

On the role of frameworks and smart mobility in addressing the rural mobility problem

Richard Mounce^{a*}, Mark Beecroft^b and John D Nelson^c

^a *Centre for Transport Research, School of Engineering, University of Aberdeen, Fraser Noble Building, Aberdeen, AB24 3UE, +44 1224274087, r.mounce@abdn.ac.uk*

^b *Centre for Transport Research, Geography and Environment, School of Geosciences, University of Aberdeen St Mary's, Aberdeen, AB24 3UF, +44 1224274055, m.beecroft@abdn.ac.uk*

^c *Institute of Transport and Logistics Studies, The University of Sydney Business School, NSW 2006, Australia. +61 2 9114 3048: j.nelson@sydney.edu.au*

*Corresponding author

ABSTRACT

Mobility is fundamentally important in enabling people to access services, which can deliver substantial benefits to people's quality of life. This is particularly important in rural areas where the range and extent of public transport services are, in general, significantly lower than in urban areas, and, indeed, below the level required to provide a level of service that is sufficiently high to enable people in rural areas without private cars to access these services. This paper looks at the role of governments in institutional, organisational, regulatory and financial frameworks in supporting rural transport services at a level that enables this access. A cluster analysis is performed to identify distinct classes of framework types across Europe. In addition, the paper gives examples of good practice and innovation in rural transport from across Europe incorporating a variety of themes: the use of Information and Communications Technology, intermodal service coordination, demand-responsive transport, shared mobility and good governance. Key success factors for introducing, sustaining and transferring these forms of good practice are then discussed.

Keywords: rural transport; smart mobility; shared mobility; rural mobility; mobility framework; good practice.

JEL classification: H1; O3; R4; R5

1. Introduction

Urban areas have higher populations and much greater economic activity than rural areas, and as a consequence usually attract much greater attention than rural areas in terms of transport service provision. In addition, the proximity of people's homes to services and amenities (relative to that in rural areas) makes the provision of adequate transport services much easier in urban areas than in rural areas. The difficulties of providing transport in rural areas have been well documented for many years (St. John Thomas, 1963, Moseley, 1979). Essentially, the low demands for travel in rural areas make it economically unfeasible for transport operators to run the range of services that are necessary to satisfy the public transport users' mobility needs; the rural transport supply does not meet the demand of people's mobility needs. Services are then often pared back repeatedly as a result; at each stage the diminishing transport offer gives rise to a diminishing demand for travel by public transport. This vicious circle generally leads to a public transport offering and demand level well below that which might have been sustainable had realistic, yet difficult, measures been implemented at a sufficiently early stage. Limited public transport services in rural areas impacts negatively on people's mobility options and leads to an over-reliance on private car as a mode of transportation.

Lack of rural mobility impacts on people's ability to access services, and hence on people's quality of life. In particular, the people who are most impacted negatively are the more vulnerable members of society such as the elderly, disabled and children, since these are the people less likely to own or have access to a car (Shergold et al., 2012). Furthermore, the value of other services such as education and health services, is lessened if people are less able to access these services through a lack of rural mobility; similarly, job opportunities may

be compromised without access to adequate transport services (Wright et al., 2009). Ideally, rural areas would be served by an efficient, comprehensive and coordinated multimodal transport system capable of linking rural communities with each other and with urban areas. However, this is rarely the case, particularly in Europe, where recent austerity measures are putting further pressure on already limited funding for rural transport services, at a time when it is sorely needed. Current prevailing trends such as rural depopulation and ageing rural populations are compounding the problem. As a result, many rural areas throughout Europe do not have the range of transport services and connections that are required by the people who live and work there. Section 2 will give more detail about the rural mobility problem, including different ways in which rurality can be defined and measured; rurality data for countries across Europe; and information about the range of transport services available in rural areas.

It is reasonable for people living in rural areas expect to be able to access fundamental services such as health and educational services. However, the transport services in rural areas may not be adequate to ensure proper access to these services; this raises the question of the role of government in providing (directly) and making provisions for adequate transport services to ensure this access. Whether providing these transport services directly (either by operating the services themselves or more likely by some local authority) or by commissioning an operator to operate the transport services, the services are often not financially sustainable, meaning that the only way for them to continue operating is if they are subsidised by government (at least to some degree). This raises the issue of whether, and to what extent, rural transport services should be subsidised, supporting the right of people to live in rural areas; this issue is discussed in Section 2. In answering this question, it is important to consider the value of rural space in itself, not only to its inhabitants, but also to its visitors, who also need transport to the countryside.

The frameworks for rural mobility put in place by governments, including the institutional, regulatory, organisational and financial frameworks, have significant impacts on rural transport provision. Section 3 looks at how the various frameworks can contribute, as well as create barriers to, rural transport provision. It will also look at framework data¹ for countries across Europe (the EU-28, i.e. the current European Union member states) and perform a cluster analysis to identify distinct classes of framework types across Europe. Governments should provide frameworks and conditions that support, rather than inhibit, transport services in rural areas. Such transport services are often community-led initiatives, some of which may be identified as examples of 'good practice'. Section 4 looks at examples of good practice across a range of themes and considers how the potential for these good practices to be transferred from one place to another, and how the supporting conditions might be put in place for this best to be achieved. Finally, Section 5 draws together conclusions from the paper.

2. The rural mobility problem

¹ This data was produced as part of the EU-funded SMARTA project (see <https://ruralsharedmobility.eu/> for more information).

Section 1 reviewed the problem of providing transport services in rural areas. This section will look at how to classify rurality and measure the extent of rurality across Europe. It will also expand on the problems associated with rural transport services, e.g. in terms of the low demand for travel, the lack of integration of modes and services, the overreliance on the private car as a mode of transport and the 'rural mindset'.

The first thing that becomes apparent when attempting to classify rurality is that there is an urban to rural continuum, i.e. the existence of areas which are not clearly urban or rural. The second thing is that the classification of an area as rural or urban depends very much upon what criteria are used. Rural areas are clearly defined by their smaller populations, and these can be measured by settlement size as well as population density.

