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THE BASIC ISSUES OF ECOLOGICAL CITY PLANNING

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1. Premise

The theme of the relationship between land-use planning and the ecological equilibrium of the urban environment has had much attention in recent years both in the academic and political world. Study meetings¹ and official documents² on the subject have proliferated. As is natural, a certain amount of conceptual disorder has accompanied the multitude of approaches. The aim of this paper is to subject this material to a sort of schematism relating to:

- a) certain taxonomic and definitional *postulates*;
- b) certain basic methodological *issues*.

The taxonomic and definitional postulates concern the concepts of *land-use* and *environment* as the objects of planning, in the framework of the current problems, and, at the same time, as an object of scientific analysis.

The basic methodological issues concern the treatment of the above-mentioned objects (land-use and environment), in terms of: b1) *the analysis matrix of the land-use/environment*; b2) *the appropriate spatial unit of evaluation and planning*; b3) the appraisal of *loading capacity indicators* (with the possible fixing of *loading capacity parameters*).

In the last part of this paper the application of the methodological issues indicated will be illustrated with regard to the Italian case, both on a *national scale* (but still relative to the "urban" environment), and on the *urban local scale*, with an Italian National Research Council Project, called the "Quadroter", the results of which have been taken up officially by the

¹Among many others: the international OECD Conference "*on the Economic, Social and Environmental Problems of Cities*" (Paris, 18-20 Nov 1992); the Conference promoted by the OECD-EC-Berlin Senate on "*Urban Environmental Improvement and Economic Development*" (Berlin, 24-26 Jan 1989); the international Forum promoted by the OECD-UNEP on "*The Global Environment and the City*" (Osaka, 2-3 July 1990); the EC conference on "*The Future of the Urban Environment in Europe*" (Madrid, 29-30 April 1991); the workshop of the European Foundation for the Improvement of Living and Working Conditions, on "*Land Use Management and Environmental Improvement in Cities*" (Lisbon, 6-8 May 1992).

²It is enough to recall the OECD Urban Affairs Group Document: *Environmental Policies for Cities in the 1990s* (Paris, 1990) and that of the EC Commission: *Green Paper on the Urban Environment* (Brussels, 1990).

Italian Government in the formulation of a "Ten-Year Plan for the Environment"³.

2. Planning and Ecology: Postulates

2.1 *The Exogenous Nature of the (Technological, Geo-morphological, Economic, etc.) Conditions*

On the improvement of the urban environment and its factors much has been said and much will be said (as mentioned above). Nevertheless we are excluding from our reflections an analysis of factors that may influence the improvement of the urban environment, however interesting, important and sometimes crucial they may be. Let us give an example to aid comprehension. Nobody would say that the introduction of a new system of urban self-propulsion, such as the electric car, or a system for reducing industrial emissions, would not have a strong influence on pollution and on the quality of the urban environment. But these factors, like many other that we could list⁴, are considered by us to be *outside our field of analysis*: which is limited to what planning (and only planning) can, or must, do, (from the point of view of the methodological approach) in order to improve the management of the balance between land-use and urban environmental quality.

The quality of the urban environment (like that of the environment in general) constitutes - if understood in a very limited sense - *only one* of the objectives of city planning or management (both as analysis and as a decision-making procedure). If understood in a wider sense (inclusive of the social, economic, cultural etc., environment) the quality of the urban environment represents *the* basic objective of planning.

In either case, planning finds itself faced with a conflict between objectives (in the first case external and in the second internal to the concept of the urban environment) which will have in some way to be composed, with a "preference function" (as we call it in "Planology").

To choose the preference function, it is necessary to know and evaluate the degree to which the objectives come into conflict. The more we examine the evaluation of the impact of alternative land-uses (which correspond

³See *Ministero dell'Ambiente* [Ministry of the Environment], 1992.

⁴See in the report mentioned by the OECD (1990) a very well conceived list of possible actions, both as innovations to be introduced, and as policy guidelines for: urban area rehabilitation; better urban transport; and greater urban energy efficiency.

to the same number of planning objectives) on the quality of the environment, the better will be the decision relating to the preference function.

The evaluation of impact of alternative land-uses will be made on the basis of given conditions, whether they be observed or programmed (or programmable); and among these conditions there will be all those to be considered "exogenous" to the specific (mental) model that will be utilised as an instrument of evaluation, such as available technology, geomorphological conditions, economic resources, etc. All these can be called the "technical conditions".

The preceding considerations represent thus a first postulate of the relationship between planning and ecology (and thus of our examination): *planning and evaluation assume as "given" the above-mentioned technical conditions*. In conformity with this postulate, planning and evaluation will leave aside the policies that aim to modify the said conditions, and deal only with maximising the effectiveness or minimising the costs of these conditions. In such a way, nevertheless, planning and evaluation provide data for the evaluation of the costs and benefits of the alternative presence or absence (through possible policy interventions) of these technical conditions.

From the above postulate it derives that our examination too will leave aside the factors that may influence the said technical conditions, improving or worsening them, however important and crucial they may be.

2.2 *The Exogenous Nature of the Objectives Constituting the Preference Function*

Analogously, an exogenous character to the method and model of planning to be used is required for the objectives. As with the conditions, the objectives as well are defined *outside* the method and planning model, even if they constitute its *raison d'être*. In fact they are the subject of the decision-makers, and not of the planners.

Exogenous are, both the objectives of the first instance or *starting* objectives (which we will call *goals* or *concerns*) and the *final* objectives (which we will call *targets*).

The first are indispensable for the construction of indicators and measuring instruments. They are defined (exogenously) by the *decision-maker* at the beginning of the process. It is a serious error not to include the decision-maker at the beginning of the process of concerns definition, and not "modelise" reality on them: the model loses the quality of a "decision model", and assumes that of an indefinite "positive model" whose variables

are casual and not justified (not made explicit but assumed by use, by the intuition of the planner and often by past problems).

The second (the targets) are the final aim of planning and the planner, But their trade-off (or final combination), on the basis of a correct approach managed by the planner, is the task of the decision-maker; they are thus exogenous to the method, even if they are defined through the method and thanks to the method.

The first are not quantified. They must only permit the appraisal of the quantifiable indicators (variables) (see below Para. 3.3). The second have no sense if they are not quantified, exogenously or endogenously to the model (see Para. 3.1).

Therefore, a second postulate could be thus formulated: *planning and evaluation assume as given the starting goals or concerns, and assume as exogenous constraints the final targets of the process* .

This second postulate of the relationship between planning and ecology (which is a general postulate in any planning, in its relations with any ambit of community interests), should put some order into the subject, free the ground from misleading arguments and allow us to concentrate on the problems and issues that are typical of the planning of the ecological city.

3. The Issues involved in the Planning of the Ecological City

As said in the premise, there are some issues that we consider fundamental for the processes of ecological planning; fundamental in as much as they are prerequisites for the supplying of a correct framework for evaluation, and thus for decision.

