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SIX CENTURIES OF GEOGRAPHY
AT THE JAGELLONIAN UNIVERSITY IN CRACOW

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The research on the history of Polish geography has been carried out for many years. However, for all the numerous papers issued on this subject, both Polish[1] and foreign, so far any exhaustive portrayal of the history of this science does not exist in Poland. The same refers to the history of geography at the Jagellonian University, especially as regards the seventeenth and eighteenth centuries. Up to the seventeenth century, the history of geography at the Jagellonian University practically matches

[1] H. Barycz, *Rozwój nauki w Polsce w dobie odrodzenia* (Sciences Development in Poland in the Renaissance Period), Odrodzenie w Polsce, Historia nauki, I, Warszawa 1956, PWN, pp. 35–153; K. Buczek, *Dzieje kartografii polskiej od XV do XVIII wieku* (Histoire de la cartographie polonaise des origines à la fin du XVIII siècle), Wrocław 1963, 119 pp.; F. Bujak, *Studia geograficzno-historyczne* (Geographico-Historial Essays), Warszawa 1925, XI+299 pp.; S. Gieysztor, W. Osińska, *Materiały do bibliografii nauki polskiej okresu Odrodzenia,* 3, Geografia i Matematyka (Materials to the Bibliography of Polish Science in the Renaissance Period, 3, Geography and Mathematics), Studia i materiały z dziejów nauki polskiej, Warszawa 1956, 4, pp. 419–521; *Piśmiennictwo staropolskie* (Ancient Polish Literature, under editorship of Roman Pollak) Bibliografia Literatury Polskiej „Nowy Korbut" (Bibliography of Polish Literature "Nowy Korbut"), I–III, Warszawa 1963-1965. Furthermore, to respective footnotes *Polski Słownik Biograficzny* PAN has been used; B. Olszewicz, *Geografia polska w okresie Odrodzenia* (Res. La géographie polonaise de la Renaissance), Prace geogr. IG PAN, 12, Warszawa 1957, 61 pp.; Ibid., *Polska kartografia wojskowa. Zarys historyczny* (La cartographie militaire polonaise. Essai historique), Warszawa 1921, LXXVII +199 pp.; Ibid., *Kartografia polska XV i XVI wieku, Przegląd chronologiczno-bibliograficzny* (Res. La cartographie polonaise du XVe et XVIe siècles. Revue chronologique et bibliographique), Polski Przegl. kartogr. A. 4, Lwów 1930, pp. 147–166; the same *for XVII* century: Polski Przegl. kartogr., Lwów 1931, 5, pp. 109–138; the same *for XVIII* century: Polski Przegl. kartogr., Lwów 1932, 10, pp. 181–213; E. Romer, S. Pawłowski, *Geografia i podróżnictwo* (La participation des Polonais au development de la géographie et aux explorations), Polska w kulturze powszechnej, 2, Kraków 1918, pp. 145–211; E. Romer, *Wybór prac,* 4, Warszawa 1964, pp. 555–619. B. Strzelecka, *Ze studiów nad geografią i kartografią XV wieku* (Rés. Quelques problèmes concernant la géographie et la cartographie

that of Polish geography in general — because up to then Cracow, the capital of the State, in close contact with the Royal Court and the Church Chapter, was the centre of Poland's culture and science, thus of geography too.

The beginning of geographical thought in Poland must be looked for in works written by chroniclers from the twelfth century on where, as a rule, the preface brought a short description of the country such as Gall Anonymous (1113–1116)[2] or occasionally some geographical remarks were inserted in the text — Vincentius called "Kadłubek" (at about 1223), etc. Some of these chronicles even date back to the time before the university at Cracow has been founded[3].

Since the foundation of Cracow University by the King Kazimierz the Great in 1364 and its revival under the King Władysław Jagiełło in 1400, the history of Polish geography revolved round this University. In the second half of the fifteenth century, the drift of geography broke away from the Middle Ages and readily aligned itself with the Renaissance science of the Earth. Through close contacts with Italy, valuable works of ancient authors reached the University, such as Ptolemaeus' *Geographia*. Cracow scientists showed keen interest in the map of Central Europe compiled by Nicolaus of Cusa and for the works of Aeneas Piccolomini who later became the Pope Pius II.