The Eurostat classification of rurality² uses a three-stage approach to classify the NUTS (Nomenclature of Territorial Units for Statistics) level 3 regions (where are generally states, regions, provinces, etc.):

1. *Definition of rural area.* Rural areas are deemed to be all areas outside urban clusters, which are clusters of contiguous grid cells of 1 km² with a density of at least 300 inhabitants per km² and a total population of 5,000.
2. *Classification of the regions.* In the second step, regions are classified according to the share of the population in rural areas:
 - a. *Predominantly rural.* If the share of population living in rural areas is higher than 50%.
 - b. *Intermediate.* If the share of population living in rural areas is between 20% and 50%.
 - c. *Predominantly urban.* If the share of the population living in rural areas is below 20%.
3. *Presence of a city.* The sizes of urban centres in the region is considered:
 - a. A predominantly rural region which contains an urban centre of more than 200,000 inhabitants making up at least 25% of the regional population becomes intermediate.
 - b. An intermediate region which contains an urban centre of more than 500,000 inhabitants making up at least 25% of the regional population becomes predominantly urban.

It is important to note that the classification of urban versus rural areas depends very much on the granularity of the zoning system that is used. Figure 1 shows the urban-rural typology for the NUTS Level 3 regions across Europe. At this level, there appears to be a reasonable balance in territorial terms between the regions classified as rural and those classified as urban. Figure 2 shows how the classification changes when smaller regions are used: in this case Local Administrative Units Level 2 (LAU2) which are generally municipalities. At this level of granularity, Europe appears to be predominantly rural, at least in territorial terms. The reason for this disparity is simply that Europe is predominantly urbanised, i.e. population tends to be centred around towns and cities, with other, more rural, areas being much more sparsely populated. Indeed, when we look at the degree of rurality in terms of population, there is more of a balance between the share of the population living in rural areas versus the share living in urban areas, at least across Europe as a whole; these proportions, which

² <https://ec.europa.eu/eurostat/web/rural-development/methodology>. For further information on Eurostat's methodology for classifying territorial typologies see Eurostat (2018).

are shown in Figure 3, vary significantly across the EU-28 countries. Broadly speaking there is a trend for Central European countries to have a greater share of their population living in rural areas.

There is a strong argument for the definition of rurality being dependent on the level of transport accessibility as well as measures of population size and distribution. The Scottish Government's classification (Scottish Government, 2018) of rurality includes such measures of accessibility in addition to settlement size. The 6-fold classification is as follows:

1. *Large Urban Areas*. Settlements of 125,000 people and over.
2. *Other Urban Areas*. Settlements of 10,000 to 124,999 people.
3. *Accessible Small Towns*. Settlements of 3000 to 9999 people, and within a 30-minute drive time of a settlement of 10,000 or more people.
4. *Remote Small Towns*. Settlements of 3,000 to 9,999 people, and with a drive time of over 30 minutes to any settlement of 10,000 or more people.
5. *Accessible Rural Areas*. Areas with a population of less than 3,000 people, and within a 30-minute drive time of a settlement of 10,000 or more.
6. *Remote Rural Areas*. Areas with a population of less than 3,000 people, and with a drive time of over 30 minutes to a settlement of 10,000 or more.

There is also an 8-fold classification that further subdivides the remote rural areas. The urban-rural classification above includes some measure of accessibility in terms of how proximate areas are to urban centres in terms of their drive-time. However, there are many people living in rural areas who do not have their own car (though this is a smaller proportion of people than it is in urban areas) and so who will be relying on public transport or other transport services.

Low levels of population and population density in rural areas translate into low levels of patronage of public transport services offered in these rural areas. As a result, it is difficult for transport operators to provide a level of service comparative to that which is offered in urban areas (Moseley, 1979). There are often flexible transport services operating on a small scale in rural areas, which can offer greater flexibility than regular public transport services and can fill some of the gaps in the public transport system (Velaga et al., 2012a). These consist of demand responsive transport (DRT) for the general public or more commonly through dedicated services (i.e. transport for specific groups of the population, e.g. the elderly). These rural flexible transport services are characterised by flexible routing and scheduling of small to medium-sized vehicles operating in shared-ride mode between pick-up and drop-off locations according to passengers' needs (Mulley et al., 2012), usually resulting in a 'door-to-door' service. Dedicated flexible transport services are generally stand-alone services for certain target user groups e.g. the elderly or disabled. Many services are provided by community transport organisations or funded through the services they are supporting, such as health or social services. Flexible transport services in the form of DRT have the potential to perform a valuable role as a feeder service to the public transport network, providing an integrated and efficient public transport offering. It is possible that they could also form part of a future Mobility as a Service (MaaS) type system (Mulley et al., 2018).

The difficulties posed by the low patronage of rural transport services raises the issue of whether rural transport services should be subsidised. Although rural transport is subsidised in many European countries, in most countries (two examples being Italy and the UK) these

subsidies have decreased in recent years as part of a wider reduction by central government on public spending. This has led inevitably to a reduction in transport services dedicated to rural populations. In contrast, these same governments have often increased capital and subsidy funding for transport in urban areas on the basis that it is essential for economic growth, quality of life, social equality and environmental protection. In such circumstances, this has resulted in populations in rural areas becoming more and more dependent on the private car as a means of transportation, with the inevitable outcomes that those with cars use them for most travel, adopting a 'rural travel mindset' characterised by an overreliance on the private car and a lack of awareness about or unwillingness to use public transport. On the other hand, those without cars are dependent on other people for lifts, often meaning they have reduced possibilities to participate in society; this is incompatible with policies that seek to develop and revitalise rural areas, to improve opportunities and to tackle social exclusion.

Subsidies can lead to inefficient transport services in the case where transport providers are paid a flat rate subsidy or block grant regardless of the number of the passengers they transport; this can lead to a lack of financial incentive to accommodate additional trips outside of the core service (Mounce et al., 2018). This can lead in turn to unmet demands for travel, which is clearly an undesirable situation. In addition, these services are often largely uncoordinated and poorly promoted. In some areas the tight eligibility restrictions lead to multiple services operating in the same places at the same time, each catering for different trip purposes and user categories; this is very costly and inefficient. In other more rural areas the tight eligibility restrictions lead to a much more limited service, in terms of operating area and times, available to only particular users for particular trip purposes: this is ineffective for those whose trips do not fall within these restrictive constraints, resulting in very limited choice for passengers. However, there is an increasing amount of data on people's transport demands, which can help governments and operators make better and more informed policy and operational decisions (White, 2011).

