Impact of Neighbourhood on Third Level Participation at Institutes of Technology

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This report examines the impact of Institute of Technology (IOT) neighbourhoods on third level participation at the small area level as means to inform interventions at Institute level in support of student progression and retention. Using open data from the 2016 census, we examine socio-economic groupings according to the Pobal HP deprivation index, in IOT neighbourhoods and their respective levels of participation in third level education. We also cross-reference this data with institutional retention and progression data to examine potential links between socio-economic indicators and success. Those small areas with the most disadvantage have lower levels of third level participation, however, IOT neighbourhoods appears to have no impact on these participation levels.

1. Introduction

Educational attainment is linked to life quality and well-being offering a route out of poverty and social exclusion. The education system cannot resolve issues relating to social exclusion and poverty alone but it must adopt a leading role in influencing interventions that directly impact on the ability of pupils to derive maximum benefit from educational provision [1].

The Bologna process [2] emphasises the pan-European objective of strengthening the drive for social inclusion and ensuring that higher eduction is more representative of the whole of society. The 2012 Bologna implementation report showed the goal of providing equal opportunities to quality higher education had not yet been reached. The vision for Ireland's national plan for equity of access to higher education is consistent with this objective as it 'aims to ensure that the student body entering, participating in and completing higher education at all levels reflects the diversity and social mix in Ireland's population'. Targets have been set to increase participation in higher education by the socio-economic groups that continue to be under-represented in the sector. These targets represent student numbers in those groups increasing by approximately 1,500 new entrants between 2015–2020 [3].

Institutes of Technology have historically recruited high proportions of students from certain socio-economic groups; the Institutes have their roots in institutions established to support trades through offering 'technical' and vocational education. The Institutes have therefore been attractive to certain socio-economic groups by reason of the vocational nature of the programmes offered and the more obvious route to immediate employment; the traditionally lower entry thresholds; the provision of programmes at levels 6 and 7 of the National Framework of Qualifications and the provision of 'ladder' programmes allowing students progress in stages towards more advanced awards; and, as is examined here, the proximity of the Institutes to disadvantaged communities in regional cities and towns. Recent HEA statistics [4] confirm a high percentage (31%) of new entrants in Institutes of Technology were from non-manual, semi- and unskilled socio economic backgrounds. (The figure for universities was 22%.) The Institutes have traditionally also been more accessible in providing part-time and night-time programmes. At the same time, Institutes of Technology also suffer higher non-progression rates, in particular in Science and

Engineering. This report seeks to clarify the nature of the relationship between higher education participation, success and socio-economic background taking Institutes of Technology as a particular case.

Our focus is to identify possible at-risk categories with a view to assisting in developing targeted initiatives to support retention. This report uses existing publicly available data sets relating to third level attainment and data relating to socio-economic status and examines participation in relation to social grouping. Using open datasets [5] and internal institutional datasets, we investigate the Institute of Technologies (IOTs) effect on third level participation rates in their surrounding communities. We will discuss findings for Waterford Institute of Technology (WIT) and comparable IOTs in the country.

In the first section of this report we present a methodology for integrating the relevant data sets and we address any issues that arise. Data analysis has been done using R programming language and relevant R files are included in the Appendix A. In the second section we discuss findings in the case of our analysis of the data, specifically in relation to social class and retention within education.

2. Data and Methodology

The chances that a student has of participating in higher education are directly related to the community the student comes from. It is very clear that there is much lower participation in higher education among people from communities experiencing socio-economic disadvantage. The national plan for equity of access to higher education 2015–2019 [3] highlights national third level participation (2011 data for 18–20 year olds) per socio-economic background as defined by the CSO's socio-economic groupings [6]. According to the CSO, there are ten socio-economic groups: Employers and managers, Higher professional, Lower professional, Non-manual, Manual skilled, Semi-skilled, Unskilled, Own account workers, Farmers, Agricultural workers and, All others gainfully occupied and unknown. According to the 2011 data, third level participation rates are lowest among non-manual workers (23%), semi-skilled (24%) and unskilled workers (25%), with the other seven socio-economic groups achieving rates of over 50%.

