https://doi.org/10.18778/1231-1952.1.2.04

EUROPEAN SPATIAL RESEARCH AND POLICY

Volume 1 1994 Number 2

Franco ARCHIBUGI*

THE 'URBAN MOBILITY INTEGRATED BASIN' AND ITS POLICY-ORIENTED IDENTIFICATION

Abstract: This contribution reassumes and updates the concept and operationality of the 'urban mobility integrated basin' (UMIB) as an appropriate unit of reference and prerequisite of rationality for any process of territorial planning and transport planning. The concept and rationality of the UMIB presuppose in fact the adoption (and consequent research) of a 'policy-oriented demand', albeit limited – in this specific case – to 'urban' mobility.

Key words: urban policy, transport planning, planning methodology.

1. THE 'URBAN MOBILITY INTEGRATED BASIN'

The concept and operationality of the UMIB has been the object of past analyses carried out in the ambit of the definition of a 'taxonomy' of transport demand (cf. ARCHIBUGI, 1984; ARCHIBUGI and LAS CASAS 1985; ARCHIBUGI, 1988), and they have gone in step with the study of 'appropriate units of territorial urban planning', i.e. with the study of an 'urban systems' policy, today called more appropriately 'urban eco-systems' (ARCHIBUGI, 1992).

The UMIB is defined as 'integrated' since it represents – as we will explain better and succinctly later – a plurifunctional basin, which responds to the multiple requisites of an urban systems policy: it is a basin for daily traffic, as it is for work, health services, university activities, cultural and recreational activities and managerial activities etc.

The concept of UMIB has been developed in fact on the basis of a 'taxonomic' dichotomy between the 'daily' accessibility and 'non-daily' accessibility of people to territorial goods and services; and thus it has been placed

* Planning Studies Centre, Rome, Italy.

at the basis of a definition and delimitation of the 'Urban Systems' (cf. ARCHIBUGI, 1984). This is why the UMIB is to be considered thus the most appropriate ambit for the analysis and evaluation of a 'policy-oriented demand' for urban transport.

2. THE POLICY-ORIENTED DEMAND FOR URBAN TRANSPORT

The concept of mobility basin, and therefore of urban transportation, is not new in the literature (cf. DE SALVO, 1973; FRIEDMAN and STUCKEY, 1973; OPENSHAW, 1977; MASSER and SCHEURWATER, 1980; FISCHER, 1982). Such a basin, however, has almost always been conceived as the result of 'current' measurements of various types: e.g. as the result of a function of maximum inclusion of flows that have an origin and destination which is external to the basin itself. In these approaches the evaluation of the demand for mobility is 'exogenous' to the procedure of the determining and identification of the basins.

More rare has been research aimed at linking explicitly and in 'policy--oriented' terms, the sequence: land use territory – transportation network planning – demand evaluation to a function of 'generalised minimum cost'.

Such research has not extended – moreover – the field of objectives to the (multi-dimensional) sector of social and environmental costs and advantages, which are linked in turn to an overall project of land use; and which, furthermore, are tied to the notion that the demand for mobility is strongly conditioned by accessibility (cf. LAS CASAS and LOMBARDO, 1978).

In mentioning research on the methods of determination of the UMIB a position has been taken that is overturned with respect to that indicated above: here, having considered as known and 'modelable' the causal and functional links between land use choices and the generation of demand for movement and access, the aim is to look for a method of planning the territorial distribution of those choices (not only concerning interventions for new settlements, but also those concerning the organisational distribution of old ones), in such a way that the necessity – and therefore the demand – for movement is minimal.

This means that the principal objective is – so to speak – 'shifted' from the satisfaction of the expressed demand to the satisfaction of needs that generate that demand.

In other terms the mobility is no longer seen as a need, the satisfaction of which constitutes an objective of the plan; but rather it becomes a function of the cost which is to be contained at the indispensable minimum. Since the real objective is that of satisfying – in the best way – the demand for accessibility to services, the work place etc.: i.e. to a mix which can be defined as 'service-

-opportunity', and on which depends the urban effect and urban living quality. In this sense is to be understand policy-oriented evaluation of demand, or more simply, 'policy-oriented demand'.