There are additional potential causes of a lack of rural mobility including: areas being so remote that it is very difficult to properly connect them; topographical challenges making transport access difficult; constraints due to conservation issues; and seasonality issues, e.g. tourism resulting in periods of high demand alongside periods of low demand.

3. The role of frameworks in the provision and regulation of rural mobility

This section looks at the role of frameworks in the provision and regulation of rural mobility, including how the various frameworks contribute to rural mobility provision; and how frameworks can also create barriers to rural mobility, e.g. how it can prevent (e.g. DRT) services operating.

It is remarkable that there is near-total absence of specific policy for mobility in rural areas across the EU and most countries do not have any policy at all on rural mobility. Some countries do have aspirational statements, but they lack clear targets and detailed objectives to deliver on these aspirations. No country has specified levels or obligations in terms of rural mobility, let alone any for which a public agency could be held accountable if they are not met. In some countries, villages and rural areas are only served by inter-urban through-

routes. The provision of school transport is the exception as this is strongly mandated in most EU states.

Looking across the EU states there are different arrangements for the primary actor in rural mobility with a mix among national, regional and local authorities. Local authorities are also very often limited in their capacity to act by dependence on limited central budgets.

The organisational arrangements for rural shared mobility are weak. Only a few countries have comprehensive coverage by mobility coordination units. DRT is widely provided as a social safety net, but it is not well integrated to public transport networks (Velaga et al., 2012a). Across the EU, very few regulatory frameworks explicitly provide for rural shared mobility. Overall, frameworks across the EU are generally not conducive to developing rural shared mobility. There is a lack of directives, strategic policy making and planning. This lack is particularly important because in many respects the institutions and mechanisms to support significant improvements rural mobility across the EU are in place.

The SMARTA project produced insight papers³ for each of the EU-28 countries and for selected countries outside the EU. There were ten questions which were posed as part of the analysis within the SMARTA project, which are as follows:

1. Which is the layer of Government at which rural mobility is primarily determined?
2. Is there a common framework throughout the country?
3. Is there a specific rural mobility/transport policy with objectives and targets?
4. Are there Sustainable Urban Mobility Plans (SUMP) or equivalent for rural areas?
5. On what basis does the public transport give coverage of villages and rural areas?
6. Are additional mobility services provided for (school, healthcare)?
7. Is there comprehensive territorial coverage by transport/mobility units which coordinate a range of rural mobility services?
8. Is there widespread provision of 'bottom-up' and community mobility services?
9. At what level are DRT and other forms of shared mobility services linked to the regular public transport system?
10. To what extent does the regulatory framework provide for DRT and emerging forms of rural shared mobility?

A cluster analysis was performed on the answers to the ten questions listed above, the aim of which was to identify groupings of data points, i.e. clusters, having similar characteristics. The algorithm employed was the *k*-means algorithm (Hartigan and Wong, 1979) which aims to partition *n* observations into *k* clusters in which each observation belongs to the cluster with the nearest mean observation to the centroid of the cluster. For this algorithm (and many similar approaches) the number of clusters *k* must be estimated prior to application of the algorithm, although the goodness-of-fit scores for a given number of clusters gives an indication of the correctness of the choice of the number of clusters. The *k*-means analysis was conducted in MATLAB and the goodness-of-fit scores for the different numbers of clusters are as shown in Table 1 (using squared Euclidean distance):

³ Available at <http://ruralsharedmobility.eu/index.php/insight-papers/>. Scotland was treated as a distinct entity for this exercise.

Table 1. Goodness of fit scores for the k-means clustering analysis for different choices for the number of clusters

Number of clusters	
2	0.4150
3	0.4642
4	0.4820
5	0.4180

The best fit was with 4 clusters, so this clustering was chosen. The 4 clusters are listed in Table 2 and shown in the map in Figure 4.

Table 2. Cluster groups for the k-means analysis with 4 clusters

Cluster 1	Cluster 2	Cluster 3A	Cluster 3B
Cyprus	Bulgaria	Austria	Finland
Czech Republic	Croatia	Belgium	Luxembourg
Estonia	France	Denmark	Slovenia
Greece	Ireland	Germany	
Hungary	Italy	Netherlands	
Latvia	Lithuania		
Malta	Portugal		
Poland	Romania		
Sweden	Scotland		
	Slovakia		
	Spain		
	Rest of UK		

The defining characteristics of the four clusters can be summarised as follows:

1. Cluster 1:
 - a. Rural mobility is primarily determined at subnational level, without a common framework and without any specific rural mobility policy.
 - b. No widespread provision of bottom-up and community mobility services.
 - c. DRT and emerging forms of shared mobility are not linked to the public transport system.
 - d. Regulatory framework is generally not supportive of DRT and rural shared mobility.
2. Cluster 2:
 - a. Rural mobility is primarily determined at subnational level, without a common framework and without any specific rural mobility policy.
 - b. DRT and emerging forms of shared mobility not well connected to the public transport system.
 - c. Some support from regulatory framework for DRT and rural shared mobility.
3. Cluster 3A:
 - a. Rural mobility is primarily determined at subnational level, without a common framework and without any specific rural mobility policy.

- b. Widespread provision of bottom-up and community mobility services, and these are well connected to the public transport system.
 - c. Limited support from regulatory framework for DRT and rural shared mobility.
4. Cluster 3B:
- a. Rural mobility is primarily determined at national level, with a common framework and with specific policy for rural mobility.
 - b. Some provision of bottom-up and community mobility services, but these are not well connected to the public transport system.
 - c. Regulatory framework is supportive of DRT and rural shared mobility.

It is important to note that these are generalisations of the core cluster properties and there are many exceptions. Countries in Cluster 1 generally have neither policy nor frameworks supporting rural mobility, and neither do they seem to have effective rural mobility services. For countries in Cluster 2, there is generally some support from frameworks and policy, and some degree of rural mobility services. Clusters 3A and 3B form a single cluster when the number of clusters is chosen to be 3 in the k-means clustering algorithm, but there are some differences. In Cluster 3A rural mobility does not receive so much support from policy and frameworks, and yet rural mobility services in these countries seem to be functioning very effectively. In Cluster 3B, there is much more support for rural mobility at a national level and yet rural mobility services in these countries seem not to be functioning as effectively as for Cluster 3A. Interestingly, there are some geographically contiguous cluster blocks (particularly noticeable in the case of Cluster 3A) which perhaps suggests a degree of cross-border influence. Also, the size of the country (in terms of its population) will play some role in the provision of rural mobility, although there does not seem to be any clear influence in terms of the cluster compositions. Similarly, overall there is no obvious relationship between the level of rurality and the prevalence of the framework conditions highlighted in the ten key questions above.