In this report we focus on third level participation in neighbourhoods directly surrounding the IOTs in Ireland. Neighbourhood effects has been a long standing area of study in the social sciences. Social scientists have been concerned about the effects on families and children of living in poor neighbourhoods for the last seventy years [7]. Neighbourhood effects refer to those factors which affect the life chances of individuals apart from those that could be predicted from their individual socio-economic circumstances. Chase-Lansdale et al. [8] state neighbourhood resources, such as the presence of sports and education centres, as the most important sources of neighbourhood effects. Chau [9] also discuss the presence of local universities generating a 'neighbourhood effect' where the behaviour and outcomes of the those in a neighbourhood in proximity to a university may cause university education to become a natural goal. We investigate the presence of this 'neighbourhood' effect in the surrounding areas of the IOTs in Ireland by comparing third level attainment within them and any relationship between these levels and their differing socio-economic circumstances. Unlike universities, it should be noted, that Institutes of Technology have a statutory obligation to spatially-defined 'neighbourhoods'; originally known as 'Regional Technical Colleges', Institutes of Technology and future Technological Universities (to be created from merged Institutes) are obliged in law to attend to the needs of their regions, however that may be defined. This suggests a particular need to examine the relationship between Institutes and their local hinterland, in the case of this report the immediate neighbourhood.

To investigate bespoke neighbourhoods surrounding each IOT, we used the 2016 Pobal HP Deprivation Index and Demographic Statistics [10], and the small area geographical data developed for Census 2011 [11]. Small areas (SA) are areas of population generally comprising of between 50 and 200 dwellings. They were created by The National Institute of Regional and Spatial Analysis (NIRSA) on behalf of the Ordnance Survey Ireland (OSi) in consultation with the CSO. Small areas were designed as the lowest level of geography for the compilation of statistics in line with data protection. These small areas (18,488) were used as the basis for the enumeration in Census 2011.

While the 2016 Pobal HP Deprivation Index and Demographic Statistics are based on Census 2016 data, the spatial aggregation is with respect to the Census 2011 small area definitions[1] [12]. This al-

[1] As part of Census 2016, a total of 37 small areas in 2011 were amalgamated due to low household numbers, 309 small areas were created by splitting 151 existing small areas due to high household numbers and residential development and, 41 small areas had their boundaries adjusted.

lows consistent coverage over the 2006, 2011 and 2016 census data.

For each IOT, we used the centroid of the small areas and the geographic distance[2] to select those within a certain radius of the IOT. The Pobal HP dataset also contains third level attainment statistics for each small area. We note that third level attainment does not necessarily imply it was attained locally, however this is not contradictory to any investigation as we are interested in the positive effect that a third level institute has on its neighbourhood. Any tertiary establishment nationally or internationally may benefit from this effect, it is simply the 'effect' that is of interest to us.

For this report, we compare third level attainment over two distinct zones formed from small areas using a distance-based definition from their local IOT. The two zones are defined as follows:

Zone 1: Small areas whose centroid lies within the circle created with the IOT as the centre point with a 1km radius.

Zone 2: Small areas whose centroid lies within the annulus created with the IOT as the centre point, with an interior radius of 1km and an exterior radius of 2.5km.

We note that, for each IOT, the zones, Zone 1 and Zone 2, are mutually exclusive, that is, do not have any small area in common. The number of small areas per zone varies from a minimum of 6 small areas to a maximum of the 107 small areas, thus the zones are sufficiently large to study a neighbourhood effect [14].

Within each of these zones we focus on the third level participation in the various socio-economic groupings. To date, the HEA has used the CSO groupings as a measure of disadvantage [3]. These groupings were created in 1996, since which time there has been much societal change, including changing family and occupational structures and the effects of social mobility. Such measures of socio-economic groupings can yield misleading estimates of inequalities in access to higher education [15]. For this reason we will use the small area HP deprivation index as a proxy for social groupings.

The HP deprivation index [12] is based on a factor analytical approach which reduces a larger number of indicators to a smaller number of underlying dimensions, factors or components. Three dimensions of affluence/disadvantage feed into the model: demographic profile, social class composition and labour market situation. Demographic profile is measured by six indicators from the census 2016 data:

- the percentage change in population over the previous five years,
- the percentage of population aged under 15 or over 64 years of age,
- the percent age of population with a primary school education only,
- the percentage of population with a third level education,
- the percentage of households with children aged under 15 years and headed by a single parent,
- the mean number of persons per room.

Social Class Composition is measured by five indicators:

- the percentage of population with a primary school education only,
- the percentage of population with a third level education,
- the percentage of households headed by professionals or managerial and technical employees, including farmers with 100 acres or more,
- the percentage of households headed by semi-skilled or unskilled manual workers, including farmers with less than 30 acres,
- the mean number of persons per room.

Labour Market Situation is measured by three indicators:

- the percentage of households with children aged under 15 years and headed by a single parent (negative association),
- the male unemployment rate,
- the female unemployment rate.

For all small areas in Ireland the HP deprivation index scores are approximately normally distributed. The experience of people living in about two thirds of areas is not significantly different from the mean. On the other hand, where HP deprivation index scores are one or two standard deviations from the mean (equivalent to 10 or 20 points on the HP deprivation index scale), this indicates a different experience [12]. Pobal HP deprivation index scores are summarised in Table 1.

[2] Distances are computed using the geographic distance functions available in the R package `raster` [13].

