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URBAN PLANNING AND ECOLOGY: WHAT RELATIONSHIP?

Some considerations on the definition of a integrative methodology

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1. Premise

Since environmentalism introduced - in the analysis of the dynamic equilibrium between development and available resources - the concept of "sustainable" development¹, the concept of "sustainability" has begun to be applied to the "urban" scale as well (in whatever way it is understood). This has coincided moreover with the reawakening, in the sphere of environmentalism (a movement born at the end of the 1960s mainly in the field of natural resource evaluation on a world scale) of new attention towards problems of the urban environment, which were first much neglected, and which suddenly emerged only in the latter half of the 1980s.

Not that the problems of the cities, of their disordered development, their social and economic degradation which is common - albeit with very different characteristics - to the great metropolitan agglomerations of the industrialised West and "third world" - of urban reclamation and renewal, have not been the subject of a vast scientific and popular literature. But the "environmental" problems have had

¹A concept which was popularised above all in the Report of the World Commission on Environment and Development - The "Brundtland" Report (WCED, 1987) but which had found a wide usage in some international study reports such as for example the study on "Sustainable Development of the Biosphere", carried out by IIASA, Laxenburg, Vienna (see Clark & Munn, eds. 1986) Neither would it be right to ignore that, albeit with slightly different terms, the concept has had a much longer history, at least as concerns the first reports promoted by the "Club of Rome".

a life which is disconnected from "urban" problems, and amongst which connections have been established which were no stronger than those established among all the categories of socio-economic problems.

The "environmental" problems ended up becoming concentrated on the problems of pollution and the over-consumption of natural resources, such as water, atmosphere, the natural heritage, forests, the "landscape"² etc. and on the factors which caused such problems: industry, energy consumption (and production), waste disposal, transport, and its infrastructures, perhaps tourism etc. and perhaps the actual physical expansion of the city (the "concrete"). The city, if at all, was considered as a factor of damage with regard to the environment, not as an environmental problem in itself. And, if at all, it was considered one of the "containers" of environmental degradation amongst other things, such as: the hydrographic basin, the "region", the continent, the stretch of water (lake, bay, gulf, sea), the oceans, the polar caps, etc. In short, the city has been considered one of the disturbing factors for an ecosystem, by which has always been meant a "natural" ecosystem. But with difficulty has the city been considered an *ecosystem in itself*: because this would have implied the inclusion in (or the extension of) such a concept with respect to other "non-naturalistic" components or variables³.

This does not exclude the fact that from the beginning (and perhaps even before) of the so-called environmentalist movement large sectors of scientific knowledge were aware of the dangers of this optical distortion, of this sort of "squint", on the part of environmentalism, concerning the city, and that a continuous and tenacious attempt to associate the environmentalist outlook with the ur-

²By "environmental assets" at the most the "landscape" was taken into consideration, indicating with such a term the countryside "landscape" (marine, mountain, hilly, lake, etc.) rather than the "urban" landscape proper.

³It is not coincidental that the first phase of the environmentalist movement (let us say the first two decades from the mid-60s to the mid-80s) provoked a great amount of antagonism on the part of academics in the natural sciences (chemist, physicists, geologists, biologists, botanists, zoologists, etc.) whilst the experts on the city, the "urbanists", found themselves somewhat marginalised. And it is not by chance that it was taken for granted that "ecology" only meant the ecology of natural life (and of man as a biological being), and not the "human ecology" which had had a great development some decades previously, above all with the so-called Chicago school of Sociology, which amongst other things had given great importance to urban analysis, looking mainly at man as a "social animal".

- It is worth noting that in recent well-informed and extensive collection of essays on the theme of the relationship between planning and ecology (Roberts & Roberts, 1984), the "naturalistic" meaning of ecology is taken for granted. Furthermore the editors complain that - despite the fact that Patrick Geddes, who is justly considered the "progenitor of modern town planning", whose training as a biologist led him "to re-interpret the phenomena of urbanization in ecological terms" (this too is true) - "since the time of Geddes the place of ecology has declined in planning circles as other professions and considerations, initially public health and engineering, latterly economic and sociological, have become more central" (p. 1). But the authors (who are biologists as well) neglect to mention that Geddes in fact "reinterpreted" the urban phenomenon as a human ecosystemic (and not only natural) phenomenon, and did not consider naturalistic ecology of any particular importance for urban analysis, apart from for methodology, considering the city, like any good biologist, as an "organism". Current attention on certain so-called ecological (natural) phenomena is important for planning, but has nothing to do with a systemic reinterpretation of the city itself as an object of planning.

banist one has not developed, above all from the point of view of planning and operational evaluation⁴. But the strength of mental fashions sometimes overwhelms - with notable cultural harm, which reverberates on the practical approach to political and administrative problems - the critical spirit. And - as was said - only recently has attention turned again to the relationship between town planning and environmentalist policy, and an explosion of attention has occurred concerning the theme of the relationship between land planning and the ecological equilibrium of the urban environment in the academic and political world⁵.