4. Good practice in rural mobility

This section looks at forms of transport services providing solutions to a lack of rural mobility which are considered examples of 'good practice' and illustrates these through specific examples identified as part of the SMARTA project (SMARTA, 2019). It is not always easy to define this good practice because mobility and public-transport practice is deeply influenced by the reference context (e.g. the actors involved and their interactions, regulation, etc.) and by local needs. Thus a solution which is proven successful in one context should not be assumed to be replicable in another (different) context with the same level of performance (a useful discussion on the transferability of "best practices" in transport policy delivery is found in Buchanan and Partners (2003)).

The forms of good practice considered here include DRT, shared mobility, etc., and within these forms several themes are highlighted, such as partnerships and community engagement, the use of information and communication technology, etc. This section will also look at the potential transferability of these good practice cases from one location to another and seek to identify changes that might be made to remove barriers and allow greater transferability of mobility solutions. It will finish by looking at innovative aspects of good practice and how this innovation might be measured.

DRT is a key part of the solution for rural mobility. First, the door-to-door nature of many DRT services can be critical for certain users such as elderly and disabled people. Secondly, the demand-responsive element means that it can be economically viable to operate it in areas where conventional transport services are unsustainable. DRT can also act as a feeder to other services, although this is an area which has a lot of potential for improvement in general. Successful operation of DRT schemes often depends on close working between municipalities, service providers and public transport operators, in order to deliver services in a rational and creative way. Social inclusion is a motivation behind many DRT schemes, e.g. the transport service acts as an enabler for social outings. Close attention to local needs is a success factor for most DRT services; an example of this is the *Bummelbus*⁴ in Luxemburg where services were extended to support participation in after-school activities by children.

Shared mobility generally refers to modes and services that are additional to conventional route-based public transport operated by buses, and includes shared taxis, car-pooling, car-sharing, most DRT schemes, etc. Shared-mobility services include both the mobility services themselves and the supporting information technology services such as traveller information, reservations, payment and operations management. These services are generally focussed on *ride-sharing*, which allows users to share rides on the same vehicle when travelling in the same direction; and *asset-sharing*, which allows means of transport (e.g. cars, bicycles, scooters, etc.) to be shared, either through a scheme operator, or peer-to-peer (for more information on car-sharing see e.g. Mounce and Nelson (2019)). Key success factors in the shared mobility solutions identified by the SMARTA project were partnership working and strong community engagement.

Several good practice examples of national programmes addressing the rural mobility problem were also identified. These were generally instigated and supported by national government; have a strong focus on community-based solutions; and have a strong emphasis on addressing social exclusion. An example is the Rural Transport Programme⁵ operating in Ireland which includes 17 *LocalLink* organisations which provide national coverage of a mix of services, including DRT for general use, scheduled fixed routes and special services for vulnerable users (e.g. to day care facilities). National Programmes are particularly effective when they offer access to technology and resources such as training, software, communications and administration; and the transfer of network resources to the local scale enables economies of scale, reducing investment requirements at the community level.

Integrating rural shared mobility services with public transport services makes for a more effective transport network. The following are required in order to achieve the necessary integration between rural shared mobility services with public transport:

1. The presence of transport services capable of being integrated;
2. Having the necessary physical infrastructure to support interchanges;
3. Having the necessary digital infrastructure and connectivity to exchange the necessary information, e.g. about service delays.

⁴ <https://www.mobiliteit.lu/se-deplacer/horaires-et-reseaux/bummelbus>

⁵ <https://www.nationaltransport.ie/public-transport-services/rural-transport-programme/>

4. The willingness of stakeholders to exchange information and to make compromises if necessary, e.g. in terms of altering timetables to facilitate speedy interchanges.

One of the good practice cases identified by the SMARTA project was *Muldental in Fahrt*⁶ in the Sachsen Province of Germany, which is a project to increase the public transport offer in a district south east of Leipzig, e.g. by increasing the number of bus lines, increasing the frequency, etc., with a clear focus on integrated public transport. In particular, the bus and train schedules were optimised to facilitate interchanges. On-board computers enable communication between buses to facilitate interchanges, meaning that passengers are more likely to make their connections. Since the aim was to re-engineer the bus network to increase the public transport offer, communication with stakeholders was key to success. As well as the prerequisites listed above, direct engagement with end users is critical to success in achieving integrated public transport as it enables better understanding of travel behaviour and more tailored planning of services.

Tourism is an important factor for many rural locations in terms of travel demands, and these demands generally have significant seasonal variations. These variations can pose challenges such as satisfying demand in the high season and low fare revenue receipts in the low season. However, the important role of tourism in local economies will generally incentivise authorities to provide funding for local transport services. The SMARTA project identified the Elba island Shared Use Mobility Agency⁷ as a tool for co-ordinating mobility services in a location that experiences a doubling of the population in summer.

Many of the SMARTA good practice cases involve partnerships and community engagement, particularly in the cases of community transport (CT) organisations. Partnerships could be with government agencies; transport authorities and organisations; and health authorities. Community engagement is useful in order to better understand users' needs. An example good practice case that features good partnerships and community engagement is the Badenoch and Strathspey Community Transport Company (BSCTC)⁸ in Scotland in the UK, which predominantly operates door-to-door on-demand services which are targeted towards older people and those who are less mobile. It has partnerships with the UK National Health Service, local taxi companies and the University of the Highlands and Islands. It actively engages the community through its community transport services (e.g. organised social activities) and has a good understanding of its users' needs. It employs a significant number of volunteers. The voluntary sector is key in supporting many community transport groups. There is often a grey area between the volunteer sector and the government's responsibility and there is a tendency for more and more to be put on to the volunteer sector and for them to be taken for granted.