3. GENERAL APPROACH TO THE DEFINITION OF URBAN PLANNING OBJECTIVES

Posed in these terms, the problem appears as that of defining a procedure of 'decision-making' relative to the delimitation of territorial spheres that are capable (in a long term optic) of satisfying a multiplicity of objectives, which are not always compatible between themselves. Such ambits, which have been named for a while 'Urban Systems' and more recently 'Urban Eco-Systems', are those within which it is probable that a 'city-effect' can be produced, whose characteristics can be summarised thus:

– every individual must be able to have access – within a reasonable time – to various types of services, to those which constitute that 'urban living quality' to which everyone should have the right;

– every type of service has its optimal efficiency size, which is limited both at the higher and lower level: from this it derives that is there is not always a sufficient size population within the possible access isochrones, whilst in other cases (of strong urban concentration) there is an 'excessive' population within the same isochrones, which determines a damaging 'gigantism' of the actual service structures (beyond the higher efficiency level);

– the costs of commuting to work and services may contribute to the reduction of the quality of life;

– the solutions for adaptation of the transportation system to the model of distribution of centres of demand (residences) and of the centres of supply (operational units), must be evaluated together with the impact they have on the entire environmental and territorial system of which they are a part.

4. THE UMIB ACCESSIBILITY SYSTEM

Thus, at the basis of the system, the concept of accessibility is built. In fact, as a general prospect objective, there has been proposed that of: "obtaining a repartition of the territory in 'ambits' (called 'Urban Systems') in which it is possible to guarantee for the whole population – with minimal adaptation costs – an acceptable access cost to that set of opportunities-services that can realise the city-effect, or rather an elevated level of urban living quality".

On the subject of 'accessibility' three fundamental aspects can be distinguished:

– accessibility to what?

– accessibility for whom?

– accessibility with what costs?

If this division of the object of any analysis of accessibility into three aspects is accepted (cf. BLANCHER, JAQUET-LAGREZE and ROY, 1977), it can also be recognized that in the first aspect that what is referred to as supply of accessibility is configured, i.e. the services to which one must or desires to have access; in the second aspect the demand for accessibility is configured, i.e. the user of such services; in the third aspect the cost or price of accessibility is configured. The classic elements making up the market are thus present, albeit with all the institutional limitations that characterise it. Let us attempt now to analyse these three aspects in their contents.

4.1. Supply of accessibility

Supply, from the point of view of spatial or territorial accessibility, is represented by the dislocation in the territory of those points (which is categorized as supply 'points' or 'centres') that are represented as the destinations of movements.

The contents of these 'supply centres' – that are able to produce the city--effect (since it is these alone that are dealt with when referred to 'Urban Systems') – in relation to the necessary user (population) thresholds, and in relation to acceptable access times, have already been analysed.

In the analysis recalled concerning the quality of supply, the indicators have already been expressed by means of which the objectives are fixed; these were:

a) the minimum users threshold (linked to a 'frequency of use' indicator);

b) the maximum users threshold (linked to utilised technologies);

c) the temporal threshold of access (isochrone).

Wishing to further enrich the analysis of the contents of supply (for the purpose of enriching the articulated taxonomy of possible 'objectives' to be borne in mind) other indicators could be added, i.e.

d) an indicator of the level of 'integrated functionality' of the preselected services;

e) an indicator of the level of 'collective utility' (attempting to express, in other words, the distinctions between indispensable, necessary, useful and superfluous);

f) an indicator of quality in relation to the urban agglomeration-effect (which in part is already contained in the indicator in (d), but which may also have a wider significance);

g) a specific indicator of the integrated presence 'services-job' (already present both in (d) and (f), but which may have an autonomous and specific expression as well).

These analyses of possible objectives, to be linked to the 'qualification' of accessibility supply (by means of the indicators suggested above and others connected to new objectives) can be the objective of *ad hoc* research.