Table 1. Pobal HP deprivation index scale.

Relative Index Score	Label
over 30	Extremely affluent
20 to 30	Very affluent
10 to 20	Affluent
0 to 10	Marginally above average
−10 to 0	Marginally below average
−20 to −10	Disadvantaged
−30 to −20	Very disadvantaged
below −30	Extremely disadvantaged

In our analysis we have omitted Dublin City and County. It is difficult to quantity the 'neighbourhood' effect in Dublin City potentially for a number of reasons: the mobility of the population beyond their home neighbourhood; the wide range of choices available to potential students; and the proximity of institutes and universities to one another and the overlap in 'catchment' area. Future projects may consider the particular case of Dublin and, indeed, the relationship between Dublin colleges and those in the greater Dublin area.

3. Institute of Technology Summary

3.1. Socio-Economic Classification

Firstly, we present the socio-economic breakdown in the immediate area around each of the IOTs in the country. Tables 2 and 3 show a breakdown of the Pobal HP deprivation index groups in surrounding areas.

Table 2 gives the 2016 Pobal HP deprivation index breakdown for Zone 1, as defined in Section 2. It is clear that WIT's neighbourhood is far more disadvantaged than any other IOT, with 51.9% of the small areas classified as very disadvantaged and 96.3% classified between very disadvantaged and marginally below average. Limerick IT (LIT) has the second highest number of very disadvantaged small areas in Zone 1, with 77.3% of all small areas classified between extremely disadvantaged and marginally below average, and is the only IOT with small areas (2.3%) classified as extremely disadvantaged. Similar to LIT and WIT, Dundalk IT (DkIT) and IT Sligo have over 70% classified between very disadvantaged and marginally below average, 40% of DkIT's surrounding small areas being marginally disadvantaged, and 42.8% of IT Sligo's disadvantaged. The percentage of very disadvantaged small areas for DkIT and IT Sligo are 15% and 14.3% respectively. 60% of Athlone IT's (AIT) surrounding small areas fell into below average groupings, however none were classified as extremely or very disadvantaged as all fell in the disadvantaged (26.7%) or marginally below average (33.3%) groupings. Galway Mayo IT (GMIT) is the remaining IOT with very disadvantaged small areas in Zone 1, with 3.1% observed small areas along with 15% disadvantaged small areas, although over 70% of GMIT's small areas in Zone 1 fall in the marginal groupings. All Letterkenny IT's (LyIT) surrounding small areas are classified as marginal. All small areas around the Institute of Technology Tralee (ITTr) fall in to the marginal groupings with no extreme values observed. In Zone 1 the majority of small areas surrounding IT Carlow (ITC) and Cork IT (CIT) are classified as above average, with 77.8% of the small areas surrounding CIT classified between marginally and very affluent (CIT is the only IOT with small areas (5.6%) classified as very affluent) and ITC having 63.6% marginally above average.

Table 3 shows the HP deprivation index for Zone 2, as defined in Section 2. WIT remains the group with the highest concentration of very disadvantage small areas, with 11.3% falling in the grouping, and LIT remaining equally high in the disadvantaged groupings with 4.7% extremely disadvantaged and 6.5% small areas very disadvantaged. The small area distribution of WIT remains skewed, with 79.2% small areas classified between very disadvantaged and marginally below average, with 34.9% disadvantaged. In Zone 2, AIT, CIT, GMIT and LIT all see an increase in small areas classified between the marginally above average and affluent groups, out weighing those classified below average in each IOT neighbourhood. However in contrast, Carlow IT now has more small areas classified between very disadvantaged and marginally below average, with 29.8% small areas being disadvantaged. IT Tralee has the largest percentage of disadvantaged small areas with 35.1% falling in this grouping. LyIT having only marginal observations in Zone 1, now has 3.8% and 17.3% very disadvantaged and disadvantaged small areas respectively. ITTr has a similar distribution to that of LyIT having only marginally observations in Zone 1 whereas Zone 2 has 35.1% disadvantaged small areas classified.

In Figure 1 the small areas in the neighbourhood of each IOT is shown for Zone 1 and Zone 2.