3.1 The Land-use and Resources Matrix (LURM)

The first is that relative to the analysis itself of the *relationship between land-use and spatial or environmental resources*.

Environmental malaise is always an *imbalance* between *demand* for environmental resources, from which arises the consumption of the same, and the *supply* of the same resources, which are - like all resources - by definition limited. The task of planning is aggravated, with respect to other socio-economic disequilibria, by the fact that the greater part of the supply of environmental resources is constituted by resources that cannot be *reproduced*, and which represent absolute, and not relative, constraints (on places, times, cultures, productive capacity, etc.).

In the so-called urban environment (we will see below the limited value of this concept) as well, environmental imbalance (whether it be from pollution, traffic congestion, the marring of the urban landscape, or the loss of social communication, etc.) is between the demand for the use of urban activities and the supply of environmental resources.

Thus the first analytical procedure required is that of listing:

- a) on the one hand, all the *land-use demands*, which satisfy activity needs (which satisfy in turn the citizens' needs); demands that are classified by type of activity or type of need to satisfy: e.g. housing, squares, roads, industrial zoning, spaces and public buildings for use, green areas to be used, zoning for pastimes and sport, shopping centres, and so on;
- b) and, on the other hand, all the available land resources (which constitute *land-use supply*), classified according to the intrinsic qualities of the territory and its "vocations" of use, both from the natural point of view and from the point of view of anthropic pre-existencies (above all in the case of city areas): e.g. historic buildings, the urban landscape, green conservation areas, land for agriculture, areas for public infrastructures, and so on.

The two lists may face each other as on a scales⁵. But they may also constitute the vectors of a "land-use and resources matrix" (LURM⁶), whose coefficients represent the transferral of existing resources into potential demand; or, vice-versa, the transferral of the existing or policy-oriented demand into necessary resources (or spaces).

The construction of land-use and resources matrix is not easy; but - albeit in different forms and approximations - it is an essential requirement for correct ecological planning of the city. The problems arise when the same land supply unit may at the same time satisfy several demands, and accept several uses, and thus be a demand for *promiscuous* use. We have classified such promiscuous uses as *proper* or *improper*⁷, if they are considered compatible or not among themselves, by nature or extent. By nature, when a use damages another in quality (e.g. a steel works in the same block as a concert hall, to use an extreme example). By extent, when a use whilst not being incompatible with another (commercial activities with

⁵A balance of territorial needs, both as *location requirements* and as *space requirements* is taken into consideration in any planning manual worthy of the name. See the highly detailed manual by Chapin (the third edition of 1985, ed. by Chapin & Kaiser), in particular Chaps. 11 and 12.

⁶A more detailed explanation of the LURM including a Graphic expression of the Matrix is to be found in the author's manual (Archibugi, 1979 and 1982, 2nd Ed.). Further technical considerations also in Archibugi, 1988, 1990.

⁷In the didactic work mentioned above (Archibugi, 1982, p. 181-184).

residential housing, for example) becomes so because of the overcrowding it creates.

The LURM constitutes a computational and evaluating model of the compatibilities and incompatibilities not only between alternative uses for a single unit of an available resource; but also of the compatibilities and incompatibilities of a demand for use - actual or policy-oriented - with the existing or potential available resources. The LURM, in short, constitutes an instrument for evaluating the opportunity cost of the use of a resource: i.e. of the advantage lost in terms of alternative uses.

And, in as much as it is an instrument of evaluation, it constitutes also the instrument offered by the planner to the decision-maker for its trade-off between costs and benefits, for fixing its targets and for rationalising, finally, its plan decisions.

3.2 *The Appropriate Spatial Unit of Evaluation and Planning*

The equilibrium between supply of and demand for territory and the matrix (LURM) constructed upon it as a decision instrument, cannot ignore spatial constraints; i.e. it is meaningless to construct it outside a reference to the territory whose scale is dictated by the nature of the demand of land use and by the spatial extent of its impact on available supply. The problem thus arises of the approach of the appropriate spatial unit of measurement of the equilibrium, and thus of evaluation, planning and decision-making.

In fact, it is known, that there is not a single appropriate ambit in which it is reasonable to manage ecological equilibrium in a rational way. Any anthropic activity, any demand on land use, any factor of pressure on the environment, has its *own* impact area, and thus its appropriate ambit for evaluation and management. The most generally recognised ambits of impact are the "planetary"⁸ scale, the "continental"⁹ scale, the "hydrographic"

⁸For example, many activities connected to the production and consumption of energy and chemicals (atmospheric emissions) or of wood products (deforestation), wherever in the world, have an impact on the planetary scale, if these are over-sized; such effects are produced as global warming or the reduction and disintegration of the ozone layer. In these cases the measurements for evaluating and managing the equilibrium between the causes and effects of the phenomenon have their appropriate ambit on the planetary scale which would imply a decision-maker or a decisions system on that scale.

⁹For example with "acid rain".

(basins) scale¹⁰, and finally the urban scale which is the specific object of our reflections.

But the majority of human activities, which produce pressure on the territory and environment, are connected to urban settlement, and of an "urban" nature (albeit in the most complete sense which we will mention later), and have the city as their exclusive ambit of ecological impact. One could call it the "urban basin"¹¹.

If certain industrial and energy activities are excluded, and those linked to touristic consumption in areas exclusively dedicated to tourism, almost all the human activities are connected to the urban life of the citizens, which is a "daily" life and functionally delimited within the arc of the day (in the ambit of that which Doxiadis and others have called the "daily urban system")¹². Such an ambit corresponds analogously to the already expressed concept of the "urban basin".

The scale on which it is appropriate (i.e. reasonable and meaningful) to measure the relationship of equilibrium or disequilibrium between demand and availability of land use (and construct the LURM mentioned in the preceding paragraph) is therefore this system or urban basin¹³.

¹⁰For example with the release into waterways of urban effluents.

¹¹Also because by now human settlement itself is becoming "urbanised", i.e. requiring for the totality of the population easy access to urban forms of life. This means also that the crisis of the urban environment due to ecological disequilibrium is the most serious both because today the majority of the population already - at least in western countries - lives in the city (80% it is said), and because - as mentioned - very soon the total population will live in the city, in urban living conditions. What will be the quality of these conditions is the very object of urban planning.

¹²See Doxiadis (1966-70, 1970), Berry (1972) and Archibugi (1987).

¹³The concept of urban system or basin evokes a long and still not finished debate on the size of the "planning area". Despite the theoretical possibility of adjusting such an area to any planning intervention circumstances and context, for long term land-use planning - above all in the USA - reference prevails to the "metropolitan area" (see what Chapin & Kaiser on the subject, *op. cit.* 1985, p.115): also because of the well known availability in the USA, from 1975, of a statistical unit of reference: the *Standard Metropolitan Statistical Area* (SMSA), which was created with criteria close to the needs of the planner, and with an abundance of available information. In Europe the debate has produced fewer results, both on the theoretical side and on that of the practical delimitation of statistical areas, apart from the case, in Italy, of the "metropolitan systems" in *Progetto '80* (a government study carried out in 1969 as a long-term perspective of a social and economic five-year Plan 1971-75 which was then not followed up); or the case, in Germany of the "*gebiet einheiten*" (basin units) of the *Landesplanung programme* (agreed by the Federal Parliament in 1975, but which subsequent governments in practice shelved).