We can only be happy about this situation. The convergence of the environmental problem with the urban one, which has always been felt and theorised by the more critical elements in planning, cannot but improve the performance of urban policy and of environmental policy.

Nevertheless a certain feeling remains that this convergence, arising from cultural and political pressure, has taken place with too much attention being given to the object of the problem (cities and the environment) and not enough to an appropriate *method of organisation* or of *approach* to the problem. In other words, much has been said about "urban ecology", the "ecological" city, the "sustainable city" and a myriad of critical factors which are found at the junction of the two basic concepts (environment and city), but not enough work has been done on the basic concepts through which the action can be efficiently "organised", and thus from which to begin for a good, scientifically suitable, treatment of the question. Often these basic concepts are simple and elementary; sometimes their very simplicity is disturbing. But often they are overwhelmed by the quantity of "aspects" and "facets" in which the problem is broken down, or seen. There is therefore the impression today that there is an abundance of a disordered *description* of the problems (which are not all new), and of their illustrating and cataloguing, which

⁴Clear evidence of this can be found, in the remarkable work of one of the most important theorists of planning, Harvey Perloff. We must not forget that one of his most important contributions to Resources for the Future in the 1960s, was placing environmental evaluation at the centre of urban planning; which was not difficult for him as a follower of the Chicago school mentioned above which must attract more attention in the history of contemporary urban planning (Perloff, 1969).

⁵Initiatives on the subject have multiplied on an international scale. Firstly some important documents have come from the OECD and the European Community, now Union. The following should suffice for all: the OECD (Urban Affairs Group): Environmental Policies for Cities in the '90s (OECD, 1990) and the EC Commission, Green Paper on the Urban Environment (EC Commission, 1990). And international conferences have proliferated. Among the most important: the OECD Conference on: "The Economic, Social and Environmental Problems of Cities" (Paris, Nov 18-20 1992); the international conference, promoted by the OECD-EC-Berlin Senate on "Urban Environmental Improvement and Economic Development" (Berlin, Jan 24-26 1989); the international forum, promoted by the OECD-UNEP on "The Global Environment and the City" (Osaka, July 2-3 1990); the EC Conference on "The European Future of the Urban Environment" (Madrid, April 29-30 1991); the "workshop" of the European Foundation for Improvement of Living and Working Conditions" on "Land Use Management and Environmental Improvement in Cities" (Lisbon, May 6-8 1992); the International Symposium on "Urban Planning and Environment", (Seattle, March 2-5 1994) promoted jointly by the Universities of Washington (USA) and Groningen (Netherlands); the more recent European Conference "On Sustainable Cities and Towns" promoted by the European Union (Aalborg, Denmark, May 24-27 1994).

lacks a suitable "taxonomy", to classify them and locate them in their correct place, and which faces them at the correct moment and with the correct instruments. In short there is the impression that the listing and vast reporting of aspects, points of view, experiences, made in documents and conferences (of the type mentioned), is today overabundant, and ends up constituting a sort of "background noise" which prevents us from distinguishing the main clear and distinct melodic theme of a method for an appropriate approach to urban environmental planning.

2. The Purpose of this Contribution

In this paper we intend to give an initial contribution to a conceptual and operational integration of the relationships, which have been widely discussed and illustrated in recent times⁶, between environmental quality and planning.

In conformity with the concerns recalled above, this contribution will not go into an analysis of the various multiple aspects by which urban environment can be influenced, negatively or positively, with the development of anthropic activities, but rather into how these multiple aspects can be *conceptually and methodologically included in a process of planning, evaluation, and decision*.

To be coherent with this purpose the paper will concentrate on two essential aspects of a planning methodology for the urban environment:

- the first concerns the assumption of some essential *postulates*, in which a good part of the discussion of the contents on urban environment and the ecological city risks losing its way;
- the second aspect proposes the assumption of three *instrumental components*, considered essential, in fact *prejudicial*, for any type of urban environment planning procedure; components through which a good part of the problems connected to environmental policy decision evaluation may find an appropriate placing.

The essential 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 instrumental components concern the treatment of the above-mentioned objects (land-use and environment), in terms of: 1) *the analysis matrix of the land-use/environment*; 2) *the appropriate spatial unit of evaluation and planning*; 3) the appraisal of *loading capacity indicators* (with the possible fixing of *loading capacity parameters*).