3.2. Third Level Participation

Third level participation figures are shown in Tables 4 and 5. Over both zones, it is clear that third level participation is consistently increasing as progression from extremely disadvantaged to

Table 2. Distribution of small areas by Deprivation Score near IOT (Zone 1).

	n	extremely disadvantaged	very disadvantaged	disadvantaged	marginally below average	marginally above average	affluent	very affluent
		%	%	%	%	%	%	%
Institute of Technology Athlone	15	0.0	0.0	26.7	33.3	40.0	0.0	0.0
Institute of Technology Carlow	22	0.0	0.0	9.1	27.3	63.6	0.0	0.0
Cork Institute of Technology	18	0.0	0.0	16.7	5.6	50.0	22.2	5.6
Dundalk Institute of Technology	20	0.0	15.0	25.0	40.0	20.0	0.0	0.0
Galway Mayo Institute of Technology	32	0.0	3.1	15.6	34.4	40.6	6.2	0.0
Letterkenny Institute of Technology	15	0.0	0.0	0.0	46.7	53.3	0.0	0.0
Limerick Institute of Technology	44	2.3	31.8	9.1	34.1	22.7	0.0	0.0
Institute of Technology Sligo	14	0.0	14.3	42.9	21.4	21.4	0.0	0.0
Institute of Technology Tralee	6	0.0	0.0	0.0	66.7	33.3	0.0	0.0
Waterford Institute of Technology	27	0.0	51.9	25.9	18.5	3.7	0.0	0.0

Table 3. Distribution of small areas by Deprivation Score near IOT (Zone 2).

	n	extremely disadvantaged	very disadvantaged	disadvantaged	marginally below average	marginally above average	affluent	very affluent
		%	%	%	%	%	%	%
Institute of Technology Athlone	23	0.0	4.3	8.7	34.8	30.4	21.7	0.0
Institute of Technology Carlow	57	0.0	5.3	29.8	40.4	19.3	5.3	0.0
Cork Institute of Technology	64	0.0	0.0	3.1	14.1	45.3	31.2	6.2
Dundalk Institute of Technology	60	0.0	3.3	8.3	45.0	33.3	10.0	0.0
Galway Mayo Institute of Technology	71	0.0	1.4	8.5	25.4	40.8	23.9	0.0
Letterkenny Institute of Technology	52	0.0	3.8	17.3	36.5	30.8	11.5	0.0
Limerick Institute of Technology	107	4.7	6.5	9.3	29.0	37.4	13.1	0.0
Institute of Technology Sligo	55	0.0	3.6	21.8	43.6	20.0	10.9	0.0
Institute of Technology Tralee	37	0.0	0.0	35.1	27.0	37.8	0.0	0.0
Waterford Institute of Technology	106	0.0	11.3	34.9	33.0	19.8	0.9	0.0

affluent is observed. The ratio of participation rates consistently decreases as progress through the groupings is observed also.

For Zone 1, in Table 4, the lowest participation rates are observed in the extremely disadvantaged small areas surrounding LIT, at 2.9%. Lowest participation in the very disadvantaged group was observed in LIT's neighbourhood, with participation of 4.3%, followed by WIT's neighbourhood at 7.2% participation rate. DkIT has similar low participation in this group. In contrast, GMIT and IT Sligo have participation rates of 15.2% and 13.7% respectively. The mean participation in the disadvantaged group was 17.3% with WIT and LIT having participation rates more than one standard deviation below the mean, with highest participation in the disadvantaged group observed at DkIT. For the marginally disadvantaged group, the mean participation rate is 31.3% with WIT having the lowest participation in the group, with 22.7%, the next lowest observing 5% more participation than WIT. ITC and LIT having 27.8% and 27.1% respectively, which both remain below the mean. For the marginally affluent grouping, average third level participation is 46.41% with LIT and WIT observing the minimum participation rates of 39.3%. The average ratio of marginally affluent and marginally disadvantaged is 1.5, falling from 1.74 for the ratio of marginally disadvantaged and disadvantaged, while the ratio of very disadvantaged and extremely disadvantaged is 2.12.

Zone 2, in Table 5, sees little change in participation rates (2.9% to 2.2%) in the extremely disadvantaged small areas surrounding LIT. Lowest participation in the very disadvantaged grouping is the neighbourhood of AIT with participation of 6.4%, followed by ITC and DkIT at 7.4% participation rate, and IT Limerick at 7.7% participation rate.

WIT's participation rates have increased in Zone 2 in comparison to Zone 1 at 10.8%. The mean participation in the disadvantaged group was 16.73% with AIT and CIT having participation rates more than one standard deviation below the mean, with highest participation in the disadvantaged group observed at LyIT. For the marginally disadvantaged group, the mean participation rate is 30.46% with WIT remaining the lowest participation rate in the group, at 25.2%, more than one standard deviation below the mean. For the marginally affluent grouping, the average third level participation is 44.29% with DkIT and WIT observing the minimum participation rates of 39.3% and 37.5% respectively. The average ratio of marginally affluent and marginally

Table 4. Proportion of population to obtain third level qualification by Deprivation Score near IOT (Zone 1).