In conformity with the prevalence of the metropolitan area concept (neither adequately discussed or clarified anywhere) the concept of "*Sub-metropolitan Analysis Zones*" has likewise been introduced and used (as they are called by Chapin & Kaiser, 1985, pp.118-

And since we have assumed that urban ecological equilibrium is given by equilibrium between these demands and availabilities of land use, we may also call this system or urban basin the "*urban eco-system*".

In short, it seems obvious that the appropriate ambit for measuring, evaluating and managing any phenomena of impact on the city, is the same as that in which the human activities are performed which produce it.

It ensues that by urban ambit (system or basin) is not meant here only the physical phenomenon of the urban built-up area (even if it is within the built-up space that the major cases of activity intrusion and overloading occur), but rather the *functions of the city*, i.e. the functions that the citizens perform in the city¹⁴.

The space occupied by these functions is much more vast than that of the built-up *continuum* (one thinks of the development of commuting between the home and the place of access to many urban services and the place of work). But such a space has nevertheless a theoretical limit provided by the *daily acceptability* of access to urban services. Within the isochrone of this accessibility one can speak of an urban system (or basin)¹⁵. Beyond this isochrone, a real urban effect is not produced, but rather a system of "meta-urban" anthropic relations (holidays, journeys, tourism, national and international business, conferences, political life, etc.) And from the point of view of ecological impact, these activities constitute an occasional load, in the urban systems in which they are developed, which is perhaps in addition, but not organic or co-substantial to the system itself.

But even if more vast than the urban *continuum*, the appropriate space must nevertheless include a mass of residents, large enough to constitute

120). These zones, which are evidently more flexible for any problem of data collection and regarding any international comparison of situations, are also the most reliable with regard to the meaningfulness of the phenomena if they are examined in their interaction and systemic interdependence. They lend themselves therefore to many risks of bad interpretation. Their statistical usefulness however is important so long as they are firmly anchored to a clear methodological approach on the "appropriate area of evaluation".

¹⁴The literature on the problems of the functional "regionalisation" of the city is vast. We would recall and recommend the work by Fox on "Functional Economic Areas (FEA): Fox, 1973 and 1974 (Chap. XII) concerning the operationality of systems; and the work of Openshaw (1977), and Masser & Scheurwater (1980) on analytical modelisation. Concerning spatial analysis in general, see works by Berry (1966 and 1972); J. Friedmann & J. Miller (1965) and by M. M. Fischer (1982). Wider references can be found in a recent report of mine on the "integrated basin of urban mobility and its policy-oriented identification" (Archibugi, 1994).

¹⁵For example, in the attempts proposed for territorial riequilibrium in Italy ("Progetto 80" and the "Quadroter", mentioned in Para. 4 below) a minimum acceptable isochrone of 1-1,30 hours daily commuting time has been assumed (see Archibugi, 1982, 1985, 1987, 1994).

an economic justification for the location of a set of social anthropic activities and "superior" services which produce the "city-effect". Without this effect, in fact, that *urban "quality"*, which is at the basis of the modern process of urbanisation, which is the primary condition and *sine qua non* of any social well-being to which any family aspires, is not acquired. Any environmental planning (preventive and/or curative) applied in a territory which does not guarantee the catchment "critical mass"¹⁶ that is sufficient to create the city-effect, is destined to fail, because the catchment load will tend to turn to those territories and situations in which such a city-effect is realised and thus render useless and redundant the preceding interventions. In brief, the ecological equilibrium must be realised in those situations in which the socio-economic (and vice-versa) equilibrium is realised as well, with the control of the factors of overload in the territory, and in the bordering territories in which the overload tends to drift, with the risk of the failure of the actual policy of riequilibrium.

The minimum limit of *accessibility* and the minimum limit of the *critical catchment mass* are the two contrasting constraints which dominate the choice of the planner of the appropriate territorial unit of planning¹⁷.

In short, in order to make sense, an analysis and evaluation of the loads and loading capacities (equilibria between demand and supply of land-use) needs to *legitimise in anticipation* the spatial unit to which such an analysis is applied. For example: what sense is there in measuring the production pro capite of refuse in a territory where people reside, if then these people leave their refuse in a territory where they spend the better part of their working day? or, what sense does it have to measure the relationship between public spending for urban services provided in an administrative area (municipality?), if the greater part of the consumption of such public services is made by citizens in a territory in which they do not pay taxes because these are paid only in the area where they reside? In short, the appropriate spatial unit of reference is that which manages to embrace *all* the functions of supply and *all* the functions of demand of land-use.

An holistic approach, in this case, does not seem optional, but is rather required in order to give logical meaning to the evaluation. It is only in this sense that one can speak of an "integrated" approach to planning.

If we mean by urban eco-system the system that collects the interdependencies of all the *anthropic activities that produce a city-effect*, it is

¹⁶For example, the "critical catchment mass" for superior (metropolitan) urban services and for the city-effect has been assessed (in the above-mentioned Italian projects for territorial riequilibrium) between 500,000 and 1,000,000 inhabitants-users.

¹⁷For further discussion on this point see Archibugi 1987 and 1991a.

essential that the supply-demand balance is made only on the scale of that eco-system, otherwise a distorted and false balance will result.

The scale of that eco-system (i.e. that appropriate unit of analysis and evaluation for the balance demand-supply of land use), is that for which the *conditions of equilibrium* of the said balance must (and can) be produced. That which (in terms of natural ecology) would mean that the tensions, pressures, impacts and eventual "disequilibria" which should be recorded in the balance, have the possibility of being absorbed, recycled, "metabolised" by the same organism in question: the urban eco-system.

If this equilibrium, or riequilibrium, could not be realised (because the conditions of such an equilibrium would not take place), it would mean that it would be necessary to have recourse to an additional supply of spatial resources outside the unit of analysis in question; in other words, to put pressure (demand) and exercise an impact on *another* unit of analysis. It would mean, therefore, that the unit of the chosen analysis *is neither* an actual *nor* a potential urban eco-system¹⁸; and therefore as a unit of analysis and evaluation for planning and urban management it is not "appropriate".

Naturally the recommendation here to evaluate equilibrium between factors of land pressure and availability on the appropriate scale, does not mean - once the need for a balance on this scale is satisfied - that balances cannot be "measured" for a zoning of more limited dimensions, if it may help to know better the "overlaying" (or total and integrated load) of various pressures on a local basis, and allow for a more aware or wiser (positive or negative) locating, above all of industrial plant¹⁹.

