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# The concept of territorial cohesion - how to apply it to monitoring development of northern Polish regions

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**The concept of territorial cohesion – how to apply it to monitoring development of northern Polish regions**

**Jacek Soltys**

**Introduction**

Regional policy aiming to increase the social, economic and territorial cohesion requires measuring changes of those cohesions. The purpose of this article is to identify possible measures and to recognize determinants of their implementation on NUTS2 and NUTS3 level for inter-regional policy (policies at the national level to the regions), with particular reference to Poland. The term “territorial cohesion” is fuzzy, therefore the article begins with the interpretation of this concept by comprehending and describing its aspects. Indicators which are proposed in literature are being considered according to aspects presented above. If it is not marked differently, the word *region* is used in both cases NUTS2 (province /voivodship) and NUTS3 (subregion) in the meaning of "research unit".

**1. The notion and aspects of Territorial Cohesion**

The concept of territorial cohesion (further named TC ) is ambiguous and fuzzy. There are various approaches, definitions and interpretations. They arise not only from different schools of thought, but also different national, regional and corporate interests. Even if a consensus on this concept and meaning of that word is found, it disappears when consideration of spatial scale and relationships between these scales come into play. Improving the consistency in the continental scale could mean a deterioration in the national and regional scale – this relationship is also true for further scales. (Dutkowski, 2009, p. 242)

In the expertise for The Ministry of Regional Development of the Republic of Poland Dutkowski (2009) indicates three possible aspects of cohesion perceived in the majority of EU documents and expert opinions:

- between subsystems of a territory- i.e. internal cohesion, for example EU,
- between territories- i.e. external cohesion, for example territory of Poland and its regions with the remaining territory of the EU,
- between interventions (EU and other politicians) - i.e. process cohesion.

The latter, concerning the sphere of control, the author of the expertise suggests to call "programme coordination" or "planning integration", considering the question which is of a separate nature. In the external coherence, related to the distance, Dutkowski (2009) sees a spatial character, while in the internal coherence - the possibility of treating measures of the endogenous development potential and proximity to the concept of sustainability and harmonisation of the area in every aspect of its operation and development: natural, economic, social and spatially and between these aspects, as one. This is of such importance that, for measuring the level of sustainable development, several methods of measurement and indicator systems have been developed. A substantial part coincides with systems of measurement of welfare and quality of life (eg Human Development Index and others).

Questions arise as how to understand the internal coherence of the territory - as the harmony between the subsystems only, or also within subsystems (or also the state, including the level of development of each of the subsystems?) and how to measure this harmony? There is a risk of too broad understanding of territorial cohesion. This is noticed by many researchers, including Śleszyński (2009), who notes that each measure of socio-economic characteristics is based on references to a specific area.

In some approaches, TC is narrowed to spatial development, especially to accessibility. Szlachta and Zaleski (2009) propose only two TC measures: basic, focusing on the accessibility and one more - index of accessibility of basic public services (after the range of public services expressing their desired minimal standard and finally a synthetic indicator has been developed by the entire community).

Markowski (2009) regards TC as measure for achieving cohesion objectives social and economic, "... such a state of the spatial development which is guaranteeing the improvement of the social and economic cohesion " (Markowski, 2009, p. 78), at more subjective approach: state of space users satisfaction from the way of arranging (that is availabilities) of advantages of stores, advantages of the demand and advantages contributing to the standard of living.

Similarly the TC is understood by Gorzelak (2009), as eliminating restrictions resulting from the spatial development of getting the economic and social cohesion. Of course conducting the regional policy also requires monitoring the level of attaining goals.

According to Markowski in achieving the cohesion in the EU development and her individual countries it is possible to allow to diverse social and territorial economic cohesion at different levels of state territorial organization in interim periods (e.g. the territorial cohesion not has to correspond with the economic cohesion on the level of communes). It is

possible also to measure individual dimensions of the cohesion, e.g. social on the level of subregions, or even commune (gmina), spatial on the level of regions, and economic on the level macroregional.

