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Society, economy, environment – towards the sustainable city

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Mariusz Kistowski

The geography of sustainable development – a new approach to the study of city sustainability

The origin of the concept of sustainable development

The concept of sustainable development has evolved considerably since the turn of the 1960s and 1970s, though it is sometimes traced back to the American environmentalism of the 1920s (Gottlieb 1993) or even to the practice of regenerating forests on the territory of present-day Germany in the Middle Ages (Weizsäcker et al. 1999).

A stimulus for the evolution of the concept of sustainable development was the repeatedly revealed fact that the further maintenance of the patterns of production and consumption present in highly industrialised countries and their adoption by developing countries could lead to a breakdown of the life-sustaining functions of the planet. A symptom of this breakdown, increasing during the second half of the 20th century, is the emergence of several crises, while the willingness to overcome them was an impulse for the evolution of the concept of sustainable development. Among these crises, the most important for further discussion are (Baranowski 1998, Capra 1987):

- the philosophical-ethical (moral) crisis – the domination of "have" over "be" in people's behaviour;
- the crisis of science – depletion of the possibilities of the reductionist model of science, together with the inability to develop holistic approaches;
- the social crisis – in which macroeconomic criteria dominate over an individualistic approach;
- the crisis of the technosphere – manifested in standardisation, specialisation, synchronisation, maximisation and centralisation, occurring mainly in the sphere of production;
- the crisis of the concept of spatial management – manifested either in excessive centralisation or in the dispersion of spatial structures with a shortage of sustainable solutions;
- the ecological crisis (of environmental quality) – the exhaustion of environmental resources and values.

The assumptions of the concept of sustainable development, variously defined, can be summarised in the notion that any kind of development may be defined as sustainable only when it takes into consideration ecological criteria, leading to the maintenance of a material and social base for the development of future genera-

tions (Mebratu 1998). This statement expresses the intergenarational principle, which, along with the pinciple of interdisciplinarity, is one of the basic principles of the implementation of sustainable development. The search for achieving sustainable development is often understood as the harmonisation of four orders: ecological, social, economic and spatial (Kołodziejski 1997).

Relationships between geography and the concept of sustainable development

What can prevent the deepening of the crises enumerated above is, among other things, a change in the approach to scientific research. Attempts at such a change have been taking place for almost 40 years. The two basic systems functioning on Earth – the natural and the anthropogenic – have long been the subject of research of two types of science: natural and social. Within geography they are dealt with by physical and human geography, respectively. The relationships between these two subsystems are studied according to the needs, goals and willingness of representatives of one or the other geographical discipline. As a result, the central subject of research is either nature or humans, and only in rare cases does the subject cover the relationships between these two spheres. Hence, the key problem seems to be devising a method of research in which the two subsystems of the planet would be treated equally, along with the relationships between their individual elements.

Attempts at such research have been undertaken, more or less successfully, by representatives of a seemingly new discipline called environmental studies. Despite the fact that, in one of the newest academic course books on this subject (Miller 2002), geography is not listed among the disciplines on which environmental studies is based, (although ecology, biology, chemistry, geology, economics, political science and philosophy are mentioned), on the basis of an analysis of the content of the course book one may conclude that the majority of it overlaps with the scope of study traditionally undertaken by physical and social geographers. Thus, in fact it is a course book on geography with a more holistic approach, in which emphasis is placed mainly on the relationships between nature and anthroposphere. It might be argued that what has fashionably been called environmental studies is in fact geography, in which the subject of research is the relationships between the biophysical and anthropogenic components of the environment (Fig. 1).