3.3 *Appraisal of Loading Capacity Indicators and Parameters*

¹⁸The urban system as well - like any other system - is a complex of relations which are, in act or potential, in equilibrium; like a biological organism which is, or tends to be in equilibrium. Where such an equilibrium is not reached, the urban system, not only enters into crisis (as in the cases in which it exists, but with overloading); but is also not realised, as in the cases when the desired processes of urbanisation fail to be activated, and certain centres, which may be urban as well, remain "dependent" (for the rarer services) on the more important centres, which constitutes a factor in the greater overloading of the latter.

¹⁹See the concept of "*Sub-metropolitan Analysis Zones*" which is much discussed in Chapin & Kaiser (see Note 13). In my opinion the methodologies and experimentation implemented in Holland by the Ministry of Housing, Physical Planning and the Environment (VROM), with the institution of "Integral Environmental Zoning" IEZ, are to be followed very closely and with interest. One might ask oneself if analogous methodologies could not be applied to a more "integral" zoning, in which pressure factors are exercised that are not only those of noise, smells, toxicity, but also those belonging to a more complete conception of the environment such as: refuse output, urban traffic, urban landscape, social and cultural accessibility, etc.). The Quadroter project is moving in this direction; and the substance of this contribution is oriented likewise.

The third issue that must be dealt with for a correct planning and evaluation of the urban environment is the construction of a *system of indicators* that is adequate for the decision model constructed. These indicators are, simply, the variables of the model. And, as said in Para 1.2, this is a "decision-model" if its variables (indicators) express in some way the problems or social goals or concerns of the decision-maker.

The first task of the planner is therefore that of translating the concern or goal into an indicator, that is susceptible to having the role of a variable of the general model²⁰. The indicator - obviously - is the instrument of measurement. And despite the obviousness, one does not understand how processes of urban planning and land-use - as almost always is the case - can be carried out without an adequate system of indicators. This is one of the factors that has made planning so unreliable: because it has disassociated it from the possibility of any control of performance and implementation.

Often a problem or social goal of the first instance, is not translatable into a single and simple indicator. That problem or goal brings with it, besides the indicator that expresses it (which allows it to measure its state, or also the result), actions as well (and relative indicators) which allow for its implementation. The *indicators of state* or of *result* are accompanied also by *indicators of action* and *achievement*.

It is highly advisable that the list of social goals or concerns - which as said in Para 1.2 should constitute the starting point of the process of planning and evaluation - is organised hierarchically and "structured" in a frame (which we have called the "programme structure")²¹. In it the hori-

²⁰One can argue whether the choice, on the part of the planner, of the indicators for expressing the goals or problems of the decision-maker must not be subsequently agreed and approved by the actual decision-maker.

²¹Programme structuring (concept, meaning, utilisation, etc.) has been the subject of many works by the Author (Archibugi, 1973, 1986, 1993), because I consider also that is a essential hinge of planning methodology. Programme structure may contain various levels of goals and actions for achieving them. If there are more than two levels, each level constitutes a goal for the lower level and a means for the upper level, in an interlinked system. Albeit at different levels of elaboration, "programme structures" are to be considered the frame organisation of the social indicators elaborated by the OECD (OECD 1973, 1974, 1976, 1982), and other systems of objectives contained in "national plans". I consider the treatment by Harvey Perloff on "the quality of the urban environment" to be a pioneering work (Perloff, 1969). See also a recent study carried out for the Italian Ministry of the Environment by the Planning Studies Centre (Centro di studi e piani economici, 1993). Certain environmental indicators are contained in a work by the Dutch Ministry of Housing, Physical Planning and Environment (NL-Ministry of Housing, etc., 1991).

zontal list expresses the various typologies of goals (with their indicators) and their relationships; the vertical one expresses the interlinked relationship goals/means, for each of the preselected objectives and their relationships.

Each horizontal and vertical relationship produces indicators that can, fixed on certain values, constitute plan coefficients or parameters. The fixed values of the indicators may be supplied by the land-use matrix (LURM) (para. 3.1), if with the appropriate evaluations one arrived at determining an *optimal programmatic loading capacity* for each portion of the territory, for each typology of use or value threshold beyond which the unbalancing overload could be determined²².

With the evaluation of the optimum policy-oriented load one could arrive at the definition of a "loading capacity standard", or "holding capacity standard" as Chapin calls it, who makes it the basis for determining space requirements in plans (*op. cit.* pp. 405-81).

In the final analysis, the three issues that we have summarily indicated, (Land-use matrix; Appropriate Spatial Unit of Evaluation; System of Indicators of Result, Achievement, and Loading Capacity) constitute three prerequisites, to be combined together, in order to render urban planning operational and efficient, intended as an integration of all the aspects or goals: social, economic and environmental.

4. The Italian Case

In Italy an attempt has been made to initiate the application of such a general methodology, but at a level that is still propaedeutic and unsatis-

²²As already said in Para. 3.2 and especially in Note 15, the optimal policy-oriented load, understood as the sum of loads due to the various load factors, may be evaluated, with regard to some "effects", on the portions of territory that do not respond to what has been defined as the "appropriate territorial unit of evaluation" (for example the IEZ indicated above). But whatever the overload is that occurs in a single area, it is necessary to know the load of all the bordering areas as well, to give an operational conclusion (of planning) to the measurement itself. It is not enough to know that we have reached an overload in some areas, if we are not able to spread it over other areas. And it is necessary to know even if a load factor (e.g. a single activity, hospital or industry) pertains or not to the overloaded area. If it does pertain, it will be thus necessary to evaluate what disequilibria are created in *other* areas by the removal of the same. This is why the appropriate ambit of evaluation and measurement should coincide with the same ambit of planning and decision. Finally, it is not enough to know (and know how to know) the integral load of an area, one must also know when and why it is useful to know, and in what moment of the planning process this knowledge must be used and for what purpose.

factory. The occasion was the research project implemented by the Italian National Research Council and directed by the Author. The project is called the "Quadroter" ("Construction of a Territorial Framework of Reference for Environmental Policy")²³. It has a predominantly national validity, in the sense that it is aimed essentially at evaluating territorial equilibria (in the sense described of supply/demand of land use) on a national scale, (at the inter-systemic level²⁴) and at creating the appropriate territorial Units of evaluation on the same scale. Notwithstanding this the methodology can be applied also to analysis and evaluation within an urban system (infra-systemic), with particular reference to those systems that manifest an evident overload. In the ambit of each level of analysis (inter-systemic and infra-systemic) we will give some examples, noting nevertheless that a lack of analysis is largely present in both levels, as will be indicated case by case.

As seen from the example given as a "programme structure" (see **Scheme**) of a "Programme for the Improvement of the Urban Environment" included in the Italian "Ten Year Plan for the Environment" (**DECAMB**), two general aims are foreseen relative to: 1. *the activation of general factors of good urban environmental quality*; 2. *land management for the realisation of good urban environmental quality*. To the first aim refers, as an objective the "definition of standards of the urban effect" (both in the field of the "provision of urban services" and in that of "inter-regional, social and political relations". To the second refer three essential objectives 2.1. of *appropriate interventions in "metropolitan areas"*; 2.2 others in *"declining urban areas"*; and 2.3. and others in *"non-urban" areas*²⁵.