4.2. The demand for accessibility

The demand, again from the point of view of spatial or territorial accessibility, is represented by the dislocation in the territory of those points (which will be called 'points' or 'centres' of demand) in which the users of the opportunities-services are placed. It is, therefore, a question of the places of residence of the served population, which are represented as the origins of the movements.

An analysis of the contents of the demand concerns thus in the first place the characteristics of the served population. However, the classification of the population with regard to their access needs and therefore of movement towards the points or centres of supply (given the mix of opportunities-services considered suitable for the urban effect) presents some particularly significant problems of approach.

In fact it is no doubt that from one merely analytical or descriptive point of view, the behaviour of the 'demand' aggregate should be analysed by single socio-demographic components of the demand itself: age, sex, professional condition, income, and perhaps also cultural traditions and influences.

In modelling, however, one intends to identify and retain only those variables that are susceptible to receiving an objective (in as far as an attempt is only made to model a system of objectives). The differences of 'present' behaviour between socio-demographic groups will be or will have to be probably annulled in the policy-oriented model which is of interest now, and thus they can be neglected in this modeling.

On the other hand, the 'spatial' nature as well of the model of accessibility that is being configured renders less significant the analysis of demand by socio-demographic groups. In fact, a territorial specialisation would be above all unrealistic of the points or centres of demand by socio-demographic groups; in other terms, it is realistic to expect in general (except for specific cases) that the socio-demographic groups mentioned above distribute themselves 'actually' as well in a uniform way in the various places of residence on the scale that is of interest, i.e. that of 'Urban Systems'. Thus, a specification of demand by socio-demographic groups, that could have importance for an overall evaluation of the needs for services in each urban system, has little or no effect on the system

of spatial interrelations (or of spatial accessibility) and thus does not solicit possible objectives ad hoc.

The diversity of approach between objectives-oriented modelling with respect to one not objectives-oriented, suggests, on the other hand a further specification of demand, which normally is neglected in descriptive and analytical models.

In fact, given the 'policy-oriented' nature of the analysis proposed, it is implicit that the demand as addressed here is always a 'potential' or 'theoretical' demand, resulting from evaluations relative to acceptable standards of behaviour and need (rather than an 'effective' demand resulting from *ex post* empirical or statistical observations). In this logic one must bear in mind – negatively or positively, according to the circumstances – that demand (elsewhere defined as 'spurious'), which can be defined both as an unexpressed demand (but which could or should be expressed, according to standards of satisfactory urban living quality), and as an expressed and satisfied demand, but with unacceptable access times and costs in principle (e.g. with excessive commuting).

4.3. Costs or prices

The aspect access-costs (or 'prices') has in general been approached in economics of transportation studies from several points of view. Such costs may in fact be seen from the perspective of the management of transportation units, from that of the interests of the users (families or firms), from that of the state, and other public bodies, in terms of costs for the infrastructures, public investments, environmental impact costs etc.

In the attempt to model a system of objectives from which an opportune delimitation of territorial ambits can be identified suitable for the spread of the urban effect, an attempt will be made to get the most extended vision possible of such costs. In the first place the traditional factors of cost for the users will be borne in mind which are linked to the various types of journey (comparative costs), and, also to the various additional needs of investment for each type. At the same time, however, one will try to include in the model the consideration of less evident and less quantifiable factors as well, e.g. the comfort or pleasantness of the journeys, or the impact on environmental conditions (pollution, effects on the natural or urban landscape etc.). Considerations on some factors of cost linked to the organisation and institutions in the territory will not be excluded from the analysis either; the border of an administrative region, of a service or consortium area; all this is considered one factor of 'attrition' that the demand must overcome or an impediment which any future policy-oriented arrangement must take into consideration.

Wherever possible, an attempt will be made to express the set of cost factors by means of 'proxy' indicators that can express them generally. An indicator on which there converges a common meaning both for the user, the operational units and for the State and the collectivity, is access time (which often synthesises the distance and cost of the modality in all its multiple aspects). Other indicators of costs that are unassimilable in that of access time, will, however, be formulated and introduced in the modelling.

The cost factors in objective-oriented modelling, although multiple, are reduced to a single function: that of their minimisation.

