indicators supplied at Local Authority District level.

Selecting the larger areas from which unreliable small area data can borrow strength

The principle for selecting the larger area should be that the SOAs within them share characteristics. In the current shrinkage methodology, Local Authority Districts are used. The SOAs within a single district share issues relating to local governance and possibly to economic sub-climates. To a certain extent, they may also share issues relating to labour market sub-climates.

The shrinkage calculation

The actual mechanism of the shrinkage procedure is to estimate deprivation in a particular SOA using a weighted combination of (a) data from the SOA, and (b) data from another more robust score (in the case of the Indices, this is the Local Authority District score). The weight attempts to increase the efficiency of the estimation, while not increasing its bias. All SOA scores are adjusted to some degree through the shrinkage process, but the magnitude of the adjustment will be greatest for areas with the least reliable scores. The amount of movement depends on both the size of the standard error and the amount of heterogeneity amongst the SOAs in a Local Authority District.

The ‘shrunk’ estimate of an SOA level proportion (or ratio) is a weighted average of the two ‘raw’ proportions for the SOA and for the corresponding District. The weights used are determined by the relative magnitudes of within-Ward and between-Ward variability.

If the rate for a particular indicator in SOA j is r_j events out of a population of n_j, the empirical logit for each SOA is:

$$m_j = \log\left[\frac{(r_j + 0.5)}{(n_j - r_j + 0.5)}\right]$$

whose estimated standard error s_j is the square root of:

$$s_j^2 = \frac{(n_j + 1)(n_j + 2)}{n_j(r_j + 1)(n_j - r_j + 1)}$$

The corresponding counts r out of n for the district in which SOA j lies gives the district-level logit:

$$M = \log\left[\frac{(r + 0.5)}{(n - r + 0.5)}\right]$$

The ‘shrunk’ SOA level logit is then the weighted average:

$$m_j^* = w_j m_j + (1 - w_j)M$$

where w_j is the weight given to the ‘raw’ SOA-j data and $(1-w_j)$ the weight given to the overall rate for the district. The formula used to determine w_j is:

$$w_j = \frac{1/s_j^2}{1/s_j^2 + 1/t^2}$$

where t^2 is the inter-Ward variance for the k SOAs in the district, calculated as:

$$t^2 = \frac{1}{k-1}\sum_{j=1}^{k}\left(m_j - M\right)^2$$

Thus large SOAs, where precision $1/s_2^j$ is relatively large, have weight w_j close to 1 and so shrinkage has little effect. The shrinkage effect is greatest for small SOAs in relatively homogeneous districts.

The final step is to back-transform the shrunk logit m_j^* using the 'anti-logit', to obtain the shrunk SOA level proportion for each SOA:

$$z_j = \frac{\exp\left(m_j^*\right)}{1+\exp\left(m_j^*\right)}$$