²³ See *Ministero dell'Ambiente* (1991 and 1992).

²⁴ Assuming the logic of the Appropriate Units of Evaluation as characterising the Urban Eco-system from the "rest of the world" (par. 3.2), the equilibrium of the territory, on the national or local scale, could be more correctly called: "inter-systemic" and "infra-systemic".

²⁵ In the concept of "urban system", the "non-urban" areas have become an integral part of the urban systems, even if - within these - they are susceptible to being the object of a special strategy, which aims at exploiting them for their natural and historical-cultural qualities, but also at saving them from the intrusion of an intense and disordered development of the city. In the Quadroter research they have been identified throughout the Italian territory, and around 300 are considered as being susceptible to special intervention. They are called **UTRAS** (in Italian: *Unità territoriali di ricupero ambientale e storico-culturale*): "Territorial Units of Environmental and Historical-Cultural Recovery", and are "allocated" to various urban systems (which likewise Quadroter has proposed as the "appropriate units of evaluation of territorial equilibrium"). Since they are areas which

4.1 *Inter-systemic Strategy of Polarisation and Depolarisation*

The strategy of territorial riequilibrium, aims in fact at two types of intervention, which are different but, at the same time, concomitant, in the metropolitan areas and in the declining areas.

In the overloaded metropolitan areas the strategy aims at a decongestion of the single all-absorbing "historic centre", by means of the creation of "alternative centres", with a conforming treatment of the outskirts and traffic²⁶. It is in this sense that one thinks of being able to riequilibrare the excess of demand of land-use with respect to supply and availability. The creation of alternative polarisations to those of the monocentric centre must however be operated with the constraint of the "critical" minimum threshold of potential usership, which permits the existence of those services that produce the city-effect (and which should be studied and defined on the basis of the goals and parameters mentioned sub 1.1 and 3.3). The accessibility constraint in these cases is more than respected already in reality, and certainly improved with the improvement of the congestion factors of traffic that could lower travelling times and thus of access to the superior services. The constraint of the critical user threshold means that, in order to be really alternative these polarisations must be at least as important as the monocentric one, which they would contrast; and avoid the risk of decentralisations which are not sufficient (and ineffective to such an extent) to constitute a real alternative, and would create a further disordered and costly "peripherisation". (This strategy will be illustrated further with its application to Rome.)

In the areas of widespread settlement (in particular for the medium-size urban centres) the strategy consists of creating polarisations that are able to hold back - reaching necessary user thresholds - the persistent attraction of the metropolitan areas. In this case, the problem is posed of the best trade-offs between the constraint of the critical demographic threshold and the constraint of temporal accessibility (isochrone).

by definition elude the problems of urban overloading, they are not examined in this brief illustration of the Quadroter.

²⁶Naturally, the metropolitan areas as well have benefitted from the general strategy of subtracting the declining urban areas (the second objective of the general strategy) from the excessive dependency on the metropolitan areas themselves; we may consider the intervention on "inter-systemic" relations, as having a *conjoined positive effect* both on the metropolitan areas, in that they are freed from a certain amount of overload due to the declining areas, and on the declining areas themselves, because they are freed from the decline-effect because of a limited utilisation of their environmental resources.

These goals are aimed at achieving optimal territorial riequilibrium on a national scale of the opportunities of urban effect, without the damage of overloading in areas with force of attraction. The absence of overloading means that it is possible to balance the demand of urban use with the territorial availability of urban use.

On the basis of these objectives²⁷, the mentioned Italian **DECAMB** ("Ten-Year Plan for the Environment") has proposed the reorganisation in Italy of **10 metropolitan cities** with the same number of "urban systems" and "plans" on which can be constructed the land matrix and the application of the analysis and evaluation of optimal loads²⁸.

And it has proposed likewise the "organisation" of another **27 "city systems"** by means of which a great quantity of medium and small sized cities can be assembled and "integrated" (with an appropriate strategy of urban transport and superior urban services location), which: a) by themselves would not be able to achieve the necessary "city effect"; b) despite their current apparent revitalisation, constitute a permanent risk of chronic gravitation towards metropolitan areas and thus of the aggravation of the burden or surplus of demand for territory in the latter; and, c) constitute, at the same time, a phenomenon of "degradation" because of the abandonment of the small and medium sized urban structures (which on the other hand represent a patrimony to be utilised²⁹).

The Quadroter has also identified for each of the urban systems proposed, besides the "*structural components*" of the same systems (the "*supporting axis*" of three different grades, a "*halo*" of the supporting axis, a "*service centre*" , likewise of three grades, the "*Territorial Units of Historical-Cultural and Environmental recovery*", (**UTRAS**, in Italian), and - finally - also the strategy for urban-metropolitan transport that is coherent with the strategy of the territorial lay-out.

²⁷And with the help of multi-objective analysis carried out on a certain number of alternative scenarios of composition of "urban systems" that are coextensive with the entire Italian territory.

²⁸The Metropolitan cities are listed in Note 33 . The entire geographical layout of the urban systems is expressed in the Maps included in the official Report of the **Quadroter** and of the **DECAMB** .See **Map**. The 10 metropolitan cities are indicated in yellow colour.

²⁹These 27 alternative system are described in the quoted. report They are of a very diverse structure, form and quality. As a strategy the(red)systems are systems which are already polycentric and are to be potentially "rationalised", and not polarised; i.e. they must not attract energy and urban factors from the metropolitan systems. Whilst the (purple) systems are those which are currently attracted to the metropolitan poles, and for which a strong autonomous "polarisation" is advisable, to be realised in strict interdependence with the "depolarisation" of the "metropolitan" systems.

4.2 *An Example of Alternative Inter-systemic Polarisation: The Lombardy Area*

One of the most obvious disequilibria, which has been much studied, in the Italian territory, between anthropic pressures and spatial and environmental resources, is that occurring in some parts of the Po valley, in the Lombardy area in particular and even more so in the Milanese area³⁰.

Here there is such a "historic" congestion of productive and economic activities, and consequently urban and residential settlements, that the whole area has reached (and with it all the natural resources of the area: water, soil, air, woodland etc) the highest risk level in Italy.

The coefficient of the coming together of industrial risk and urban residential pollution is at its highest in the Milanese area, which has reached a level of maximum pressure saturation and is extending its congested area of influence more and more to the Lombard territory and to the adjacent regions.

The Quadroter project, because of its long range spatial vision, which is by nature multi-regional in character, has examined the possibilities of a spatial strategy of recovery of the tendency towards the compacting of the Lombardy area, and towards the environmental degradation that ensues, according to a non-regionally limited optic (meaning by these those that are not constrained by regional administrative borders). Naturally the vast and irreversible presence of "pre-existences" that must be borne in mind, constitutes an important constraint for a multi-regional optic.