- 6A privileged reference will be made to a recent excellent report entitled "European Sustainable Cities" which has still not been definitively approved, produced in the ambit of the "Urban Environment Experts of the European Union", constituted by the EC Commission in 1991 (and of which the author is incidentally a member). This report was presented as a "consultation draft" at the previously mentioned "European Conference on Sustainable Cities and Towns", Aalborg, May 24-27 1994.

In the last paragraph, we will illustrate how the assumption of the methodology proposed - including the postulates - could be applied to the current state of discussion for an "ecological" or "sustainable" city, in Europe.

3. Planning and Ecology: Postulates⁷

3.1 *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). However, for a correct organisation of the various problems which concern planning, evaluation and decision, we should separate the analyses and reflections about the factors which may influence the improvement of the urban environment, from those relative to the method and procedures of planning itself. Independently from 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 list⁸, are considered by us to be *outside* our field of environmental planning 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 to the same number

⁷This paragraph reproduces substantially with slight adaptations a part (Para. 2 & 3) of a background paper entitled "The Basic Issues of Ecological City Planning" presented at the International Symposium in Seattle, March 2-5 1994, on "Urban Planning and Environment" (Archibugi, 1994).

⁸See 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.

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, geo-morphological conditions, economic resources*, etc. All these can be called the "*technical conditions*"⁹.

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 *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-oriented model", and assumes that of an indefinite "positive model" whose variables are casual and not justified (not made

⁹It would be helpful to open a separate chapter of analysis for each of these technical conditions, and give an ordered catalogue of all the factors for and against the urban environment, which those conditions - internally - represent. For example: a systematic analysis of all the available technologies and their efficacy on the reduction of environmental impact, in the various fields of anthropic activity; the analysis of the environmental effects of certain classes or categories of geographical factors (climactic, orographic, landscape, etc.) on living conditions. The analysis is less extensive on the economic constraints, which usually have a single parameter (the monetary one) to evaluate the opportunity costs of alternative plan solutions.

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. 4.3). The second have no sense if they are not quantified, exogenously or endogenously to the model (see Para. 4.1).

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.

4. The Methodological Prerequisites in the Planning of the Ecological City

As said in the premise, there are some approaches that we consider fundamental, in fact *prejudicial*, 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.

4.1 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 (on places, times, cultures, productive capacity, etc.) constraints.

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 scales¹⁰. But they may also constitute the vectors of a "land-use and resources matrix" (LURM¹¹), 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 a 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*¹², 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 residential housing, for example) becomes so because of the over-crowding 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 also constitutes the instrument offered by the planner to the decision-maker for its *trade-offs* between costs and benefits, for fixing its *targets* and for rationalising, finally, its *plan decisions*.

4.2 *The Appropriate Spatial Unit of Evaluation and Planning*

- 10A 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.

11A more detailed explanation of the LURM is to be found in the author's manual (Archibugi, 1982, 2nd Ed.). Further technical considerations also in Archibugi, 1988, 1990.

12In the didactic work mentioned above (Archibugi, 1982, p. 181-184).

The equilibrium between the 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"¹³ scale, the "continental"¹⁴ scale, the "hydrographic" (basins) scale¹⁵, 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"¹⁶.

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")¹⁷. 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 basin¹⁸.

13For 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.

14For example with "acid rain".

15For example with the release into waterways of urban effluents.

16Also 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.

17See Doxiadis (1966-70, 1970), Berry (1972a) and Archibugi (1987).

18The 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 Chapin & Kaiser on the subject, op. cit. 1985,

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 city¹⁹.

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)²⁰. 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 oc-

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 - see Centro di studi e piani economici, 1971); 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.118-120). 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".

¹⁹The 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, 1967, 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, 1972a and b); 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, 1993).... □ □

²⁰For example, in the attempts proposed for territorial riequilibrium in Italy (the above-mentioned "Progetto 80", and the "Quadroter", Ministero dell'Ambiente-CNR, 1991), a minimum acceptable isochrone of 1-1,30 hours daily commuting time has been assumed (see Archibugi, 1982, 1985, 1987, 1993).

casional 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 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"²¹ 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 equilibrium is realised as well (and vice-versa), 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 planning²².

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 inter-dependencies of all the *anthropic activities that produce a city-effect*, it is essential that the supply-demand balance is made only on the scale of that eco-system, otherwise a distorted and false balance will result.

21For 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.

22For further discussion on this point see Archibugi 1987 and 1991.

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-system²³; 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 "overlying" (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 plant²⁴.