The fifteenth century brought the first detailed description of Poland by Jan Długosz — Dlugosius (1415–1480), a Cracow canon, historian and graduate of Cracow University; as a preface to his *Annales Regni Poloniae*[4] he wrote *Chorographia*. Ptolemaeus' maps, kept until today in the

du XV-e siècle), Czas. geogr., 30 (1959), pp. 287-335; S. Wojciechowski, *Geografia krakowska a Odrodzenie* (The Cracovian Geography and the Renaissance Period), Wiad. geogr., 5 (1927), pp. 83-86; *Dzieje Uniwersytetu Jagiellońskiego w latach 1364-1850* (History of the Jagellonian University from 1364-1850), 1 (1364-1764), Kraków 1964; 2 part 1 (1765-1850), Kraków 1965.

[2] *Galli Anonymi Cronica et gesta ducum sive principium Polonorum*. Ed. K. Maleczyński, Kraków 1952, Mon. Pol. Hist., II, 7.

[3] F. Bujak, *Geografia kronikarzy polskich* (The Geography of Polish Annalists), Wiad. Numizm., Kraków 1901; also *Studia geogr. hist.*, Warszawa 1925, pp. 78-90.; Kürbisówna Brygida, *Kształtowanie się pojęć geograficznych o Słowiańszczyźnie w polskich kronikach przeddługoszowych* (Shaping of Geographical Ideas on Slavonic Countries in Polish Chronicles preceding J. Długosz), Slavia Antiqua, 4 (1953), pp. 252-282.

[4] Jan Długosz, *Chorographia Regni Poloniae* — on the beginning of I Księga Historii Polski (I Book on the History of Poland), printed — Dobromili 1614, 1615; second ed. — Francofurti 1711; third ed. Lipsiae 1712; Varsoviae 1776; new ed. by A. Przeździecki in "Opera Omnia", X, Kraków 1873; Polish translation by K. Mecherzyński II 1867; recent edition by W. Semkowicz-Zarembina: *Annales seu Cronicae incliti Regni Poloniae...* Warszawa 1964, Polish translation, 1962.
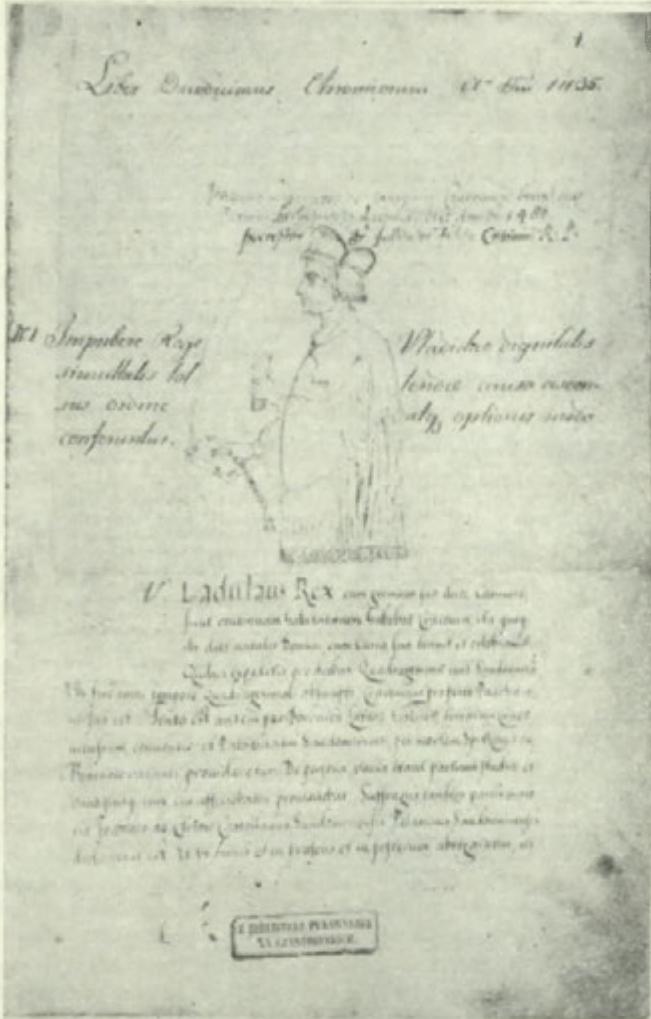
Fig. 1. Jan Długosz