Austerity across Europe has made funding for rural mobility more limited, particularly for CT groups. These generally operate as not-for-profit organisations and have multiple funding streams. They also sometimes operate registered services (e.g. in the case of BSCTC above) in order to cross-subsidise their community transport services. CT operators are currently allowed to do this in the UK, but this may be under threat due to proposed changes in

⁶ <https://www.mdv.de/informationen/projekte/modellvorhaben-muldental-in-fahrt/>

⁷ <https://civitas.eu/measure/shared-elba-mobility-agency>

⁸ <http://www.ct4u.co.uk/>

regulation. Often measures will be introduced but with a limited timeframe in terms of funding, so that they are not financially viable in the long-term. There may also be a lack of awareness and understanding of all the potential sources of funding in many cases. When applying for funding, the proposed measure may have 'hidden' social benefits which may be difficult to demonstrate. An example from the SMARTA good practice cases is the *Ring a Link* Kilkenny organisation in Ireland, which provides primarily minibus-based DRT services and some fixed route services. It is a not-for-profit entity that must balance its income and costs. Its funding sources are varied and include fares from scheduled and DRT routes; public financial support from the Irish National Transport Authority; compensation from the Department of Social Protection for participation in Free Travel Scheme; and other sources for specific services, e.g. from Kilkenny County Council.

Information and Communications Technology (ICT) can function as a service enabler, i.e. allowing a service to be operated which otherwise would not be possible without the supporting ICT. ICT can also operate as a service enhancer, i.e. allowing a service to operate in an enhanced way by using the supporting ICT. In either case it is important that ICT should support innovative good practice rather than being the determinant. There is a clear digital divide between rural and urban, which is characterised by (in rural areas):

1. A complete lack of access in some very remote rural areas;
2. Poor quality of access generally in rural areas; and
3. A lack of digital skills and infrastructure.

This digital divide could be a major limiting factor in some cases in terms of introducing good practice measures that require supporting ICT (Velaga et al., 2012b). An example SMARTA good practice that uses ICT is the *RezoPouce* organised hitchhiking service, which is a successful modern hitchhiking service with relatively low waiting times operating in approximately 2,000 municipalities. The *RezoPouce* service was introduced in 2009. A mobile app was introduced in 2017 to support the service, but it is possible to use the service without using the app. However, use of the app gives more information, including about waiting times and about users' ratings (e.g. in terms of reliability and trustworthiness).

The key criteria in evaluating rural mobility solutions is whether it meets the local needs, and clearly these will be different in different places. In evaluating cases of good practice, it is important to capture the 'hidden' social benefits, e.g. to health or well-being. Rural mobility solutions are often more about meeting social needs rather than just providing transport. Indeed, it is the activity that the transport supports which is important, such as accessing a service. Transport solutions need to be sustainable, so if a rural mobility solution encourages behaviour change towards more sustainable mobility, this provides an added benefit. Social exclusion and isolation can be addressed through rural mobility solutions that facilitate physical meetings, but clearly there needs to be locations where these can happen.

A rural mobility solution which is successful in one context cannot be assumed to be replicable in a different context with the same level of performance. The SMARTA project is particularly interested in finding cases of good practice with high potential impact that also have high potential for transferability. Key criteria for successful transferability of mobility measures (Buchanan and Partners, 2013) are:

1. Reference context: institutional level, actors involved and their interactions, regulation, territorial context of the rural area, features of the operated services, operational procedure and organization, socio-economic indicators and target users;
2. Needs of current situation compared to the evolving demand, objectives behind the mobility measures, existence of supporting policies;
3. Scheme of regional structure and local cooperation between mobility stakeholders in the region.

The transferability of rural shared mobility solutions is limited by the sheer diversity of rural communities and their mobility needs. Hence, it is better to think about 'best fit' rather than a literal transfer of solutions, and to focus on adapting solutions to different local contexts.

In addition to identifying examples of good practice, the SMARTA consortium has sought to undertake a comparative appraisal of similar mobility services. The principal objective of this work has been to develop a practical approach for highlighting the aspects of each good practice case that is innovative and which has contributed to its success; and to consider how this information might be used to foster replication of good practice and further innovation. A classification of the innovation in the good practice has been performed, based on the following four types of innovation (OECD, 2005): organisational and operation; planning and implementation; business model and marketing; and product and service. Innovation has been found to be crucially influenced by the key framework conditions in place.

5. Conclusions

This paper has looked at the rurality mobility problem with a focus on Europe in light of the near-total absence of specific policy for mobility in rural areas across the EU. It assessed the degree of rurality at different levels across Europe and looked at different ways of classifying rurality. The role of frameworks was considered and the responses to ten key questions about frameworks and rural mobility for the EU-28 countries was used to perform a cluster analysis, which resulted in four clusters. These clusters displayed varying support for rural mobility from policy and frameworks across Europe but did not find an obvious relationship between rurality and the prevalence of particular framework conditions. The most noticeable conclusion from the analysis was that rural mobility policy at a national level does not necessarily translate into effective rural mobility services, and in fact linking rural mobility services with the public transport network may be a much more important determining factor in their effectiveness. The paper also looked at different forms and examples of good practice in rural mobility, and identified common themes, success factors and barriers. The potential for transferability of good practice cases was also considered. Finally, a suggested area of potential further research is in how minimum supply standards for rural mobility might be defined and put into practice.

Acknowledgements

We would like to acknowledge the European Commission in funding the SMARTA project, which has enabled this research to take place. The insight papers and good practice cases

referred to in this paper have been completed by members of the SMARTA Consortium: MemEx (IT), University of Aberdeen (UK), Transport & Mobility Leuven (BE), Vectos (UK) and European Integrated Projects (RO).

References

Buchanan and Partners (2003) *Transferability of Best Practice in Transport Policy Delivery: Final Report*. Prepared for Scottish Executive by Buchanan and Partners.

Eurostat (2018) *Methodological manual on territorial typologies*. ISBN: 978-92-79-94874-9, DOI: 10.2785/930137.

Hartigan, J. and Wong, M. (1979) Algorithm AS 136: A k-means clustering algorithm. *Applied Statistics*, 28(1), 100–108.

Moseley, M. J. (1979) *Accessibility: the rural challenge*. Methuen and Company Limited.

Mounce, R., Wright, S., Emele, C. D., Zeng, C. and Nelson, J. D. (2018) A tool to aid redesign of flexible transport services to increase efficiency in rural transport service provision. *Journal of Intelligent Transportation Systems*, 22:2, 175–185.

Mounce, R. and Nelson, J. D. (2019) On the potential for one-way electric-vehicle car-sharing in future mobility systems. *Transportation Research Part A*, 120, 17–30.