According to Śleszyński (2009) term "cohesion" is used in geographical reserches in a few meanings for explaining features of the given area, the region or the system, as: 1) appearing and intensity of connections, in addition in the special, advanced form it can be: 2) interdependence of elements (cohesion); 3) inner standardization (resemblance, lack of the diversity); 4) the complementary character, i.e. mutual supplementing or complementing each other, substitutability; 5) comparability of features and (or) regularities of the development.

Dutkowski (2009) identify five aspects of the territorial dimension's phenomena of socio-economic processes and public interventions into their course:

1. The influence of the territory specificity on his functioning and the development.
2. Territorial diversity of functioning and the development.
3. Relations between territories relying on flows.
4. Territorial managing and co-governing.
5. Cooperation between territories.

An additional aspect of territorial diversifying the susceptibility of individual territories to public intervention is also presented (Dutkowski, 2009).

Toczyski and Lenzion (2003) for monitoring the sustainable development of North Poland<sup>1</sup> grouped indicators into 7 fields, referring to the international functional typology of indicators (tab. 1).

It is proposed to supplement the list of potentials for the spatial development, that are essential for TC. Its role is twofold: the potential, because it serves, enables (or hampering, when is insufficient, flawed), and express ("measures", indicates harmony) the development. Such aspects could be included in a group of impact and effectiveness indicators.

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<sup>1</sup> Prepared by the team of: J. Lenzion, T. Plenikowska, J. Sołtys at the cooperation W. Toczyski, with using proposals drawn up through M. Kistowski and J. Zaucha and foreign experience.

**Tab. 1. Indicators structure**

Indicators (field)	Functional type of the indicator
Level of meeting the essential needs	I – impact of direct transitions effects
State of the subsystem (of capital): social, economic, ecological	S – state both amount and qualities resources dynamics
The impact and the effectiveness of resource management methods	D – driving force – features of system influencing the way of resources managements (E) and level of pressure (P) E – efficiency of resources managements P – pressure disrupting systems and their resources
Operation of sustainable development policy instruments and self- adjustments adaptations	A – system adaptability real and of control system R – direct response limiting the pressure
Interrelations and influences of regions	Right S, D, P characterize the state of the environment and flows of factors disturbing or having a positive effect to the development and to the stability of monitored system

Source: Toczyski and Lenzion (2003) with abbreviations and simplifications and little changes

Indicators are further analyzed for their possible use in monitoring for regional policy. As to which indicators measure the TC, is a problem left open for further discussion. It is noted also that it is difficult to systematize the issues discussed, using disjoint divisions, as some of the results achieved impinge the possibilities of development, therefore they are also potentials. For example, the level of fulfillment of needs is influenced by components of the natural and economic subsystem and land spatial development. In such cases, a principle is assumed that in such cases, the indicators will be discussed in the section corresponding to the reason for, eg the level of needs because of the accessibility of services – not in the Chap. 2, but in Chap. 4. The following structure of the text is assumed:

- Social subsystem in the division into the social potential and the social cohesion, including the level of satisfying needs.
- Economic subsystem in the division into the economic potential and the economic cohesion.
- Ecological subsystem: natural and cultural potentials, ecological cohesion, human environment.
- The spatial structure and the spatial development, in it: settlement network structure, technical infrastructure, spatial internal and external accessibility.
- Other aspects:
  - The influence and the effectiveness of ways of managing stores

- The Territorial management and co-governing
- Cooperation between territories.

## 2. Social subsystem

With frames of this subsystem (affecting development) and the social cohesion a potential is acquainting as the result of the development and policies assisting him. Potential is creating by:

- Biological potential, which in the quantitative aspect can be call demographic potential. He includes also quality features (mainly health condition)
- Human capital - "... immaterial stores (attributes) associated with the man treated as a self-reliant human being" (Walukiewicz, 2011, p. ....)
- Social capital - intangible assets associated with relations of at least two persons (cooperation, trusting ) (Walukiewicz, 2011).

Fetures determine the biological potential:

- the number of population (indicator of population density analysed in the chapter...)
- economic structure of the age: the rate of population in an economically productive age in the total population (Toczyski and Lenzion, 2003) (essential for the economic development) and indicator of the demographic burden of elderly people (the number of people beyond age of retirement "dependent on" professionally active persons) (Dutkowski, 2009).