4.4. The relations between the components of the accessibility system

The analysis of the components of the accessibility system (on the basis of which one intends to define the specific objectives of a method of delimitation of the UMIB) is completed with a reflection on the 'relations' that intervene between the three components of the system itself.

According to a 'classic' conception, the relation between supply and demand, in spatial or locational terms, is posed in terms of research into maximum reciprocal proximity.

Such research is nevertheless motivated in a very different way in two cases. The supply seeks proximity of demand with the objective of 'maximising the catchment area', leaving aside the induced costs for the users (apart from the extent to which these influence the market area). The demand seeks proximity of supply with the double objective of minimising the individual access costs, whilst at the same time maximising the number of 'opportunities' (or choice opportunities) available.

From the meeting-clash of the two systems of objectives (that correspond to those of the 'operator' or producer of the services and to those of the 'user' of the same), emerge the conditions to be studied and modelled for a process of decision-making of the type that is intended to formalise.

From the point of view of the operator, it is in fact indispensable to constrain oneself to a value of 'minimum threshold' of use, for each operational unit or 'point of supply' (no differently from how, in the economic theory of corporations, minimum size of survival is defined). For each 'centre of supply', therefore, this minimum threshold will result from the combined evaluation of the various (more or less integrated) 'opportunities-services' that are present.

From the point of view of the user, on the other hand, an availability must be formulated to support a certain movement (as acquisition cost) to go from the place of residence to the point of supply of the service.

The behaviour of the user is, therefore, founded on a simple spatial relation between 'distance' to be supported and acquired benefit; and this determines the 'complementary region' of the supply centre[1]. The behaviour of the operator has not only the 'spatial' component, in that the market area is no longer determined by the location of the centres of demand, but also by their demographic density.

The supply/demand relationships referred to above, are strongly conditioned by the items of relative cost to access. In propositive terms, a reduction of access costs should have a positive influence on the reduction of trade-off in the supply/demand relationship, as was outlined above.

The influence is different, however, according to the type of access costs reduction that is realised. In fact the reduction can have the effect of:

- strengthening of the infrastructures;
- relocating of supply and demand;
- combined action of the two.

In the first case, it is also necessary to bear in mind the fact that the strengthening of infrastructures may create an additional demand that is dependent on other causes, and thus that reduction of costs for the user may not respond to it, for which it was promoted.

In the second case, two types of phenomena may be induced: that of the desertification of the less favoured areas or that of a waste deriving from a policy of assistance to the peripheral areas (in terms of services below the minimum threshold of use or in terms of underused transportation).

In the third case, a territorial operation is perhaps determined of the most suitable 'adaptation', the validity of which, however, is posed only in a long range viewpoint.

5. OPERATIONAL SPECIFICATION OF OBJECTIVES: THE USE OF MULTICRITERIAL DECISION MAKING ANALYSIS

The general objective proposed in the preceding sections may be reformulated in the following operational terms: "proposing aggregations of the points of origin of demand and of the points of supply in such a way that the generalised cost of access to the supply points of the opportunities-services is minimal, under opportune constraints" (cf. ARCHIBUGI and LAS CASAS, 1985).

The search for 'maximum realism' that was posed in the modelling of the process of choice in the delimitation of the UMIB, requires the introduction of

[1] The expression 'complementary region' is borrowed from the classical work on space economy of 1933 by Walter CHRISTALLER on 'central places' in South-Western Germany (translated into English in 1965).

further specifications that are relative to the cost items and to the demand/supply relationship.

For example, as already mentioned, among the user costs the cost linked to journey comfort and the availability of facilities complementary to the origin and destination of the journey must be taken into consideration (e.g. nursery or crèche facilities or the ability to achieve various purposes with one journey etc.).

For collective costs, one intends to take into consideration those connected to environmental damage, and to attrition of an administrative nature etc.

Although apparently the formalisations proposed could be led back to functions characteristic of mathematic programming, in reality – given the complexity of the characters that make them up – they lead to the preference of an approach of the type: 'multi-criteria analysis (MC) of preferences'.