Mulley, C., Nelson, J., Teal, R., Wright, S. and Daniels, R. (2012) Barriers to implementing flexible transport services: An international comparison of the experiences in Australia, Europe and USA. *Research in Transportation Business and Management*, 3, 3–11.

Mulley, C., Nelson, J. D. and Wright, S. D. (2018) Community Transport meets Mobility as a Service: on the road to a new a flexible future. *Research in Transportation Economics* 69, 583–591.

Organisation for Economic Co-operation and Development (OECD) & Statistical Office of the European Communities (Eurostat) (2005) *Oslo manual: Proposed guidelines for collecting and interpreting technological innovation data* (Third edition). OECD publishing.

Scottish Government (2018) Scottish Government Urban Rural Classification 2016. <https://www.gov.scot/publications/scottish-government-urban-rural-classification-2016/>

Shergold, I., Parkhurst, G. and Musselwhite, C. (2012) Rural car dependence: an emerging barrier to community activity for older people. *Transportation Planning and Technology* 35(1), 69–85.

SMARTA (2019) Sustainable shared mobility interconnected with public transport in European rural areas. Project website: <https://ruralsharedmobility.eu/>

St. John Thomas, D. (1963) *The rural transport problem*. Dartington Hall Studies in Rural Sociology, Routledge and Kegan Paul, London.

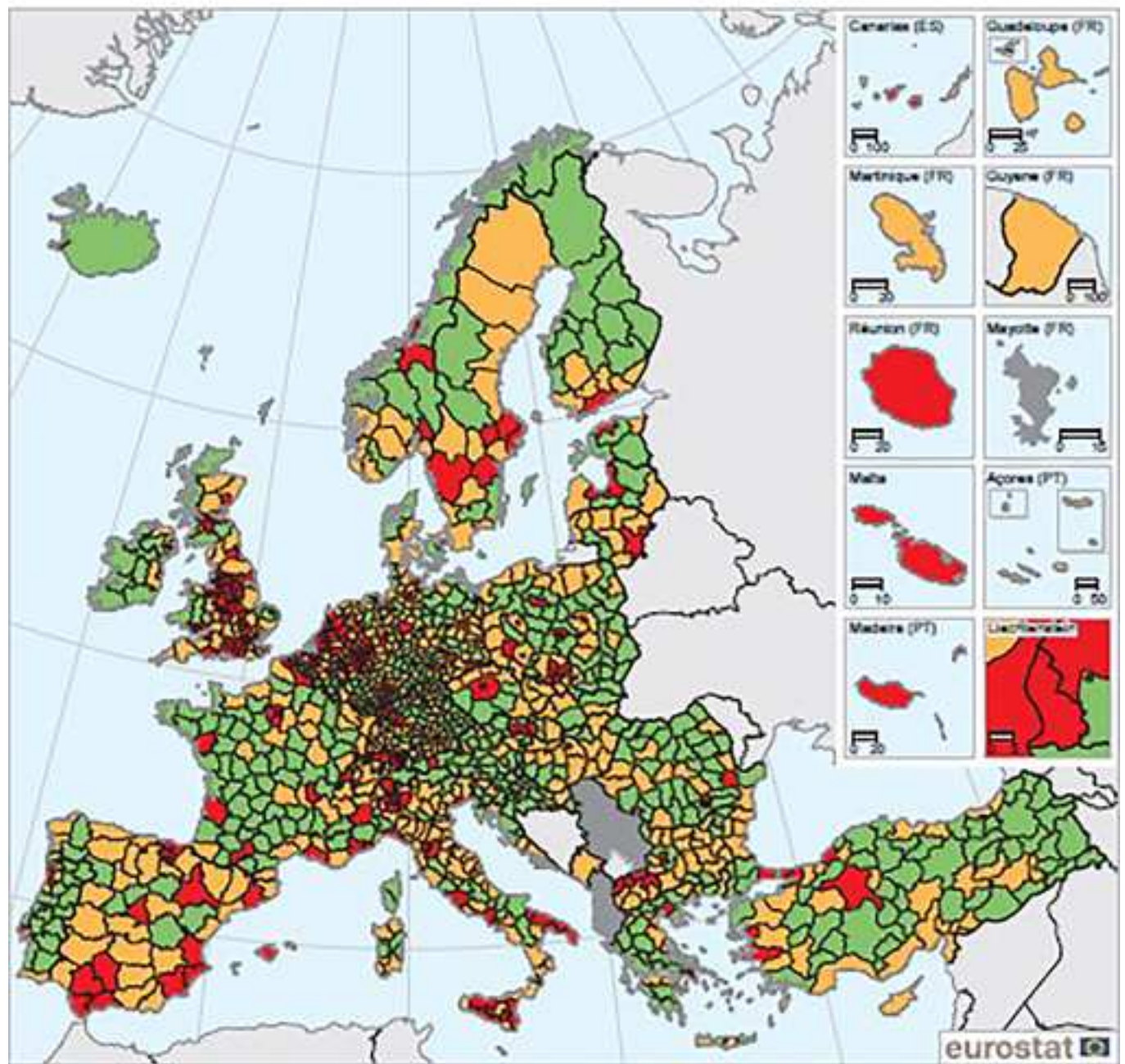
Velaga, N. R., Nelson, J. D., Wright, S. D. and Farrington, J. H. (2012a) The Potential Role of Flexible Transport Services in enhancing Rural Public Transport Provision. *Journal of Public Transportation*. 15(1), 111–131.

Velaga, N. R., Beecroft, M., Nelson, J. D., Corsar, D. and Edwards, P. (2012b) Transport poverty meets the digital divide: accessibility and connectivity in rural communities. *Journal of Transport Geography*. 21, 102-112.

White, P. (2011) Equitable access: Remote and rural communities' transport needs'. Discussion Paper No. 2011-19, International Transport Forum.

Wright, S., Nelson, J. D., Cooper, J. M. and Murphy, S. (2009) An evaluation of the Transport to Employment (T2E) scheme in Highland Scotland using Social Return on Investment (SROI). *Journal of Transport Geography*, 17(6), 457-467.