	extremely disadvantaged	very disadvantaged	disadvantaged	marginally below average	marginally above average	affluent	very affluent
	%	%	%	%	%	%	%
Institute of Technology Athlone	–	–	16.2	33.4	46.5	–	–
Institute of Technology Carlow	–	–	19.1	27.8	42.7	–	–
Cork Institute of Technology	–	–	14.7	31.4	53.7	63.2	100.0
Dundalk Institute of Technology	–	7.6	22.3	33.2	45.7	–	–
Galway Mayo Institute of Technology	–	15.2	17.8	29.1	45.3	62.7	–
Letterkenny Institute of Technology	–	–	–	35.4	49.4	–	–
Limerick Institute of Technology	2.9	4.3	14.2	27.1	39.3	–	–
Institute of Technology Sligo	–	13.7	19.9	32.7	56.4	–	–
Institute of Technology Tralee	–	–	–	39.9	45.8	–	–
Waterford Institute of Technology	–	7.2	14.5	22.7	39.3	–	–

Table 5. Proportion of population to obtain third level qualification by Deprivation Score near IOT (Zone 2).

	extremely disadvantaged	very disadvantaged	disadvantaged	marginally below average	marginally above average	affluent	very affluent
	%	%	%	%	%	%	%
Institute of Technology Athlone	–	6.4	12.5	35.5	45.5	58.7	–
Institute of Technology Carlow	–	7.4	18.0	28.7	40.3	47.6	–
Cork Institute of Technology	–	–	10.5	29.8	50.3	64.7	75.5
Dundalk Institute of Technology	–	7.4	18.3	27.3	39.3	55.6	–
Galway Mayo Institute of Technology	–	13.4	19.3	30.6	49.4	60.6	–
Letterkenny Institute of Technology	–	14.7	19.7	35.5	48.8	63.4	–
Limerick Institute of Technology	2.2	7.7	18.0	29.2	45.5	59.6	–
Institute of Technology Sligo	–	9.6	18.6	30.7	42.5	52.6	–
Institute of Technology Tralee	–	–	16.8	32.4	43.6	–	–
Waterford Institute of Technology	–	10.8	15.6	25.2	37.5	38.2	–

disadvantaged is 1.46, falling from 1.9 for the ratio of marginally disadvantaged and disadvantaged, while the ratio of very disadvantaged and extremely disadvantaged is 1.98.

Average participation rates marginally decreased in Zone 2 in comparison to Zone 1, but as the observed decreases were between 1 and 3 percentage points it is not possible to conclude this to be considered a 'neighbourhood effect'.

4. Discussion

The chances that a student has of participating in higher education are directly related to the community the student comes from, and it is very clear that there is much lower participation in higher education among people from communities experiencing socio-economic disadvantage. The higher education sector must continue to look at ways to open up to communities experiencing entrenched socio-economic disadvantage and to address inequality of access at a policy level.

One such initiative, Campus Engage, was established by a number of higher education institutions to provide a national platform for the enhancement and co-ordination of civic and community engagement. In 2014, 22 Presidents of higher education institutions, including WIT, publicly signed up to the ten-point Campus Engage Charter. It is unclear how successful Campus Engage has been but there is evidence of some positive engagement with the initiative in University Limerick (UL). UL has wide spread engagement with the community as is clear from the link on UL's webpage to the various events coordinated under the engage initiative [16]. More recently, Campus Engage, in collaboration with the Irish Research Council launched 'Engaged Research' [17], to highlight engaged research practices in Ireland and to set out recommendations to advance these practices for societal impact. Engaged research is described in the initial report as a 'wide range of research approaches and methodologies that share a common interest in collaborative engagement with the community and aim to improve, understand or investigate an issue of public interest or concern, including societal challenges'. Participation in the national consultation on engaged research involved the universities in Ireland, Dublin Institute of Technology and the Institute of Technology Blanchardstown while no IOT outside of Dublin participated.

National initiatives clearly provide an important policy framework and set of guiding principles to direct local action. We suggest that bespoke local

action that takes account of the particular qualities of the local population is strongly advisable and likely to lead to greater impact. In determining access recruitment policy, we contend, the 'neighbourhood effect' must be taken into account and the physical proximity of colleges to areas of socio-economic disadvantage exploited to ensure people from within these areas identify with the local institution and the possibilities it offers them. The strong regional orientation of the Institutes of Technology traditionally and, in the future, the Technological Universities makes it imperative for these institutions at least that strong linkages between local communities and higher education are created and maintained.