Health is determined mostly by averages longevity expectancy. Development capabilities determine demographic permanence can be described by indicators presented by Toczyski and Lenzion (2003):

- average number of children in the family or rate of the general fertility (Def.) or rate of the net reproduction (average in 5 last years),
- rate of the birth rate average in the period a few years (e.g. 5) (repeating more synthetically in other form information included in other indicators).

Human and social capital are difficult to measure<sup>2</sup>.To measure some of aspects of the human capital listed indicators are applied:

- For the education; participation of the population with the higher education in the number of population aged 15 and more.

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<sup>2</sup> Walukiewicz (2011) proposes the method of measurement practicable in companies, recognizing the measurement in regional units, demanding special research of the future matters).

- For the enterprise: number of entity of private persons for 1000 of entire population in productive age.
- For the social activity: attendance at elections of the comparable type (in an optimal way: in a few different types).

As the only readily available indicator concerning the social capital is applied the number of (associations (NGO) on 10 000 of inhabitants.

The importance of the human and social capital for development is justified by appropriate sociological researches.

Measures of the social cohesion considered in the context of demographic aspect can be regarded as:

- expected further longevity beyond age 60 according to the sex ((Dutkowski, 2009), in the moment of the birth (T),
- average indicator of the migration balance of in the period a few years (for eg. 5).

It is also possible to define such aspects:

- year average rate of population growth taking into account natural processes and migrations (Toczyski and Lendzion, 2003) – indicator is dependent on other already presented indicators, but synthesizing and having an additional information value (e.g. the negative migration isn't attesting to low TC, if the birth rate is appropriately high).

The majority of rates of the social cohesion will concern meeting needs.

Firstly appears the scope of needs. Some lists are using the number of over 40 needs (Kocowski, 1982), other using low figure, as a sets of grouped of needs, e.g. Toczyski and Lendzion (2003) are mentioning 9 groups containing visions of the sustainable development described by nearly thirty most significant needs. The question appears, if on account of the territorial cohesion, the field of interests should focus on the level of spatial diversity of all essential needs or only of the ones, which satisfying is directly connected with the spatial development.

To first from groups mentioned above belong indicators described by Toczyski and Lendzion (2003):

- education: percentage participation of continuing the learning on the secondary school
- economical bases: average monthly disposable income on one citizen. (available from the voivodship level).

The basic indicator of the social cohesion is recognized as an unemployment rate (of indirect assessment of the activity cohesion politic effectiveness). Moreover the social exclusion indicators are also being mentioned. Toczyski and Lendzion (2003) mentioning the

social exclusion in the group of needs described as usefulness's and the esprit de corps. They are characterized by following indicators : number of the unemployed permanently (above 2 years), the homeless and attempted suicides on 10000 citizens.

The flat's standard universally is being measured with the surface indicator: average usable floor space in m<sup>2</sup> per capita. More diagnostic indicators are possible to get exclusively in general censuses:

- percentage participation of individual households in the total number of households
- percentage participation of population residing in housing conditions regarded as bad in terms of equipping and concentration (border indicators for establishing to the structure of available data ).

However measurement of the level of satisfying the needs associated with the quality of the natural environment and the spatial accessibility to services, as it was mentioned before, is presented in other chapters.

### **3. Economic subsystem**

This point refers to the potential and an economic cohesion. In the assessment of the potential essential indicators concern financial and material resources (fixed assets)<sup>3</sup>, effectiveness's (a rate of resources usage and an ability of self-financing development) and structure together with other features - influencing to the continuity of the development, for e.g. contribution to activities and products being based on stable development factors, especially endogenic as well as from the close environment: renewable natural resources, unique cultural potential. However the most diagnostic information is hard to reach. Based on the information readily available, the following measures of economic potential can be suggested:

- fixed assets to 1000 habitants or workers (if necessary 1 km<sup>2</sup>)
- number of entities in national economy (according to BDL) or business entities (more difficult accessibility of information) - above the determined size, e.g.: 10, 50 or 250 workers (if necessary 2 or all these indicators) - in every case rate to 1000 habitants in all or in an economically productive age.
- number of workers in market sectors (I, II and III from the market services according to BDL) in entities employing above 9 persons to 1000 people in all with the whole or in a productive age.