Jagellonian Library[5], were known to him, and on these maps he identified the name of only one locality in Polish territory: Calissia (*Kalisz*). Dlugosz's *Chorographia* is most valuable for its original, hydrographical description of Polish lands, enumerating the principal streams and their
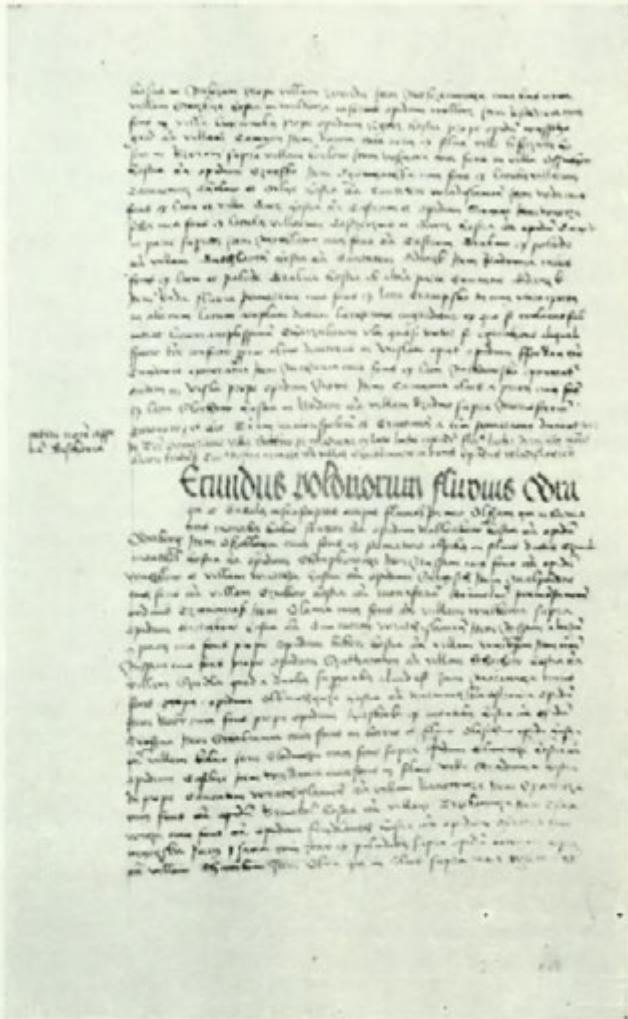
Fig. 2. Jan Długosz's "Choreographia Regni Polonie" A fragment

tributaries, their springs and mouths. Thus Długosz mentioned 103 tribu-
taires of the Vistula and 50 of the Odra, 90 lakes, many mountains, and
a great number of towns and settlements. Rich is the toponymical material
in all of Długosz's writing. Even more detailed is his topographical–sta-

VIII, Kraków 1852, pp. 49–102 (reprinted in *Dzieła* Wincentego Pola, VI, Lwów
1877); Gloger Zygmunt, *Wyciągi z Dziejów polskich Długosza dotyczące fizjografii
dawnej Polski* (Extract from Długosz's Polish History, Concerning Physiography

tistical description of the Cracow diocese *Liber beneficiorum* sive erectionem et dotationem ... totius *dioecesis Cracoviensis*[6], called the "photograph" of Lesser Poland (*Małopolska*) as it was in the fifteenth century. In the middle of the fifteenth century, geographical descriptions of such type were rare in Europe and, because of this, Jan Długosz's works deserve exceptional attention[7].

It is necessary to mention also Filippo Buonacorsi, an Italian, usually called "Callimachus" (1437—1496)[8]. In his historical an d political writings much space is given to geographical descriptions; he used Ptolemaeus' Atlas, paying spatial attention to Nicolaus Germanus' map of northern countries. Callimachus supplied much valuable information on Tartarian and Turkish countries, part of which was based on his own observations made during numerous diplomatic voyages[9].

At the turn of the fifteenth century, a vigorous evolution of geography occurred within the general pattern of the exact sciences, by which

of Ancient Poland), Pam. Fizjogr. VIII, 1888, 5, pp. 1–31, Zeissberg H., *Die polnische Geschichtsschreibung des Mittelalters*, Leipzig 1873, Zarębski I., Giovanni Boccacio jako chorograf kraju ojczystego (Giovanni Boccacio as a chorographer of his country), *Roczn. Nauk. dydakt. WSP w Krakowie, 8, 1958.*

[6] Długosz Jan, a manuscript written in 1470–1480 in the Chapter Library in Cracow, "Opera omnia", VII-IX, under editorship of L. Łętowski, Kraków 1863–1864.

[7] Bujak Fr., *Długosz jako geograf* (Długosz as a Geographer), Przew. nauk. i liter., 29, 1901, pp. 171–184, also Stud. geogr. hist., pp. 91–105.; Pawłowski S., *Długosz jako znawca polskiej ziemi* (Dlugosz's erste Landeskunde von Polen), Kosmos, 40., Lwów 1917, pp. 452–474.; Kornaus J., *Jan Długosz, geograf polski XV wieku* (Joannes Długosz, the Polish Geographer of the 15-th Century), Prace geogr. 5, Lwów 1925 pp. 81–120.