One of the factors, as mentioned, of maximum effect in environmental degradation, is the great and often useless concentration of urban activities (those that produce the "city-effect") in restricted portions of "historically" occupied territory, towards which a user quantity ends up gravitating which is greatly superior to that strictly necessary to allow the same activities to economically survive. This is the case of the city of Milan, the superior services (universities, theatres, business centres, specialized health care, culture, sport, publishing etc.) of which serve an excessive *catchment area*, that gravitates from areas that, if well organized, could justify the development of such services with much easier and convenient access. In other words, if in general these superior urban services need a quite high user threshold, and thus have to concentrate themselves, in the case of the

³⁰This paragraph has been taken with suitable adaptations from a report given in a study meeting at the Polytechnic of Milan in 1992 on "The Ecological Aspects of Territorial Planning". See Archibugi, 1992a.

Milanese and Lombardy area, however, this threshold has been crossed over by a long way, thus priming a process of "diseconomies of scale", with respect to those economies of scale of the first phase of urbanization.

A good organization of the Lombard territory could create alternative "centralities" or polarities to those of Milan, with the effect of lightening the Milanese area from an overload of functions, and of managing on a more decentralized scale the entire load of activities of the population, which would benefit from the systems of territorial access to the activities themselves.

For the Lombard and Milanese areas the Quadroter has explored a form of territorial aggregation and, at the same time, disaggregation that will satisfy as well as is possible the double opposing demand:

- a) to respect the threshold constraints (and as a consequence of concentration) for the supply of the superior urban services;
- b) to maximise the decentralisation of the urban functions in the territory, and thus lighten the Milanese area of its excess of functions, and free the adjacent areas from a role of "dependency", with elevated access and management costs.

One has tried to apply the concept of *urban eco-system*, as illustrated in the previous paragraphs. It has been realised that the Milan area, obviously in its "metropolitan" dimension, which corresponds approximately to a wider territory than that of the administrative province, needs a) to be greatly decongested, i.e. freed from the gravitation from the adjacent areas that could be "served" by other alternative centralities, and b) needs also a territory of "expansion" for those "endogenous" development activities (linked to the pre-existencies and to the demographic settlements already installed) that cannot be transferred to "other" urban systems.

So, on the one scale (which we will call "inter-systemic"), *alternative urban systems* to those of Milan have been projected, that are capable of polarizing the territories now polarized on Milan. And, on the other scale, (which we will call "infra-systemic) within the Milanese system, *alternative centralities* to that of the historic centre have been designed (see [Map](#)).

The alternative systems on a (regional and multi-regional) inter-systemic scale are:

- a) a system of "*Northern Lombardy*", (or "*City of the Lakes*"), of a transversal character, unifying the territories of the provinces of Varese, Como, Bergamo, Lecco and Sondrio). To this would refer an overall catchment area of about *two and a half million people*, who today gravitate to Milan and its centre, with serious environmental and social costs;
- b) a "*City of the Po*" system that integrates the territories of the Lombard province of Cremona with those of the Emilian province of Piacenza in a

single alternative territorial system to the polarization on Milan and its area (a system that reaches the critical threshold of about *700 thousand users*);
c) a "*City of the Garda*" system that integrates the Lombard territories of the provinces of Brescia and Mantua with the Venetian ones of the province of Verona, in a single system that is likewise alternative (at least as far as Brescia is concerned) to polarization on Milan (with a critical user mass of more than *two million inhabitants*).

In this overall picture of the territorial lay-out, the territory of the province of Pavia, constitutes an element in the strategy of depolarization *within* the Milanese system; it would remain aggregated to "Greater Milan", but would become the seat of one (and perhaps the most important) of the *alternative centralities* to the historic centre of Milan, thus creating an essential bipolarism and an area of internal growth of great environmental breadth. As also within the Greater Milan system it would be necessary to identify *two or three other alternative centralities* in which to strategically locate the superior urban services and to which will refer, by quota, portions of the Milanese catchment area. But this strategy would be part of the infra-systemic depolarisation.

4.3 *Infra-systemic Depolarisation*

In the case of the 10 metropolitan systems identified in Italy, territorial equilibrium is also, and above all, guaranteed by a depolarisation of the type of that defined as infra-systemic³¹.

The only strategy possible, in order to oppose hyper-congestion, depolarise the function of the historic centre, and reduce the overload, is that of designing *alternative centres* that absorb a part of the centrality functions and public space functions reserved for the traditional centre.

However, these alternative centres must have certain *dimensional requisites* and they must represent an *integrated functional whole* with the same force of attraction as that of the historic centre, and, at least, have requisites that respect the "physiological" thresholds of use necessary for the economic development of the superior urban services in question. Decentralisation that does not have the polarising capacity of the historic centre is destined to fail and to thus constitute a waste. Alternative centrality in other words should respect the dimensional constraints of use that are con-

³¹This paragraph has been taken - with adaptations - from a report presented in 1992 by the author to the Group of Experts on the Urban Environment (of which the author is a member) created by the EC Commission (see Archibugi, 1992b).

sidered sufficient for the functional economic development (not forced or protected) of the superior urban services on which it is based and centred.

To obtain this it is necessary to design and promote the guided positioning (on the part of urban and spatial Plans on a suitable scale) of superior tertiary activities (starting from public activities) in *central places* chosen somewhere in the peripheral areas to be recovered and requalified. The amount of alternative centralities of this type depends on the size of the (user) population that presently gravitates to the hyper-congested centre, and on the demographic size standard of the catchment area considered as the minimum for the functioning of alternative centralities. Excessive diffusion produces the opposite result to the one sought for: further reinforcement of the traditional centre with an increase in the confused and chaotic peripheral settlements, a great waste of new resources and the continuation of the decay of urban quality.

In brief, the fundamental constraint that inspires the design of new "central places" is that of the redistribution of the functional "burdens" in a catchment area that constitutes a sufficient "critical mass" for the superior urban services provided previously (and perhaps redundantly) by the historic centres that are to be decongested³².

The design of these new central places constitutes the "actions" of the Programme.

These "Actions" are identified with the Italian metropolitan areas for which it is necessary to carry out the actions with this strategy, and which need therefore as many *prospects of alternative centres*³³.

³²Further discussion on the policy of new centralities is to be found in a report by the author for an EC Conference in Madrid on the "The Future of the Urban Environment in Europe", see Archibugi, 1991a.

³³The areas are:

- *Rome*, (which we have chosen as an example, see Para. 4.4) where there are catchment areas in the metropolitan area that suggest at least *five or six alternative*
- *Modena*, the catchment area of which is such that at least *three alternative centres are justified*, plus an alternative centre dependent on the strengthening of *Pavia's* historic centre, in a single urban system.
- *Naples*, the catchment area of which justifies at least *two alternative centres*, besides the strengthening of *Caserta's* centre in a single urban system;
- *Genoa*, the catchment area of which justifies the strengthening of *Savona* in a single urban system;
- *Turin*, the catchment area of which justifies the design of an *alternative centre* within the metropolitan area;
- *Bologna*, the catchment area of which justifies the design of an *alternative centre* within the metropolitan area;
- *Florence*, the catchment area of which justifies the alternative strengthening of *Pistoia* in a single urban system;

4.4 An Example of Infra-systemic Depolarisation: Rome

For Rome, as for Milan, and for other Italian metropolitan centres, the problem of overloading is posed contemporaneously as a problem of both inter-systemic and infra-systemic "depolarisation".