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<sup>3</sup> The indicators concerning the human and social capital as well as natural stores were discussed in the frame of appropriate subsystems.



- business sector's investments on 1000 habitants (Toczyski and Lenzion, 2009) or workers in all in the business sector.
- endogenic factor: participation of employees of the companies registered with the region and individual farmers in the total number of employees,
- degree of the modernity of the industry structure: relation of number of workers in the traditional and onerous industry to workers in the high-technological<sup>4</sup> and ecological industry or two indicators: shares both of these types of the industry in the total number of workers in the industry or in the entire unit,
- efficiency of the economy: rate of the average gross turnover of enterprises.

On account of the role of relations in creating the cohesion and the role of clusters in the economic development concerning essential elements are for e.g.:

- number of clusters to 1000 business entities,
- number of companies belonging to clusters,
- number workers in companies forming clusters.

Information requires individual research, e.g. from websites of self-government agencies, mainly voivodship, individual clusters and from their management boards or coordinators.

The economic cohesion universally is being measured with the indicator of gross domestic product (GDP) per per capita.

#### **4. Ecological subsystem – the potential of natural and cultural stores**

To distinguish in frames of natural potentials is possible potentials: resources-utilities, self-adjustable-resilience and perceptual-behavioral (Przewoźniak, (1991). In another approach to the subsystem living environment is standing out with it.

**Natural stores** creating the endogenous potential for the economy development can be measured through the following indicators proposed by Kistowski (2003):

- indicator of the agricultural production area (in points),
- rate of attractiveness of the natural environment for the recreation (in points),
- afforestation rate (participation % of forests in the individual surface)
- the size of underground waters reserves  $m^3 / km^2$ ,
- rate of the geothermal waters reserves size (descriptive assessment: big, average, small)

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<sup>4</sup> High & medium-tech according to Eurostat. According to Lenziona and Toczyski (2003) also "waste disposal"

and if necessary standardized by the synthetic indicator of natural resources sizes (Kistowski, 2003).

In relation to non-renewable resources (raw materials) and renewable with difficulty (water) it is possible to apply indicators proposed by Toczyski and Lenzion (2003):

- size of reserves of underground water sources in the relation to current annual exploiting in %,
- size of reserves of natural resources in the relation to current annual exploiting in %.

These indicators are illustrating the degree of resources' usage. Every recognised raw material resources have an individual measure (e.g. ton), but on account of diversifying stores the universal indicator rate is difficult to define. It could be based on an economical evaluation (product of the amount and the market price) related to the area unit or the population.

The permanence and the potential of the self-regulation of the ecosystem are in principle no measurable, but certain substitute can be an indicator of percentage participation of nature conservation in the researched area (Kist) or two indicators, concerning crucial and remaining areas:

- with the highest quality of the ecosystem: participation of areas included into the NATURE 2000 system as well as areas of nature reserves and national parks not included in this system according to region surface,
- stabilizing the state of the natural environment: percentage participation of region area occupied by crucial and remaining areas, essential on that account: not-degraded forests, waters over I-II class of the cleanness, public parks and areas covered by organic farming (this area should included whole surface of the legally protected environment as a minimum).

Moreover essential ratings of the natural environment quality are: man-made of transforming the flora (in points), air qualities (middle class), qualities of surface waters (in points) and if necessary synthetic indicator in the quality of the natural environment - standardized value (Kistowski 2003).

For the measurement of the level of meeting the people needs associated with the quality of the natural habitat an indicator proposed is similar to Toczyski and Lenzion (2003), however with the certain modification: percentage participation of population settling in areas not satisfied with at least one of norms: the quality of air, water consumption or level of noise.

**Cultural resources**, including landscape resources, are contributing to the environment of the recreation and housing estates and according to that are influencing the quality of life. They are also a significant potential for the economic development, not only for various tourism activities, but in the large perspective for activities based on a creativity production and new personnel recruitment, to whom an attractive life environment is substantial.