If this thesis is deemed true, and the aim of environmental is to exmine the conditions and processes of sustainable development of the natural and anthropogenic spheres, then it is geography that can investigate the development processes most fully, determining the principles of their sustenance. Here are several arguments to support the thesis:

- firstly, development is a process occurring in space and only a spatial approach to it, most comprehensively studied by geographers, offers proper conclusions about developmental disproportions and the direction of matter, energy, information and capital flow that may diminish these disproportions;

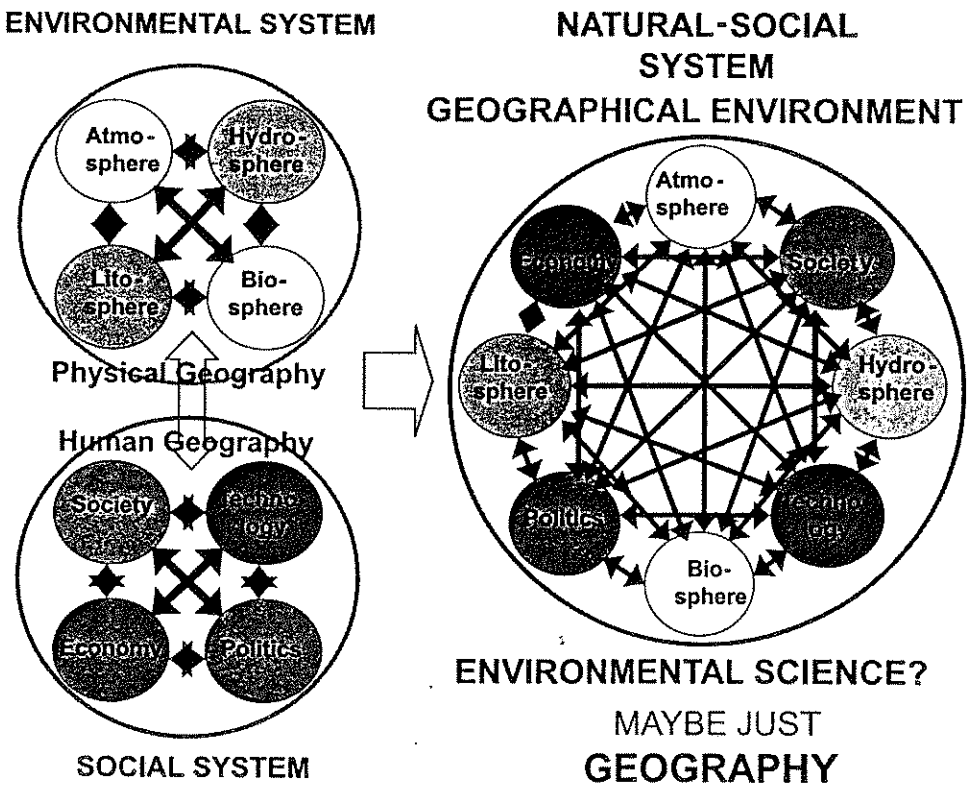


Fig. 1. The traditional and holistic approaches to geographical studies (based on Miller 2002)

- secondly, the concept of sustainable development approaches development processes as a close relationship between the anthropogenic and natural spheres, and geography has traditionally been the discipline seeking to study the interactions between these spheres;
- thirdly, the theory of sustainable development allows for the formation of scenarios or forecasts on the further course of development processes, and geography has for decades been the leading discipline in forecasting both natural and socio-economic processes.

Thus, the question may be asked: if the relationships between geography and research on sustainable development are so strong, why is geography unable to fully cope with the challenge related to the holistic approach to development processes? The answer to the question should be sought, among others places, in the history of the development of geography as a science over the last two centuries. Already in the 19th century geography lost its central position in the system of knowledge, when Kant placed it in his division of sciences (Wilczyński 1996) by dividing it into physical, human and regional geography. It has systematically lost its significance as a link between the humanities and natural sciences. The specialisa-

tion processes continued in the 20th century, leading to the establishment of numerous subdisciplines and research trends (Fig. 2).

The specialisation of science is not itself a negative phenomenon, though if the vast majority of science undertake research on very narrow problems (of a branch or component nature), science almost loses touch with the problems of complex studies. In the case of geography, researchers performing investigations in the contact zone of various disciplines, e.g. physical geography and ecology or social geography and sociology, were seen as "renegades".