The first is posed (we have seen in the case of Milan), as a possible relationship with the gravitating areas which with opportune strategy have the requisites for "emancipating themselves" and becoming autonomous, more balanced urban eco-systems. The problem of infra-systemic depolarisation is instead posed as a possible relationship between areas which, whilst not always being able to belong to the same system, must alleviate an unbalanced overload of the same system on a single centrality - usually the "historic centre" - which creates likewise an overload that is not acceptable with respect to the load parameters established. In this case the strategy is that of creating "alternative centralities" to the mono-centre in such a way that the system passes from *monocentric* to *polycentric*.

For this second type of depolarisation (which has, in many ways, numerous characteristics in common with the first) we have chosen Rome as an example. Besides inter-systemic depolarisation³⁴, in Rome an "infra-systemic" depolarisation is essential *within* the same city "continuum" which, with its three million inhabitants and users, weighs exclusively on its old historic centre. Here it is not only a case of identifying which are the

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- *Palermo*, the catchment area of which justifies *another alternative centre* within the metropolitan area, and the alternative strengthening of *Trapani* and its territory, within the confines of the same urban system;
 - *Catania*, the catchment area of which justifies the alternative strengthening of *Siracusa* in a single urban system;
 - *Bari*, the catchment area of which justifies *another alternative centre* within the same metropolitan area.

For each of the "alternative centre projects" to be promoted in the above metropolitan areas, there will have to be drawn up - in agreement with the Regional, Provincial, and Local governments concerned - various, in part indicative and in part normative, "Master plans", which measure environmental impact on the basis of the matrix (LURM) discussed in Para. 3.1.

³⁴By means of the strategy of creating future urban bordering eco-systems which include territories (and small and medium sized centres) which weigh hierarchically on Rome). See in **Map** quoted, for example: a) an urban system for northern Lazio (the provinces of Viterbo and Rieti together with southern Umbria, i.e. the province of Terni); and an urban system for southern Lazio (the provinces of Latina and Frosinone); which both have the requisites for emancipation from Rome, if they are organised with an opportune planning strategy.

"intrusive" activities in comparison to the "compatible" or "environmentally sensible" ones. Beyond certain thresholds of the relationship between demographic pressure and users (with the inevitable demand on land-use) and the availability of environmental resources, any activity becomes - so to speak - intrusive. This is the case with Rome in which - moreover - its urban historic stratification, which over the course of time has not undergone excessive demolition and restructuring (luckily³⁵), has made the supply of space (for example, streets for traffic, and spaces for vertical construction) much more limited in comparison to that of the urban fabric of other great European historic cities.

But in order to be efficient, and effectively free the historic centre from the overload that is suffocating and destroying it (the historic squares of Rome have been transformed in fact into garages), "decentralisation" must be feasible. And that the alternative centres which the strategy wished to create, have the minimum requisites of force of attraction which today the old centre has with regard to the number of services and functions provided. In other terms centralities must be created that are capable of carrying out the function of serving a catchment area in a more advantageous way than happens now with the old centre. In Map 2 the alternative proposal is schematically given, that is coherent with the strategy and conditions expressed here. It is possible to articulate Rome into six alternative centralities, which would have - with respect to the important urban services - autonomous "urban services", with a catchment area of more than half a million inhabitants each. This catchment area represents a demographic threshold that is sufficient to feed an autonomous production of the rarer and more representative urban services of the "city effect"; those services which constitute the strongest and most lasting factor of attraction of cities and of constant increase of flow towards the city, even in the presence of non-acceptable environmental conditions.

4.5 The Evaluation of Loading Capacity in the Quadroter Research

The first approach of the Quadroter research, as seen, was in essence that of rebalancing the loads on the territory which are understood as the anthropic activities producing the city-effect (those factors that constitute

³⁵Because this has allowed, through factors connected to a historical delay in demographic development in Rome and to the specific quality of its monuments, the conservation of its historic character to a much greater extent than in any other European capital (see on this point a work by the Author: Archibugi, 1991b)

in the long term the main "primary" factors of the consumption of the territory and the environment). From this endeavour has arisen the awareness that the appropriate territorial unit for achieving a really "integral" evaluation of loads and the loading capacity is the "urban eco-system". The Quadroter research has proposed the division of the entire national territory into "urban eco-systems", which will be useful for the purposes of measurement, evaluation and further planning³⁶.

But the Quadroter intends to give incentive also to:

- a) the construction of a LURM for each of the "urban eco-systems" proposed, providing the common methodological scheme;
- b) the creation of national maps on the impact (load) that each main anthropic activity produces throughout the entire national territory; these maps are currently being produced³⁷. Their further aim is that of a super-

³⁶The method with which we have arrived at the said articulation of urban systems (the creation of the confines of 27 potential urban systems to rationalise and polarise, and of 10 metropolitan urban systems to depolarise), is that of multi-criteria analysis not rigorously bound to a single calculation and evaluation procedure, but linked to the general definition of objectives, on whose basis one can compare case by case (in the face of alternative system confines) the solution that is closest to the goals; and bearing in mind also the current preferences expressed by regional and local authorities, in the form of ad hoc consultation, and of already existing institutional orders.

³⁷At the moment there are 21. Of these 5 have been "concluded" (the financial wherewithal is lacking). The 21 maps are:

1. A map of territories at natural risk and of the intervention requirements needed for the reduction of such risks.
2. A Map of Water Potential
3. A Map of Environmental Climactic Vocation
4. A Map of Naturalistically Interesting Areas
5. A Map of Agricultural Land Capacity Utilisation
6. A Map of Forest Productive Functions and Fire Hazards
7. A Map of Coast and Coastal Waters Utilisation Potential
8. A Map of Urban Land Utilisation
9. A Map of the Polluting Potential of Agriculture
10. A Map of the Polluting Potential of Industrial Activity
11. A Map of Urban Pollution and Decay
12. A Map of the Production and Disposal of Waste
13. A Map of Tourist Areas
14. A Map of Infrastructural Locations and Impediments
15. A Map of Urban Services Location
16. A Map of the Functional Transport Network of National Interest
17. A Map of the Functional Energy Transport Network
18. A Map of the Urban Eco-Systems of Planning
19. A Map of the Urban Transport Systems of Planning
20. A Map of the Territorial Units of Environmental and Historical-Cultural Recovery
21. A Map of Land-Use Destination.

imposed reading of the Maps, in order to glean overall evaluations, aimed mainly at indicating the overloads and at constructing the LURM.