**The landscape** is interpreted here as the physiognomy of the natural environment and cultural environment. It is possible to recognize landscape values as the part of cultural component, since the natural element of the landscape is being assessed in terms of the information impact - values of compositional form can be evaluated as the cultural advantage. As composition advantages of the space Maga-Jagielnicka (1997) is mentions: the hierarchy of forms, the harmony, the style, the historical continuity and the symbolism. Furthermore attraction is also the subject to an evaluation.

Toczyski and Lendzion (2003) propose the synthetic indicator of the landscape quality created including the number, the rank and the area of the objects listed in the international and domestic legacy register (or designated to him), including areas of the rural landscape quality. If necessary two indicators as by analogy as for the natural environment can be applied: for areas and objects about the highest advantages and for the sum of areas with above average values of the cultural landscape.

More comprehensive assessment, going beyond the register and including a degraded landscape would be desirable. With such evaluations in the regional scale problems are connected to: ways of acquiring information, objectivization of evaluations providing the comparability as well as the aggregation and the construction of indicators. Landscape in region is noticed through number of landscape interiors. Methods of visual aspects analyses being elaborated in the computer information base about the area. (Böhm, 1994). There are methods of the economical evaluation of the landscape using public surveys, for e.g. group of methods of the Contingent Valuation of Methods (CVM) and of travel expenses (SCM), as well as method of the price of pleasure (HPM) using a statistical analysis for estimating, what part of those difference in prices depends on the quality of the landscape (Kot J., Norek I., 1996). These methods, suitable for more detailed scale, would be too laborious on a regional scale. Regardless of the identification and assessment method, in an aggregate on a regional level, authors propose a better than the averaged indicator: share % of areas with a positively distinctive landscape (possibly in two classes: a prominent landscape and above average) and negatively (eg, degraded landscape). But more important than the shares may be scenic

advantages of specific spots (areas): of the current and potential settlement, recreational and possibly along communications routes affecting the image of the region. The method of measuring the landscape values and defining the indicators continues to be a research issue.

## 5. Spatial development

The scope of research it is here the settlement network structure. In the EU documents and in the literature describing TC an attention is being returned to the policentric settlement grid, recognizing defects of the excessive concentration. Dutkowi (2009) proposes indicators appropriate for the national level, among others a percentage participation of inhabitants in the biggest urbanized area to number of state population in general as well as shares of the city's population in periods: 100-500 and more than 500 thousand. For many bottom units of that grid the problem of excessive concentration seems less significant. On the contrary, the problem could be the lack of appropriately big knot. Therefore to presented facts the proposed indicators are:

- participation of the population in cities counting e.g. above 100 000 for NTS2, 50 000 for NTS3,
- measure in absolute numbers: population of the biggest settlement knot of one city or the complex of cities. In case of the doubt, which cities to recognize as complex it is possible to accept the simplification that they encountering oneself.

It is also possible to suggest the following indicators:

- participation of the urban population,
- number of cities related to the surface (on  $\text{km}^2$  - applied indicator) or to the population (more difficult indicator to interpretation, because of dependence fon other proposed indicators and on an average-sized towns),
- population density
  - or other set of indicators, irrespective of oneself, alternative to presented below:
- number of cities on  $\text{km}^2$ , or if necessary the urban population on  $\text{km}^2$ ,
- population density of the village: the rural population on  $\text{km}^2$ ,
- average size of the city (as influencing on accessible services, the range of eligible and attractive workplaces).

Other concerning issues of the spatial development concerning in literature according to the aspect of the territorial cohesion, the sustainable development are: urban sprawl and defragmentation of ecologically important areas. Toczyski and Lenzion (2003) propose the

indicator for **urban sprawl**: growth dynamics of housing estate and communications areas in communes around agglomeration in the relationship to average in the voivodeship.