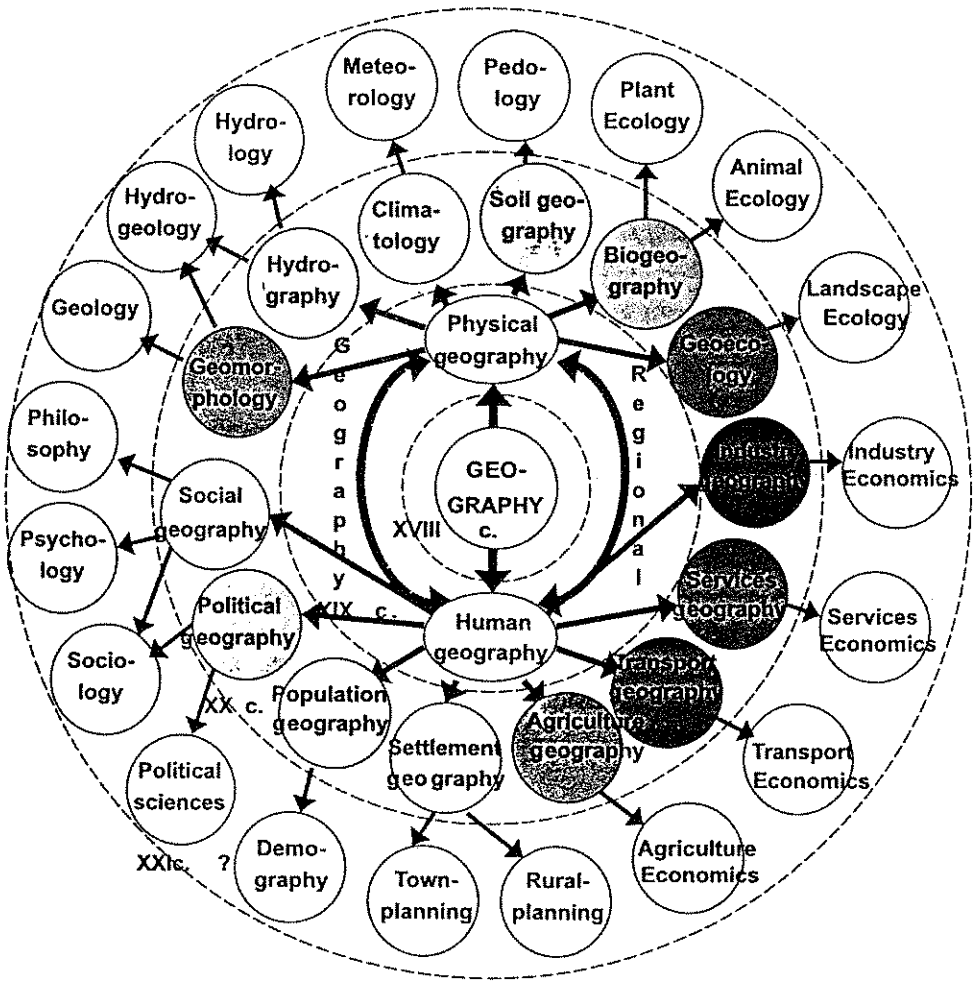


Fig. 2. The process of specialisation and potential dispersion of geographical sciences into non-geographical science disciplines (after Kistowski 2003)

Geographical studies on sustainable development

What is sometimes called the crisis of 20th century geography is related to some degree to the temporal variability of the between pure research and applied research. The studies on sustainable can be characterised as either pure research or applied research. What determines their usefulness is the extent to which an holistic approach to man's environment is adopted. As Frazier (1982) argues, "applied geography uses the principles and methods of pure geography but is different in that it analyses and evaluates real-world action and planning and seeks to implement and manipulate environmental and spatial realities. In the process, it contributes to, as well as utilizes, general geography through the revelation of new relationships". In the case of studies on sustainable development, both kinds of research are usually used. In this sense they are closer to the applied approaches than to theoretical ones.