Urban-rural typology for NUTS level 3 regions (*)



Administrative boundaries: © EuroGeographics © UN-FAO © Turstat
Cartography: Eurostat - 01600, 12/2016

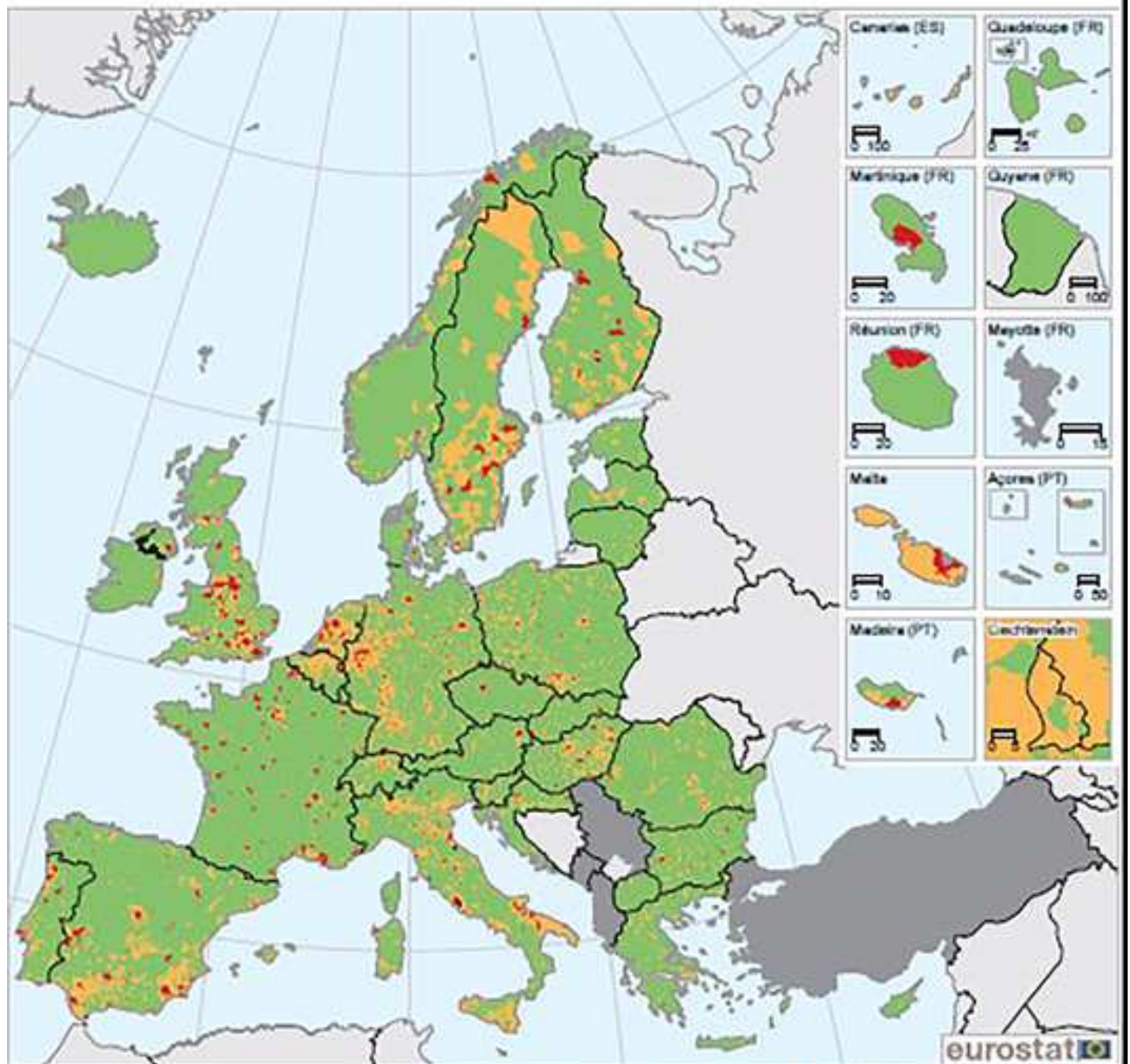
- Predominantly urban regions (rural population is less than 20% of the total population)
- Intermediate regions (rural population is between 20 % and 50 % of total population)
- Predominantly rural population (rural population is 50 % or more of total population)
- Data not available

0 200 400 600 800 km

(*) Based on population grid from 2011 and NUTS 2013.

Source: Eurostat, JRC and European Commission Directorate-General for Regional Policy

Degree of urbanisation for local administrative units level 2 (LAU2) (*)



Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat
Cartography: Eurostat — GISCO, 05/2016

- Cities**
(Densely populated areas: at least 50 % of the population lives in urban centres)
- Towns and suburbs**
(Intermediate density areas: less than 50 % of the population lives in rural grid cells and less than 50 % of the population lives in urban centres)
- Rural areas**
(Thinly populated areas: more than 50 % of the population lives in rural grid cells)
- Data not available**

0 200 400 600 800 km

(*) Based on population grid from 2011 and LAU 2014. Denmark, Greece and Malta: local administrative units level 1 (LAU1).

Source: Eurostat, JRC and European Commission Directorate-General for Regional Policy