This generally means the transforming of each of the functions proposed into a sort of 'target achievement indicator' – both of a quantitative and of a qualitative type – on the basis of which indicators could be organised the analysis of preferences, carried onto the various aggregative strategies (cf. HILL and TZAMIR, 1972; HILL, 1973; ARCHIBUGI and LAS CASAS, 1985).

6. CONCLUDING REMARKS

The methodology proposed results from research carried out in the past and which would deserve further reflection, and above all application to real planning processes (cf. VINING, 1953; DUNCAN et al., 1960; DZIEWOŃSKI, 1964; HARRIS, 1965; FRIEDMAN and MILLER, 1965; MAČKA, 1967; BERRY, GOHEEN and GOLDSTEIN, 1969; MASSER and SCHEURWATER, 1980; FISHER, 1982).

This contribution intends to represent an intervention in the field of research for regionalisation of a particular character: it fits the special problems of planning-oriented regionalisation. It is to the region-programme or region-plan, that the basic approach of this contribution looks, as was indicated by the present author in a work on the 'delimitation of planning areas'.

Of course, one must not ignore the fact that the problem was born as the delimitation of 'regions' for transportation planning. However, as was already pointed to, the first steps of the taxonomic research have arrived at the conclusion that UMIB, Urban System and policy-oriented regionalisation have a reciprocal interest in being 'co-extensive'. For which reason this contribution has meant to view the delimitation of the UMIB (in as much region-programme for urban transportation) as a problem of multi-criterial decision making.

There has been a certain amount of discussion in the literature about the opportunities to seek 'fixed' ambits for urban transportation planning (cf. DE

SALVO, 1973). In fact some authors have challenged, rather reasonably, its usefulness. The goal of 'regionalisation' may be posed in two ways:

– as a research for a certain uniform set of criteria that may be used to split a country into a complex of exhaustive 'regions' which exclude each other reciprocally;

– as a research for a complex model of 'regions' that correspond to different needs and goals, the regions which may, therefore, also intersect and be superimposed on one another.

It is clear that the procedures suggested herein fit to the first way of posing the goal of regionalisation (as was pointed to in the introduction). If the second way was chosen, we would be led (cf. FRIEDMAN and STUCKEY, 1973) to the question of how planning (and linked activities) could be 'spatially' organised so as to respond more efficiently to the needs of transport emerging in the various parts of the national territory. In this sense, the problem would not be that of designing a regionalisation useful for transportation planning, but rather that of conceiving a transportation planning that would satisfy regionalisation.

On the other hand, the arguments against fixed regionalisation must not be ignored. Regional transport, according to this view, is difficult to 'delimit'. It is essentially 'nodal', because of which it is relatively easy to identify a 'centre' or 'axis', but from this centre or axis it spreads out in space in such a way as to render any type of delimitation arbitrary. It, moreover, changes over time with the changes in technology and in the structure of the economy, so that any regionalisation may become obsolete after a short period of time (cf. ALONSO, 1973).

Nevertheless the advantages of a regionalisation for transportation are not to be neglected. Above all there is the advantage of providing a suitable framework of reference for coordinated policies of multisectoral intervention in the territory; an intervention which – if singularly 'optimised' – could produce in some way an overall 'pessimisation' (cf. WENGERT, 1973).

The choice of an 'overall' and exhaustive regionalisation is in fact a 'plan' choice; and, as such, arbitrary. But it is for this exactly that this contribution addresses the need to use 'organised' 'decision-making methods', which are not, however, 'mechanical': the methods that offer a greater flexibility and capacity of adaptation to the single concrete realities, and thus a greater 'realism' – even if they do not correspond to a total 'rationality' in the sense of a rigorous procedure of total optimisation.

REFERENCES

ALONSO, W. (1973), *Markets and planning regions for transportation,* [in:] DE SALVO, J. S., (ed.), *Perspectives on Regional Transportation Planning*, Lexington: Lexington Book.