In the 20th century Pacione (1999) distinguished two main periods of applied and pure research, with the latter lasting slightly longer than the former. From the point of view of the future of geographical research on sustainable development, the basic question is which research approach will characterise geography in the decades to come. It would be desirable to search for balance between the theoretical and applied approaches.

Geographical studies on the conditions of sustainable development, though lacking a full theoretical and holistic basis, have been undertaken since the mid 20th century. Still, these studies are performed separately by physical geographers and human geographers. Among the former, from the 1980s on research on the sustainability of the functions of the natural environment has developed rapidly (Meadows et al. 2004). This was stimulated by the changes, both observed and predicted, in the natural environment, especially global climate change. This trend includes global research on the sources and quality of water, the effects of deforestation and desertification and the subsequent abandonment of arable land or black fields, the reconstruction of degraded areas and the protection of swamps. The basis for such research was established as early as the 1960s when studies were undertaken on matter and energy flow in landscapes (both rural and urban) under the influence of man (Mizgajski 1994). They had the character of basic research and, until recently, were rarely used to formulate generalisations and conclusions useful for the implementation of sustainable development policies. Another trend relatively close to the concept of sustainable development is that of geo-ecological studies (Krönert et al. 2001), in particular the examination of environmental resistance to anthropogenic pressure. Over the past decade many geographers in this field headed down the path of practical application, which has resulted in the development of models and programmes of sustainable development for various areas (Van den Bergh, Nijkamp 1991, Gończ, Kistowski 2004), or in the preparation of guidelines for constructing such programmes (Kistowski, Staszek 1999, Bringezu 2002).

Due to its anthropocentric character, the concept of sustainable development began to emerge in social geography quite early (Ravetz 2000). Social geography

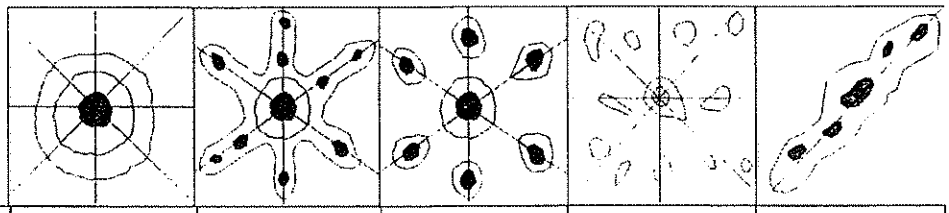
already had a tradition of adopting a holistic approach to problems, joining the processes occurring in the social system with natural processes. This originated from the idea of a dialogue between civilisation and nature, formulated at the beginning of the 20th century by Vidal de La Blache. Studies of social and economic phenomena and processes, such as housing conditions, poverty, crime, migration within the city, morbidity, social segregation and discrimination, paved the way for undertaking deeper research on sustainable socio-economic development (Walmsley, Lewis 1987, Smith 2004). One of the currents of this research concerned "ecological conflicts" as contradictions between various ways of socio-economic development, more or less concordant with natural conditions (Dutkowski 1995). It was also on a geographical basis that general concepts of sustainable development emerged, such as the ecoregional strategy in relations between man and environment (Bahrenberg, Dutkowski 1992).

Studies on sustainable development undertaken by geographers took the form of hermeneutic studies as well. The best example of such an approach may be the critique of Chinese Agenda 21 carried out by Bradbury and Kirkby (1996).

Examples of research on the sustainable development of cities

The limited size of this article permits a discussion of two examples of research on sustainable development, both of which concern cities. The first covers studies of the geography of settlement and town planning, and has a more theoretical character (Kamieniecki 2002). By analysing five basic layouts of the spatial structure of towns (concentric, radial, satellite, dispersed and linear), is the model most favourable for the sustainable development of towns was determined. For the purposes of the evaluation the following criteria were adopted:

I. accessibility of the centre;
II. costs of technical infrastructure and transport;
III. accessibility of recreational areas;
IV. possibility of shaping spatial order.