Figure 4

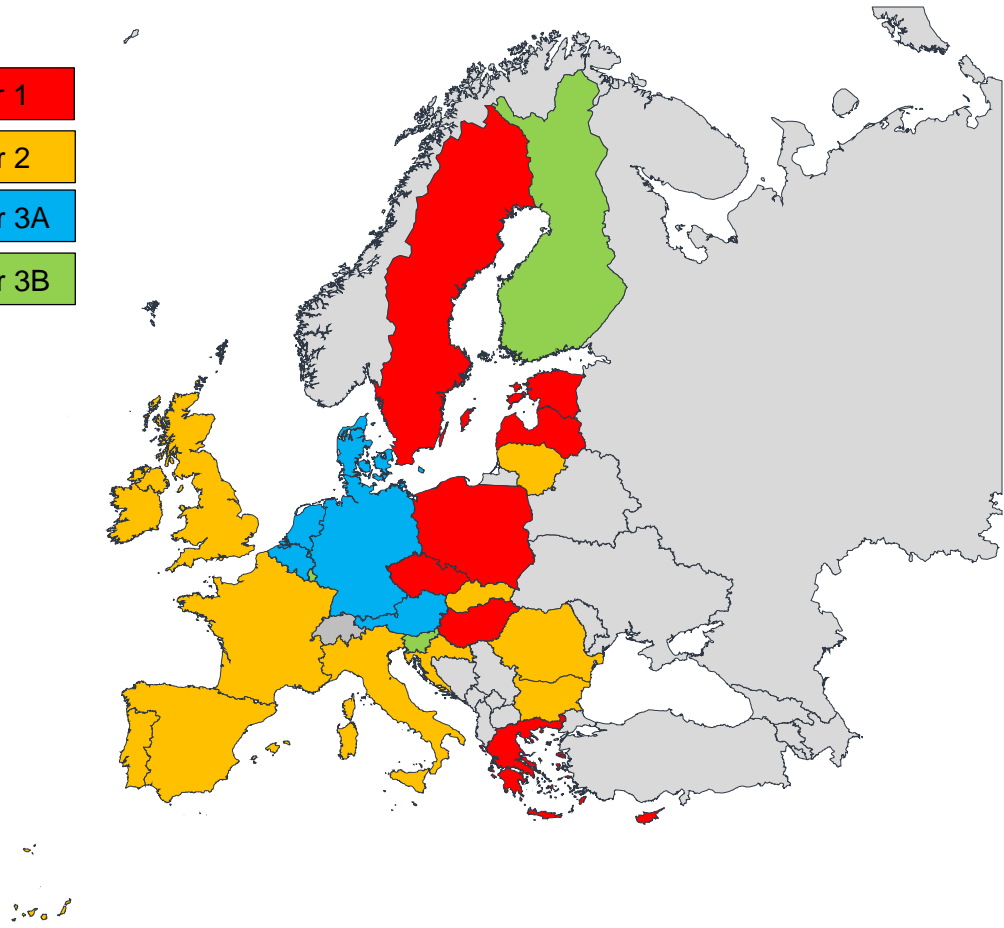
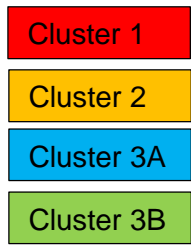


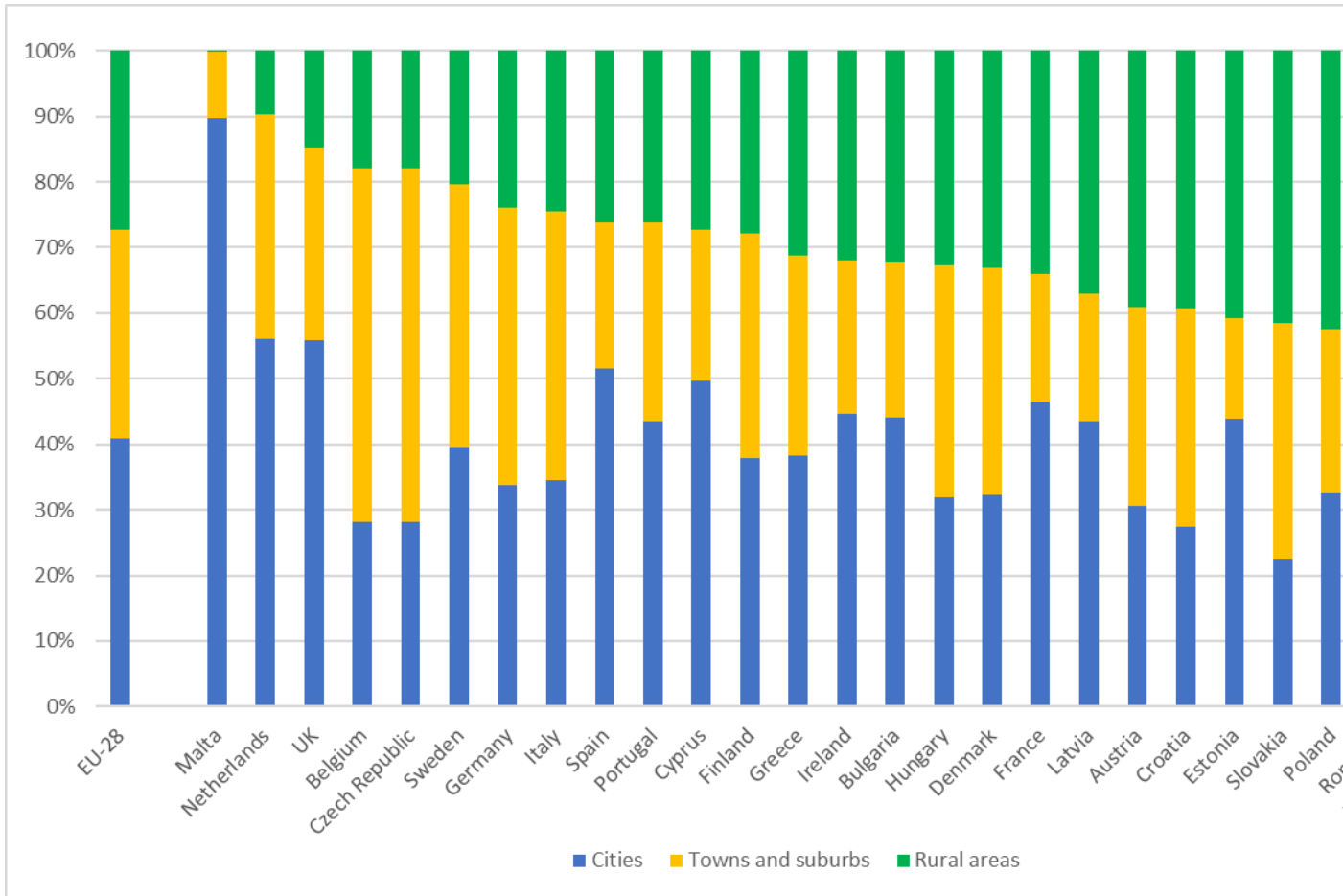
Figure 1. Urban-rural typology for NUTS Level 3 regions across Europe

Figure 2. Urban-rural typology for Local Administrative Units Level 2 (LAU2) across Europe

Figure 3. Percentage of population living in cities, towns and rural areas for EU-28 (Source: Eurostat, January 2019)

Figure 4. Cluster analysis classification for responses to the 10 key rural mobility framework questions

Figure 3



Highlights

- Looks at the role of governments in addressing the rural mobility problem
- Gives examples of good practice and innovation in rural transport from Europe
- Looks at key success factors for operating and transferring forms of good practice