A big problem, which is currently being discussed among the research groups involved in the project, is that of ensuring an easy passage from a scale of "national" inter-systemic evaluation (with the relative collection of meaningful indicators on that scale for all types of impact factor or effect) to a scale of local and urban, infra-systemic, evaluation (which implies a collection of different meaningful indicators at this scale). On this point the Quadroter research is still at the beginning.

However, at whatever scale one intends to operate, the Quadroter research will utilise, in both theoretical and operational urban and environmental planning, the system loading capacity indicators and parameters wherever one has been able to study and define them.

5. Conclusion

This contribution has limited its field of vision concerning the question of "ecological" planning of the city, to the *methodological* issues to be considered as *prerequisites of a correct approach to this planning*. And we feel we can claim that - despite much interest and study of the subject of city management that is sensitive to environmental values, few steps have yet been taken (and it is worth taking them quickly) in the direction of the following logical itinerary (which includes all three prerequisites indicated): 1) the construction of a matrix of demand and availability of use, for each area to be planned, bearing in mind that it corresponds 2) to an appropriate unit of evaluation, and 3) to a set (as internationally valid as possible) of standard loading capacity parameters on the different typologies of available spatial resources.

Obviously it would also be very useful, if these itineraries are followed correctly, in planning experience, to produce a useful digest both for the scientific and professional community, and for those who take the planning decisions in this field.

References

- Archibugi F. (1973), *La "struttura di programma", base operativa sistematica della programmazione*, [Programme Structuring; The Systematic Operational Base of Planning] General Report No. 2 for the "Progetto Quadro", Ministero del Bilancio e della Programmazione Economica, Rome, 1973.
- (1979), *Principi di pianificazione regionale* [Principles of Regional Planning], Angeli, Milano, 1979, 1982 (2nd Ed.).
- (1985), *Metodologia per la delimitazione programmatica di bacini integrati di mobilità urbana* [Methodology for the Policy-oriented Delimitation of Integrated Basins of Urban Mobility], Contribution for Third National Meeting of the Transport Project, Taormina, May, 1985.
- (1986), *Per una metodologia di valutazione multi-criteri dei Programmi FAI*, [Multi-criteria Evaluation Methodology for the FAI Programmes], Centro di studi e piani economici, 1986.
- (1987), *La politica dei Sistemi Urbani*. [Urban Systems Policy] Centro di studi e piani economici, Rome, 1987.
- (1988), *La matrice di uso del territorio, strumento di valutazione dei piani*, [The Land-use matrix, An Instrument of Plan Evaluation], Paper to an International Seminar "Plan Evaluation Techniques in Town-Planning", University of Rome, 18-19 Mar 1988, Centro di studi e piani economici, Roma, 1988.
- (1990), *New Instruments for Integrated Evaluation of Environmental Impact*, Planning Studies Centre, Rome, 1990.
- (1991a), *A Strategy for New Public Spaces and Centralities: The Renewal of the Urban Environment*, Report to the EC Conference on "The Future of the Urban Environment in Europe" Madrid, 29-30 April 1991, Planning Studies Centre, Rome, 1991.
- (1991b), *Rome: A New Planning Strategy* (Italian version in: *Lazioricerche*, IRSPEL, N. 4, Roma, 1991); English version, Planning Studies Centre, Report No. 94.1, 1994.
- (1992a), *The Quadroter Project: An Ecosystemic Reading of the Italian Territory*, Paper presented at a Conference organised by the Polytechnic of Milan on "The Ecological Aspects of Territorial Planning", Planning Studies Centre, Rome, 1992.
- (1992b), The Urban Environment risk and assessment of the intervention requirements needed for the reduction of such risks.
- (1994). "The "Urban Mobility Integrated Basin" and Its Policy Oriented Identification: A Prerequisite of Rationality for Planning of Urban Transport." *European Spatial Research and Policy* 1(2).
- Berry B. J. L. (1966). Reflections on the Functional Economic Areas. In: *Research and Education for Regional and Area Development*. W. R. Maki, ed. Ames, Iowa State University Press.
- Berry B. J. L. (1972). Population Growth in the Daily Urban Systems of the U.S. in: M. S. Mills, ed. *Population, Distribution and Policy, Research Report of*

- US Commission on Population Growth and the American Future*. Washington D.C., GPO. V.
- Chapin F. Stuart Jr. (1967). *Urban Land Use Planning*. Urbana, University of Illinois Press.
- Chapin F. Stuart Jr. and Kaiser, J. E. (1985). *Urban Land Use Planning*. Urbana, University of Illinois Press.
- Chapin F. Stuart Jr. et alii. (1994). *Urban Land Use Planning*. Chicago, IL, International City Management Association and APA.
- Doxiadis C. (1966-70). *Emergence and Growth of an Urban Region*. Detroit, Edison. (Three volumes: Vol. 1 Analysis (1966); Vol.2 Future Alternatives (1967); Vol. 3 A Concept for Future Development (1970))
- EC Commission (1990). *Green Paper on the Urban Environment*. Brussels.
- Fischer M. M. (1982). Some Fundamental Problems in Homogeneous and Functional Regional Taxonomy. *Societies, Regions, Boundaries*. A. Kuklinski, UNRISD and Mouton.
- Fox K.A. (1967). *Functional Economic Areas and Consolidated Urban Regions of the United States*. Social Sciences Research Council (21).
- Friedmann J. and Miller J. (1965). "The Urban Field." *Journal of the American Institute of Planners* **XXXI**(4): 312-320.
- 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.
- Ministero dell'Ambiente (1992). *Piano Decennale per l'Ambiente (DECAMB)*. [Ten Years Environmental Plan] Roma, Ministero dell'Ambiente,
- NL-Ministry of Housing, Physical Planning and Environment (1990). *National Environmental Policy Plan Plus*. The Hague, Dept. for Information and International Relations.
- NL-Ministry of Housing, Physical Planning and Environment (1990). *Ministerial Manual for a Provisional System of Integral Environmental Zoning. Nr. 14*. The Hague, NL-Ministry of Housing, Physical Planning and Environment.
- OECD (1973). *Social Indicators - Guiding Principles and Concepts for the Development of Social Indicators in the Oecd Programme*. Paris, OECD.
- OECD (1974). *Indicateurs sociaux - L'experience de l'Ocde*. Paris, Oecd.
- OECD (1976). *Measuring Social Well-Being: A Progress Report on the Development of Social Indicators*. Paris, Oecd.
- OECD (1982). *The OECD List of Social Indicators*. Paris, OECD.
- OECD Urban Affairs Group Document (1990) *Environmental Policies for Cities in the 1990s* Paris.
- Openshaw S. (1977). "Optimal Zoning Systems for Spatial Interaction models." *Environment and Planning* (12): 1357-1382.
- Perloff Harvey S. ed. (1969). *The Quality of the Urban Environment: Essays on "New Ressources" in an Urban Age*. Baltimore, John Hopkins Press.
- US Office of Management and Budgeting (1990). *Environmental Protection Agency*. In: OMB, *Regulatory Program of the United States Government*. Washington D.C.