From the open data studied in Section 3, we concluded that no neighbourhood effect was observed around WIT and its neighbouring communities. To benefit from such an effect, the need for explicit targeting in the immediate area around WIT and increasing support of initiatives such as the Learning for Life programme [18], should continue to be carried out to encourage access to education—and arguably such a focus should be replicated elsewhere with greater 'spatial awareness' determining access policy and practice. WIT's recently published Strategic Plan 2018–2021 [19] makes explicit reference to recruiting more students from certain socio-economic backgrounds (and thus orienting the organisation towards this population), building stronger community alliances, and driving a more engaged institution particular when it comes to local and regional links[3]. A detailed consideration of the 'neighbourhood effect' in this sense can have a direct influence on institutional policy. There are potentially lessons here for other colleges. Time will tell whether these and other initiatives have a direct impact on student recruitment and retention. Another exemplar here is DCU's civic engagement project whose influence on society has been recognised by the National Strategy for Higher Education [20]. As stated on DCU's website: '*DCU's Civic engagement* is best defined as a mutually beneficial relationship between the university and the community, understood in its broadest sense to encompass local, national and global individuals and associations committed to social, economic, political and cultural development. It encompasses a range of activities through which staff and students engage with the needs of communities and also seek a development of their own social understanding though active and global citizenship. In brief, civic engagement means working to 'make a difference' in the civic life of our communities through the development of appropriate knowledge, skills and values'. Clearly such projects have outcomes that transcend measurable student recruitment figures that need to be taken account of in determining the success or otherwise of such programmes.

It is clear that continued intervention is needed through third level with targeted interventions throughout all stages in support of students; institutional commitment to access therefore involves sustained commitment to student support. WIT currently is engaged in detailed analysis of data associated with student retention and has focussed on clarifying potential risk factors that influence student progression outcomes. One measure of student socio-economic background not explicitly considered above has to do with school origin, specifically whether the school within which the student completes her/his secondary education is a DEIS school. In WIT's case, one primary school falls in Zone 1, and three fall in Zone 2. St Paul's Community College, in Zone 1, is a DEIS school. Between 2007–2017, 85.4% of third level enrolments from that school were in WIT. Three post primary schools fall within Zone 2: Presentation Secondary school, CBS Mount Sion and St. Angela's Ursuline convent, the first two of which are listed as DEIS schools. Between 2007–2017, 75.3% of third level enrolments in the Presentation Secondary school were in WIT and 82.5% in the CBS Mount Sion were in WIT. St. Angela's Ursuline convent, the only non-DEIS school in Zones 1 or 2, saw 41.4% enrol in WIT over the last 10 years[4]. Non-progression rates from the cohort of students who had enrolled from the 3 DEIS schools was found to be 27%; 7% higher than non progression rates in the cohort of students who had enrolled from the remaining 8 non-DEIS schools [21]. Clearly bespoke interventions towards these populations where the risk is greater is more likely to bring positive outcomes. It should be noted that community engagement initiatives, such as the DCU project mentioned earlier, have allowed for significant progress to be made in increasing retention rates in DEIS schools. Figures available [22], show retention rates of 82% for the 2008 Leaving Certificate DEIS cohort, in comparison with rates of 68.2% for the 2001 cohort which in very general terms suggests some level of impact. However, for the 2008 cohort, DEIS schools retention rates were still 8.5% lower than the national average rate.

[3] In particular, see pp.33–4 and 41–2

[4] Figures obtained from the Irish Times feeder school link: https://www.irishtimes.com/feeder-schools.