**Defragmentation influences to the ecological cohesion** as well as to the ecological potential. It is possible to consider her, as the state or as the process examined in the period for e.g. of five or ten years. Markowski (2009) proposes to measure the state of the forest defragmentation with the average area of forest complex. On account of the ecological role of meadows he proposes to unite wooded areas and meadow (if necessary also pastures) above the certain surface and for such areas entitled 'permanently green " he suggests to calculate the average area. Toczyski and Lendzion (2003) for the measurement of defragmentation process propose the indicator: increase of defragmentation areas to total area of ecologically and culturally valuable areas in the region. The way the area is designated in GIS needs clarification.

Equipping in the **environmental protection infrastructure** with indicators proposed by Kistowski (2003):

- percentage participation of habitants served by sewage treatment plants,
- length ratio of a sewer system and waterworks.

**The spatial accessibility** The spatial accessibility is a feature most often combined with TC. It is possible to identify spatial accessibility with the transport accessibility (Dostepność, 2010). On a base of the literature review (Dostepność, 2010) Rosik distinguishes six survey and measure methods of transport accessibility. Four of them are presented in this paper: 1) infrastructure-based accessibility measure, 2) distance-based accessibility measure, 3) isochrones-based accessibility measure, 4) potential-based accessibility measure. In methods 2) and 3) described above, two kinds of problems appears: the selection of the purpose of the movement and the way of the accessibility measurement as well as indicator construction. In the accessibility measurement research for regional politics the purposes of movement are workplaces, areas of the weekend recreation, and services - provincial and regional centres, and if necessary some specific services like district centres, secondary schools (to support districts with the worst accessibility).

Possible destination points are prefer services or their concentrations forming the structure of levels(centers/ central services) and in the method of the potential accessibility - knots of diversified attraction. The advantage of assuming service as a purposes of movement is better synthesis, but this framework has also some defects: 1) only some levels can be identify with the administrative division, 2) services in official zones are not use very often,

and location of other services is mostly convergent with administrative centres but not identical. The typical services of the specified level of centres (for e.g. colleges and theatres in provinces) can be seen also apart from centres (much more rarely the typical service for the level is missing). This leads to taking into account the accessibility of some specific services as complementary or even exclusive goals, especially since aiming at the centres according to the levels requires the identification of centres not related to the administrative division (sub-regional centers in Poland). Ranges of services are different in different cities. Including cities with powiat (county) status (which are not components of agglomeration) and other former voivodship provincial cities into sub-regional centres as in (Dostępność, 2010), has the advantage of clarity and rationale in the fact that in ex-provincial cities there are many higher-level services. However it has also a defect - big durability of existed centres causes an inability of researching the improvement as a result of creating new service centres in existing centres which origins are already in sub-regional centres (e.g. Szczecinek, Chojnice). These cities are situated in the most extensive area of the country with bad accessibility to subregional centres defined as above (Dostępność, 2010) and it would be hard to change them to the satisfying even through significant transport investments. Still remains a problem of choice of services as purposes of the movement. In documents the EU (Green, 2008) and literature considering TC problems as a solution a public service is being presented, and thematically of the education and the health.

The legitimacy of taking universities into account in the research about the service accessibility requires further discussion. Students' temporary settling in the place of studies is a general rule if university is apart from the everyday scope of journeys. On the other hand, running costs in other city, especially in metropolis, can be a barrier of studying for the poorer population. Some more popular, easy to organize and cheap in the running, are being located in medium and small cities. The part of students is studying in part-time system, paying tuition and parallel working. The temporal accessibility to the place of the part-time studies is less significant than for daily commuting, but more essential than, to the place of studies with the temporary stay. A large number of little colleges recently incurred in Poland, especially in many medium and smaller cities, is typical for Poland and probably phenomenon of a certain extent transitional. It will certainly be limiting by demographic decline and perhaps the last amendment of the Act (duty of getting the consent of the Rector before the employment agreement in other college). A question appears, what colleges (more

widely: places of studying, for e.g. non-resident departments) should have been taken into account? All, only public - leading free full-time studies, or only universities?

Hospitals can also be disputable objectives of services. When quantifying their accessibility, one must distinguish between their referral levels. They are correlated with the hierarchy of service centres, but only to a certain extent: the level II -sub-regional centres, level I - provincial centres (not all).

Further issues include the choice of the availability measurement method, including the measurements of distance (the actual physical, time or cost), modes of transportation, assumed speed, the way of constructing the indicator.