Cri	CONCENTRIC	RADIAL	SATELLITE	DISPERSED	LINEAR
I	+	+	+	–	–
II	+	+	–	–	+
III	–	+	+	+	+
IV	+	+	+	–	+

Fig. 3. The evaluation of spatial structure sustainability of large cities (after Kamieniecki 2002)

The analysis showed that most favourable model for sustainable development is the radial model, while the least favourable is the dispersed model (Fig. 3).

In the radial model, access to the centre of the city is relatively easy, thanks to many alternative transport axes from settlements to the centre. This model facilitates the reduction of transport costs and improves access to public transport. The settlement quarters lay on the many axes around of the centre of the city, and there are large open spaces between these axes, close to settlements and often suitable for recreation. It is easier to maintain spatial order in the case of radial model of the city. The dispersed model, in contrast, has many negative features, i.e. higher costs of transport and technical infrastructure, which should connect more small settlement points. There are also greater difficulties in shaping the spatial order. Only access to open spaces is better in the case of the dispersed model of the city; however, the susceptibility of natural and cultural landscape to degradation is higher.

The "pure" forms of these models do not exist in reality; however, during the physical (spatial) planning processes of parts of larger cities and smaller towns, such analyses are helpful for undertaking sustainable development in its ecological, economic, social and spatial aspects.

The second example concerns the functioning of a city in terms of matter-energy flows. One model of these flows, called the 'metabolism' of human settlements, was prepared by Newman (1999) and includes four main phases of 'metabolism':

- resource inputs;
- dynamics of urban societies;
- capabilities of towns to meet the living needs of their inhabitants;
- "waste" outputs (pollution).

In each of the phases several elements and processes were distinguished. It is worth noting that the structure of most of these elements is the subject of geographical studies. Resource inputs are usually dealt with by physical geographers, urban dynamics and town capabilities are studied by economic and social geographers, and the "waste" outputs by specialists in environmental protection, who are often also physical geographers (Fig. 4). The model was applied to Sydney, and its composition for 1970 & 1990 were compared (Table 1).

Table 1. Trends in certain per capita material flows in Sydney 1970 and 1990 (Newman 1999)

ELEMENTS	1970	1990	1990/1970
Population (thous. persons)	2790	3656	1.32
Energy (thous. MJ/capita)	88,6	114.2	1.29
Food (thous. MJ/capita)	0,23	0,22	0.96
Water (thous. MJ/capita)	144	180	1.25
Solid waste (tonnes/capita)	0.59	0.77	1.31
Sewage (tonnes/capita)	108	128	1.19
Air waste (tonnes/capita)	7.6	9.3	1.22