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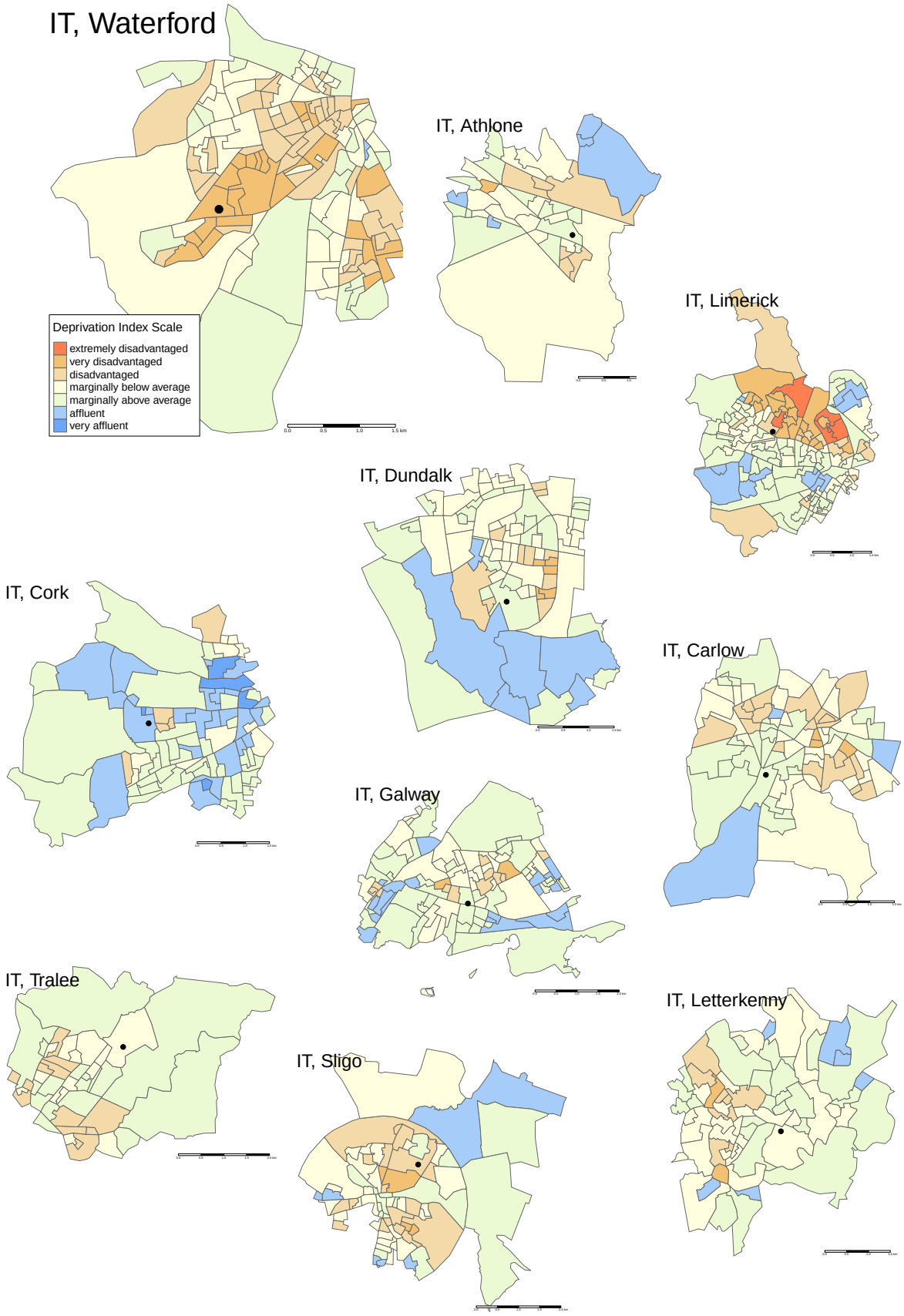

Figure 1. Distribution of small area by Deprivation Score near IOT (Zone 1 and Zone 2).