With isochrone-based methods of accessibility measurement, per cent shares of the population residing within the region of a specific isochrone of accessibility to a specific target with car or public transport, are proposed as indicators. In the construction of these indices for services not related to the administrative division, there is a problem of reference - whether to calculate the shares for the population within the administrative boundaries (which is easier), or rather for the population quantities in the areas of gravity of a given type of service (which is more correct methodologically). This requires splitting to such areas according to a criterion such as a shorter route.

At applying the method of the potential-based accessibility measure the level of centres is replaced with the weight (with degree of knot attraction), calculated for e.g. according to the number working in the services in total or in chosen sections of services. This method it is not recommended to examine the service accessibility but to accessibility of individuals, synthetically taking into account a lot of types of the people and goods movement. Such researches were performed for Poland according to districts, diversifying the way of calculating the weight of the knot for the movement of persons and goods (Dostępnosc, 2010). Research for the EU according to NUTS3 was performed within the framework of ESPON (2006).

The indicator of infrastructure-based accessibility measure is the density of roads about the hard surface in the km on km<sup>2</sup> (and if necessary also railways by analogy). It is straightest and universal. The indicator doesn't consider correlations between sources and purposes of the movement, but it isn't a defect while new concentrations of workplaces and new services should be erected (for e.g. on peripheral areas). This indicator is essential in the evaluation of the endogenous potential for the economic development and (probable) accessibilities to workplaces, which site is not clearly specified.

The indicator of the access to the **fast Internet** is connection to broadband Internet per 100 habitants.

**External accessibility** can be measured as the accessibility of points important to external links and reciprocal accessibility of the subject units. These important points are: the nearest motorway junction (or a dual carriageway, if closer to the highway), AGC or AGCT rail station, an international airport, seaport, border crossings. For highway and expressway, the road transport is proposed, for the others - road and rail transport separately or the faster, or combined (intermodal). A problem arises from which point of the region the distance should be measured. It can be assumed to simplify, the largest city, but it would be too simplistic. Other methods which may include distribution of population or economic potential, are free from this problem. In the isochrone-based method, following indicator is proposed: per cent share of the population residing in a given isochrone from the above-mentioned important points. In the potential-based accessibility method, the ratio calculated by the formula (Availability, 2010) is the measure. Reciprocal accessibility of surveyed units (ESPON) can be measured by distance or time for various modes of transport or intermodal transport. One of the best measures is an indicator of potential intermodal accessibility. It has been calculated in Poland in the framework of studies for the national spatial development concept for counties (Dostępność, 2010) and in the EU for subregions NUTS 3 (ESPON, 2006, p. 32, 36, 38).

## **6. Other aspects**

In terms of impact and effectiveness of resource management, indicators refer to the relations between subsystems, mainly economic and environmental. Toczyski and Lendzion (2003) propose 13 indicators. Sources of information are: environmental monitoring, public statistics, GIS. Some indicators require research or specialized studies. Among the indicators are CO<sub>2</sub> emissions per capita. In some regions, a single large industrial or power generating facility has a strong influence on the indicator. Cooperation between the territories can be measured by the indicators: per cent participation of units forming local associations or covered by the agreements for the development and solving common problems in the total number of local government units in the region, possibly also per cent share of the population and size of these units.



## 7. Conclusions

This article is to be treated as a voice in the discussion on the quantification of TC. A ready-to-use list of indicators has not been proposed, recognizing that the choice should be made by the operator of the monitoring, according to their aim and available resources. Sometimes, in fact better (more diagnostic) indicator is more difficult to obtain due to the availability of information - their laborious capture and processing. The principle of monitoring is its continuity. Hence the merits of investing in database systems and algorithms to create better indicators because they are used repeatedly. Examples of activities in this direction are referenced studies carried out in Poland (Dostępność, 2010), and within ESPON. It is reasonable to use at least two lists of indicators: 1) wide, for analytical and diagnostic use and 2) narrow to inform policy makers and communities (Toczyski and Lenzion, 2003). Some methods of measurement and construction of indicators still require research, for example those regarding landscape values, human and social capital.

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