4.3 *The Definition of Loading Capacity Indicators and Parameters*

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 vari-

23The 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., □ □ □

24See the concept of "Sub-metropolitan Analysis Zones" which is much discussed in Chapin & Kaiser (see Note 18). 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. (See De Roo, 1993). 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 (see Note 20) is moving in this direction; and the substance of this contribution is oriented likewise.

ables (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 model²⁵. 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 3.2 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")²⁶. In it the horizontal 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. 4.1), 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 determined²⁷.

²⁵One 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.

²⁶Programme 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, 1992). Certain environmental indicators are contained in a work by the Dutch Ministry of Housing, Physical Planning and Environment (1991).

- ²⁷As already said in Para. 4.2 and especially in Note 24, 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

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 pre-requisites, 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.

5. Application to a Case of a Policy of Urban "Sustainability"

What relevance may the postulates and methodological and instrumental pre-requisites recommended above have for a policy of urban sustainability (above all on the European scale and with reference to the EU Urban Environment Group document mentioned above)²⁸?

5.1 Implications of the Use of Assumable Postulates

The first result of a clear assumption of the two postulates proposed would be that of separating cleanly (in the discussions which normally develop on the sustainable city) from the defence of the use of advanced technology, which is completely obvious and acceptable, with respect to the problems of management and planning. This would avoid a great deal of confusion of language; and it would avoid being obliged - to avoid such confusion - to make tiresome distinctions between the technical, geographical, cultural conditions etc. To give an example, one can think of the different climactic conditions which can present variable decisive differentials and equally decisive costs to environmental policies for the rationalisation of urban heating.

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 the 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.

²⁸Obviously here we refer also to numerous programmes for the improvement of the urban environment which have been formulated in recent times on a national scale. Interesting perspectives may be found in the national plans for the environment of various countries (for example, the Dutch Government plan and those of the French, British, Canadian, and Japanese governments).

The second postulate, relative to the exogenous nature of the goals, induces likewise a clear separation of the reasoning of value judgements and on cultural preferences, which deserve as much attention and analysis as possible, but do not merit being mixed - or worse "smuggled" in - with "technical" arguments. They (value judgements and absolute preferences) must be dealt with for what they are, with a full awareness and notion of their significance, otherwise the general educational result would suffer greatly. The defect of many international documents of a "literary" nature is that of lumping everything in together; here a technical argument is developed, there a quality choice is introduced, and it is not clear whether we are faced with the opinions of experts or politicians, or the expert masquerading as a politician, or the politician who apes the expert.

5.2 *The Effects of the Adoption of the Prejudicial Instruments of Analysis*

But even more obvious would be the positive effects of the adoption of the methods of evaluation and of the prejudicial instruments of analysis suggested.

First of all they all aim at rendering the different situations comparable, when it is a question of making comparisons, in the evaluation of experts and decision-makers. To quantify the situations (for example, the impacts of anthropic actions on resources) it is necessary to have clear and homogenous units of measurement in the various situations. Making a "balance" of the supply and demand for territory implies the burden of approximating a measurement of supply and demand which are conceptually valid, i.e. which refers to single concepts and comparable realities. If there is no common unit of measurement, each comparison risks being misleading or false. In this case as well it is the absence of method which would create falsity in the data and thus also in the opinions taken from these, whatever the attraction of the arguments. The lack of homogeneity in the indicators constitutes one of the most dangerous pitfalls in environmental planning.

The measurement of phenomena loses any sense if it is not applied to the appropriate territorial units of evaluation and planning. Many of the discussions on small, medium, big cities and their quality (of life, environment, etc.) are authentic *flatus vocis* if there is no guarantee beforehand of the sense and significance of the territorial, demographic, economic ambits to which they refer, and the thresholds (of accessibility, the "critical mass" of services, the "urban effect") are not pre-established on which to be based, in order to give judgements. Throughout the world at debates on the sustainable city, I have not yet had the pleasure of coming across a premise or frame of reference, modest and numerical, in which a sort of conceptual "glossary" was put first, also perhaps with quantified parameters, of the words used (metropolitan area, congestion, and so on). The day when a serious (multidisciplinary and also multinational) work of research provides such parameters, the work of environmental planning which refers to it would lead to sure "spontaneous" results. In the present conditions any intervention or policy is a lottery.

And in effect it is on the loading parameters (used however with the appropriate schemes of territory supply and demand equilibrium, and with the appropriate

territorial ambits), which the efficiency of any environmental policy would be measured, which will always be nevertheless a trade-off between alternative uses of resources and a choice between alternative scenarios. Without appropriate goal and performance indicators and without reference parameters any plan or any policy would just be a dream.

I do not think that such parameters and indicators (of goals, performance, load, etc.) will be able to reach a universal and absolute validity. They too are subject to temporal and cultural variables. But knowing the experience of others in measureable and comparable terms is the premise for a creative exchange of authentic experience and greater cohesion, if really desired.

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