A. R Code Used to Process Data

R script `Generate_Tables.R`

```
# Summarise statistics of SA in near each IoT

# libraries
x <- c("rgdal", "raster", "tidyverse")
invisible(sapply(x, require, character.only=TRUE))

source("common.R")

# import CSO 2011 SA shapefile (and exclude Dublin)
sdf.country <- readOGR(dsn=paste(root, "cso_ie/2011/SA/SA_20m", sep="/"))
sdf.country <- sdf.country[substr(sdf.country@data$SMALL_AREA,1,2)!="26",]

sdf.country <- spTransform(sdf.country,CRS("+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs"))

# fix missing leading zero (not needed for this project)
sdf.country@data$SMALL_AREA <- as.character(sdf.country@data$SMALL_AREA)
sdf.country@data$SMALL_AREA[sdf.country@data$SMALL_AREA=="037018001/37041001"] = "037018001/037041001"

# import Pobal deprivation index and demographic stats
df.country <- read.csv(paste(root, "generated/pobal_sa_stats.csv", sep="/"))

# band deprivation index to get deprivation index score
df.country$DS_band <- cut(df.country$Deprivation.Score.2016, breaks=ds_breaks, labels=ds_labels_short, right=FALSE)

#df.country$SA <- as.character(df.country$Small.Area.ID)
# merge the geospatial and demographic datasets
#sdf.all <- sp::merge(sdf.country, df.country, by="SA")

sdf.all <- sp::merge(sdf.country, df.country, by.x="SMALL_AREA", by.y="Small.Area.ID")

# reduce columns to those of interest
vars <- c(SA="SMALL_AREA",
          Population="Total.Population.2016",
          DS="Deprivation.Score.2016",
          DS_band="DS_band",
          Prop_TLE ="Proportion.with.third.level.education.2016")
sdf.all@data <- sdf.all@data %>%
  dplyr::select(!!vars)  %>%
  dplyr::mutate(Num_TLE = Prop_TLE*Population)

get_regions_near = function (hei="WIT", min_distance=0, max_distance=1000) {

  hei.coordinates <- df.hei[df.hei$id==hei, c("lon","lat")]
  sdf.all$dist <- pointDistance(coordinates(sdf.all), hei.coordinates, lonlat=T)

  # limit MAPS to SA of interest
  sdf <- sdf.all[sdf.all@data$dist>=min_distance & sdf.all@data$dist<max_distance,]
}

generate_stats = function (hei="WIT", f, min_distance=0, max_distance=1000) {

  hei.coordinates <- df.hei[df.hei$id==hei, c("lon","lat")]

  sdf.all$dist <- pointDistance(coordinates(sdf.all), hei.coordinates, lonlat=T)

  # limit MAPS to SA of interest
  sdf <- sdf.all[sdf.all@data$dist>=min_distance & sdf.all@data$dist<max_distance,]
```

```r
  # apply stats operation and convert to wide format
  f(sdf@data) %>% spread(key,value)
}

generate_stats_Count = function(hei, min_distance=0, max_distance=1000) {
  df <- get_regions_near(hei, min_distance, max_distance)@data
  df_summary <- df %>%
    dplyr::group_by(DS_band) %>%
    dplyr::summarise(N = n()) %>%
    dplyr::select(key="DS_band", value="N") %>%
    complete(key,fill=list(value=0))
  df_summary <- rbind(data.frame(key="n", value=nrow(df)), df_summary)
  dplyr::mutate(df_summary, hei=hei) %>% spread(key,value)
}
generate_stats_Count("LIT", max_distance=2000)

generate_stats_Prop = function(hei, min_distance=0, max_distance=1000) {

  print(hei)
  df <- get_regions_near(hei, min_distance, max_distance)@data

  df_summary <- df %>%
    dplyr::group_by(DS_band) %>%
    dplyr::summarise(N = n()) %>%
    dplyr::select(key="DS_band", value="N") %>%
    complete(key,fill=list(value=0))

  df_summary$value <- sprintf("%.1f",df_summary$value / nrow(df) * 100)
  df_summary <- rbind(data.frame(key="n", value=nrow(df)), df_summary)
  dplyr::mutate(df_summary, hei=hei) %>% spread(key,value)
}
generate_stats_Prop("WIT", max_distance=2500)

generate_stats_TLE = function(hei, min_distance=0, max_distance=1000) {
  df <- get_regions_near(hei, min_distance, max_distance)@data
  df_summary <- df %>%
    dplyr::filter(Prop_TLE>=0) %>%
    dplyr::group_by(DS_band) %>%
    dplyr::summarise(TLE = sum(Num_TLE), Population=sum(Population)) %>%
    dplyr::mutate(Prop.TLE = TLE/Population) %>%
    dplyr::select(key="DS_band", value="Prop.TLE") %>%
    complete(key,fill=list(value=0))
  df_summary$value <- ifelse(df_summary$value>0, sprintf("%.1f",df_summary$value), "-")
  #df_summary <- rbind(data.frame(key="n", value=nrow(df)), df_summary)
  df_summary <- data.frame(df_summary)
  dplyr::mutate(df_summary, hei=hei) %>% spread(key,value)
}
generate_stats_TLE("LIT", min_distance = 0, max_distance = 2000)


d <- do.call("rbind", lapply(df.hei$id, generate_stats_TLE,min_distance=0000, max_distance=1000))
d$hei <- lapply(d$hei, function (x) { as.character(df.hei$name[df.hei$id==x]) })
stargazer(d, summary=FALSE, type='latex', rownames=FALSE)
```

R script `Draw_Neighbourhood.R`

```r
# Draw SA in neighbourhood of IOT showing Deprivation Score

draw_neighbourhood = function(hei, show_leg=FALSE) {

  sdf <- get_regions_near(hei, max_distance = 2500)

  sdf@data$"Deprivation Index Scale" <- factor(sdf@data$DS_band, levels=levels(
      sdf@data$DS_band), labels=ds_labels)

  hei.coordinates <- df.hei[df.hei$id==hei, c("lon","lat")]
  HEI <- SpatialPoints(cbind(hei.coordinates$lon,hei.coordinates$lat))
  tmp <- SpatialPointsDataFrame(HEI, data.frame(id="LIT"))
  tmp <- set_projection(tmp, get_proj4("longlat"), current.projection="longlat")

  g <- tm_shape(sdf) +
    tm_polygons("Deprivation Index Scale", palette=ds_colors,
                auto.palette.mapping=FALSE) +
    tm_scale_bar(position = c("right", "bottom"))  +
    tm_style_white(title = paste("IT,", df.hei$county[df.hei$id==hei])) +
    tm_shape(tmp)+tm_symbols(shape=20,col="black", size=1.8) +
    tm_legend(show=show_leg, title.size=2, text.size = 1.1, frame=T) +
    tm_style_white(title.size=3, bg.color="white", frame=FALSE)
  save_tmap(g, gsub(" ", "_",paste("pic/",hei,".pdf", sep="")), units="cm", width
      =20, height=20)
}

invisible(sapply(df.hei$id,draw_neighbourhood))
draw_hei("WIT", show_leg=TRUE)
```