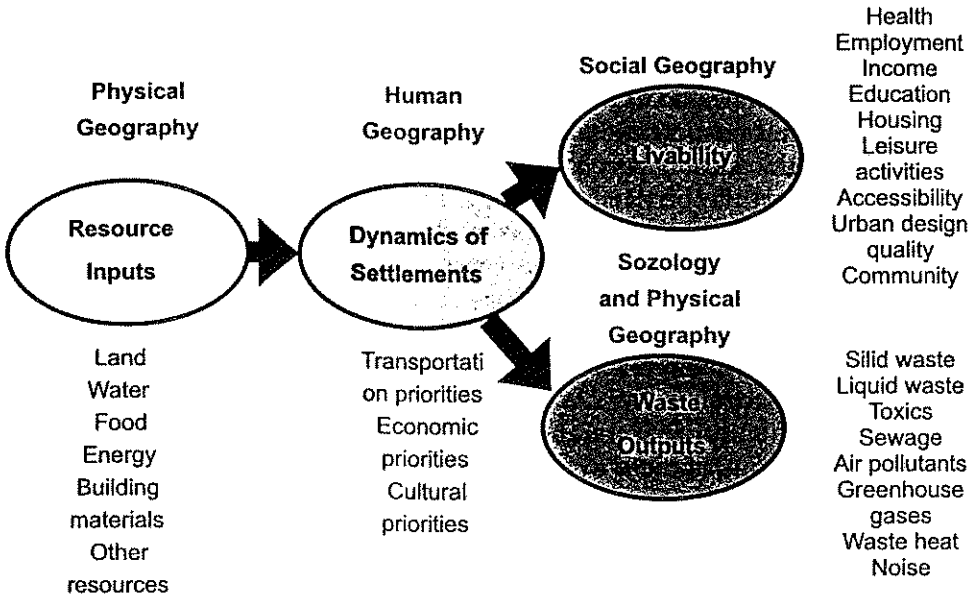


Fig. 4. Extended metabolism model of human settlements (after Newman 1999) and the role of geography in studying this model

Limiting the presentation to resource inputs and "waste" outputs, except for the supplied food their growth was significant over this 20-year period, both in absolute terms and per capita (Fig. 5). It was assumed that the diagnosis of Sidney's development as unsustainable was a signal for urgent changes in it's the city's functioning, especially in the context of new investments connected with the

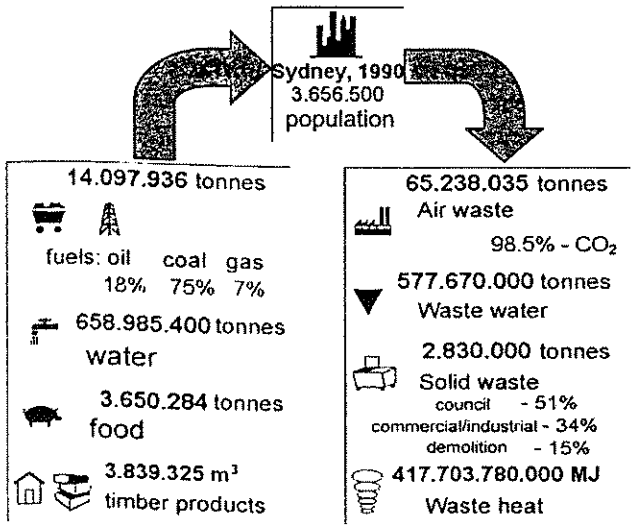


Fig. 5. Resource inputs consumed and waste outputs discharged by Sydney in 1990 (Newman 1999)

Olympic Games held in Sydney in 2000. They were held under a "green" banner and the tender for the design of the Olympic village was won by Greenpeace.

The design assumptions included:

- 100% of electric and heat energy will come from renewable resources;
- 80% of transport will be performed by non-motorised means;
- traffic will decrease by 20% by 2005 and by 40% by 2015;
- 100% of solid waste will be recovered;
- the quantity of waste will decrease by 20% by 2005 and by 40% by 2015;
- the use of wood of species occurring in the equatorial forests will be discontinued;
- sewage will be used to irrigate arable fields and to produce energy.

It was decided to apply the goals successively to the whole city. At this stage the implementation of the principles of sustainable development will depend on town planners and architects.

Prospects for the participation of geographers in research on sustainable development

The examples presented show that geography can be a discipline if not leading then integrating the various directions of research on sustainable development. The previously noted potential risks for geography in the form of excessive integration with non-geographical disciplines may paradoxically become its advantage, if it does not merge with them but draw them towards its abilities to approach space and environment holistically. When emphasising the special role of applied geographical research in this process, the traditional involvement of geographers in procedures of ecological-landscape planning (physical geography), social-economic planning (social and economic geography) and spatial (physical) planning should also be highlighted. The planning and programming of sustainable development includes all of the three types of planning mentioned.

The participation of geography in the research on sustainable development may become not only a factor in its external integration with non-geographical sciences but also an impulse for the internal integration of geographical disciplines. The integration may occur directly or in co-operation with other sciences related to each of geographical subdisciplines (Fig. 6).