ARCHIBUGI, F. (1984), *Per una tassonomia della domanda di trasporto nell'ambito della pianificazione dei trasporti (For a taxonomy of transportation demand in the ambit of*

transportation planning), [in:] Cnr-Pft, *La ricerca sui trasporti in Italia: primi risultati del Progetto Cnr, (Research into transportation in Italy: first results of the CNR Project)*, Milano: Angeli.

ARCHIBUGI, F. (1988), *La domanda programmatica di trasporto: conclusioni di una analisi metodologica (Policy-oriented demand for transportation: conclusions of a methodological analysis)*, Centro di studi e piani economoci (CP/WP/88.4), Roma.

ARCHIBUGI, F. (1992), *The urban environment programme of the Italian government Ten-year--plan for the environment,* Paper prepared for the Urban Environment Group of Experts of the Commission of the European Community, October.

ARCHIBUGI, F. and LAS CASAS, G. (1985), *Metodologia per la delimitazione programmatica di bacini integrati di modalità urbana (Methodology for the policy-oriented delimitation of urban mobility integrated basins),* Centro di studi e piani economici (CP/WP/85.1), Roma.

BERRY, B. J. L., GOHEEN, P.G. and GOLDSTEIN, H. (1969), *Metropolitan area definition: a reevaluation of concept and statistical practice,* U.S. Bureau of the Census, Working Paper, 28.

BLANCHER, M., JACQUET-LAGRÈZE, E. and ROY, B. (1977), *Elaboration de crytères permettants une integration de divers aspects liés au temps dans l'aide à la decision en matiere de transports,* Sema.

CHRISTALLER, W. (1933), *Die zentralen Orte in Süddeutschland,* Jena (Eng. Trans.: Baskin Englewood Cliffs, NJ, 1965).

DE SALVO, J. S. (ed.), (1973), *Perspectives on regional transportation planning,* Lexington Mass.: Lexington Books.

DUNCAN, O. D. et al. (1960), *Metropolis and region,* Baltimore: John Hopkins Press.

DZIEWOŃSKI, K. (1964), *Economic regionalisation*, "Geographia Polonica", VI: 171–185.

FISCHER, M. M. (1982), *Some fundamental problems in homogeneous and functional regional taxonomy,* [in:] KUKLIŃSKI, A. (ed.), *Societies, regions, boundaries,* "New Babylon: Studies in Social Sciences", UNRISD and Mouton.

FRIEDMANN, J. and MILLER, J. (1965), *The urban field*, "Journal of the American Institute of Planners", XXXI(4), November: 312–320.

FRIEDMANN, J. and STUCKEY, B. (1973), *The territorial basis of national transportation planning,* [in:] DE SALVO, J.S. (ed.), *Perspectives on regional transportation planning,*

HARRIS, C. (1965), *Methods of research in economic regionalization,* "Geographia Polonica", 4.

HILL, M. (1973), *Planning for multiple objectives, an approach to evaluation of transportations plans,* Regional Science Research Institute, Monograph series 5, Philadelphia, Penn.

HILL, M. and TZAMIR, Y. (1972), *Multidimensional evaluation of regional plans serving multiple objectives,* "Regional Science Association Papers", 29.

LAS CASAS, G. and LOMBARDO, S. (1978), *Proposta di un metodo per la delimitazione dei bacini di traffico, (Proposal for a method for the delimitation of traffic basins),* Segesta, Urbino: Atti Convegno Airo.

MAČKA, M. (ed.), (1967), *Economic regionalization,* Prague: Publishing House of the Czechoslovak Academy of Sciences.

MASSER, I. and SCHEURWATER, J. (1980), *The functional regionalization of spatial interaction data: an evaluation of some suggested strategies,* "Environment and planning", 12: 1357–1382.

OPENSHAW, S. (1977), *Optimal zoning systems for spatial interaction models*, "Environment and Planning", 9: 169–184.

VINING, R. (1953), *Delimitation of economic areas: statistical conception in the study of the spatial structure of an economic system*, "Journal of American Statistical Association", 48: 44–64.

WENGERT, N. (1973), *Political and administrative realities of regional transportation planning,* [in:] DE SALVO, J. S. (ed.), *Perspectives on regional transportation planning,* Lexington: Lexington Book.