In light of the discussion above it may be assumed that the participation of geographers in studies on sustainable development can cover a wide range of problems, and the actual contribution of geographers to these studies depends on our own activities, adopted philosophies, research methodologies and our ability to adopt a complex approach to processes occurring in the relationship between humans and nature. It may be assumed that in the nearest decade, due to a relatively well-developed methodological background and practical demand, geographical research on sustainable development will focus on the following problems:

- optimisation of the structure and functioning of natural and anthropogenic systems in order to minimise redundant flows of matter and energy or maximise flows favourable for achieving the goals of sustainable development;

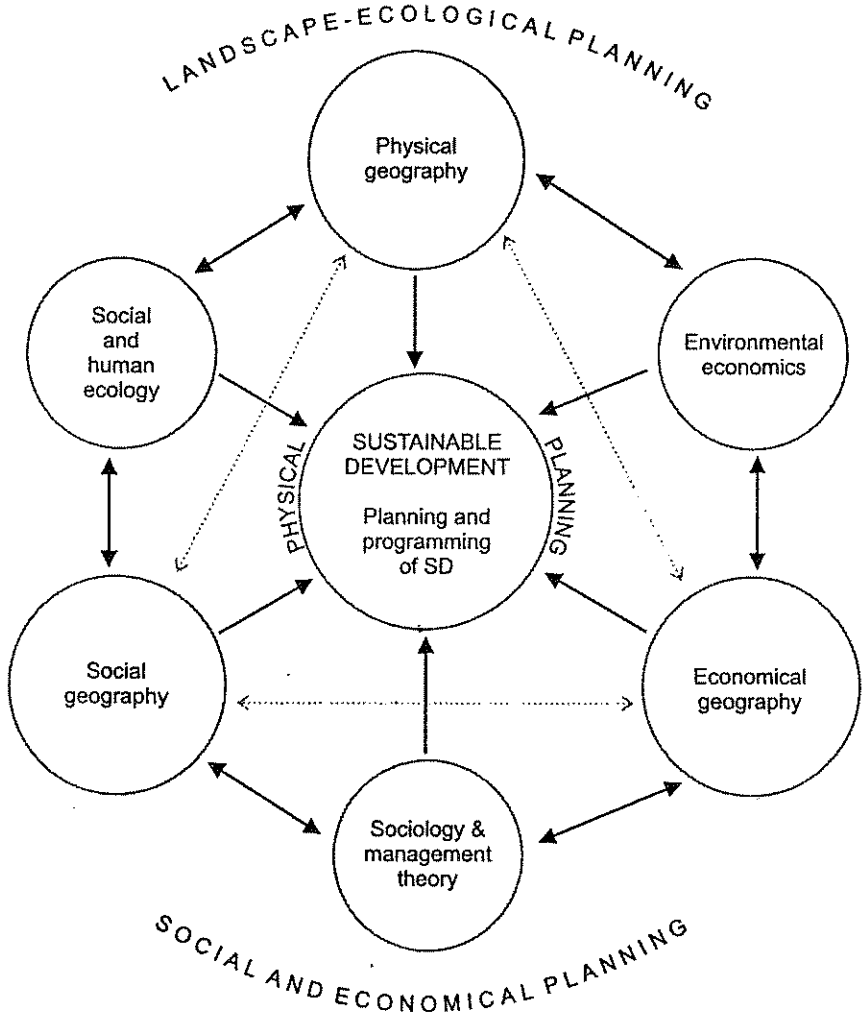


Fig. 6. Sustainable development studies as the integration factor for geographical sciences (after Kistowski 2003, changed)

- determination of the capacity of the natural environment for matter-energy effects of anthropogenic pressure;
- evaluation of effects of burdening the environment with the functioning of the economic system and social consumption;
- research on the social conditions for introducing the concept of sustainable development;
- studies on the diffusion of innovations in society, such as sustainable development and the instruments of its implementation;
- evaluation of environmental and social effects of technological transformations consistent with the principles and goals of ecodevelopment;

- modelling and forecasting the effects of sustainable development and, for comparative purposes, of other unsustainable models of development.

Whether such research will have practical use depends basically on entire societies – on whether they will follow the path of consumption or if social attitudes will evolve in a direction closer to the principles of sustainable development.

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