[8] Buonacorsi Filippo (1437–1496), *Historia de rege Vladislao, seu clade Varnensi... libri tres*, Augustae Vinde 1519; second ed. — Francofurti 1573; third ed. — Francofurti 1578; fourth ed. — Cracoviae 1582; fifth ed. — Cracoviae 1584; sixth ed. — Francofurti 1584; seventh ed. — Coloniae Agripp. 1589; eighth ed. — Francofurti 1600; nineth ed. — Vindobonae 1766–1768 (sometime as a part of larger compilation). New ed. critical by S. Kwiatkowski in *Monum. Pol. Hist.*, VI (1893), 3; Polish translation by M. Glinczyński encloses description of Warna and informations about Turkey, Bulgaria and the Balkan countries. Bibl. Warszawa 1851/52; recent edition by I. Lichońska and J. Kowalewski, Warszawa 1961, Bibliotheca Latina Medii et Recentioris Aevi, 3, Polish translation by A. Komornicka; Ibid., *Ad Innocentium Octavum Pontificem Maximum, Jenua ortum de bello inferendo Turcis Oratio*, first ed. — Cracoviae 1524; second ed. — Haganoae 1533; third ed. — Lipsiae 1596; fourth ed. — Francofurti 1601; fifth ed. — Solebii 1609, (In speech he gave a comprehensive characteristic of the whole Turkish State); Ibid., *De Tartarorum moribus liber I*, a lost manuscript from the XV century.

[9] F. Bujak, *Kalimach i znajomość państwa tureckiego około początku XVI-go wieku* (Kalimach and the Acquaintance of Turkish State on the Beginning of XVI Century) Studia geogr. hist., Warszawa 1925, pp. 114–137.; Rozp. Wydz. hist.-filozof. AU, 40, Kraków 1900, pp. 268–288 and an offprint 23 pp.

Cracovian geography gained a high reputation in Europe. Animated contacts with other European countries lured to Cracow numerous scientists and students[10]. Among others, Cracow University was attended by: Conradus Celtis, a German humanist, Rudolphus Agricola Wasserburgensis from Switzerland, Johannes Turmair (Aventinus), Johannes Honterus from Transylvania, as well as Silesians like Bartholomaeus Stein (Sthenus), Georgius Werner, Martius Helwig, etc. — all of whom later became prominent in geography and cartography. At that time, systematical lectures were delivered in cosmography, with the intention of advancing beyond Ptolemaeus' *Geographia* and of modifying Nicolaus Germanus' map. All this contributed to facilitate later a ready acceptance of news reporting geographical discoveries.

Among other professors, cosmography was lectured by a Silesian Laurentius Corvinus — Raabe (about 1465–1527). His lectures, published as a cosmographical textbook *Cosmographia*, edited in print by one of his pupils, Henricus Bebel, at Basel in 1496 (with a secon edition in 1557). This author's description of the world is similar in approach and nomenclature to that of the anciens[11]. He also gave two descriptions written in rhyme of Silesia[12], Vistula, Cracow, Wieliczka and other polish localities[13].

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[10] F. Bujak, *Geografia na Uniwersytecie Jagiellońskim do połowy XVI-go wieku* (Geography on the Jagellonian University till the Middle of the XVI Century), Księga Pam. Uczniów Uniw. Jag., Kraków 1900, pp. 49-96, reprinted in Studia geogr.-hist., Warszawa 1925, pp. 1-62.

[11] Laurentius Corvinus (about 1465-1527), *Cosmographia dans manuductionem in tabulas Ptolomei; ostendens omnes regiones terrae habitabiles, diversa hominum genera diversis moribus et conditionibus viventes; annumerans diversa animalia in diversis provincijs; insulas; maria; flumina; et montes; et plurima scitu dignissima; una cum nonnullis epigramatibus et carminibus.* First part encloses mathematico-physical description of the earth and space, second — description of the three continents based upon compilations of Ptolemaeus, Strabon and Solinus; F. Bujak, *Laurentius Corvinus*, Studia geogr. hist., pp. 25-33.

[12] Wawrzyniec Korwin, *Silesiae compediosa descriptio*, Basileae 1496; second ed. — Basileae 1557, third ed. — Francofurti 1612; fourth ed. — Lissae 1729 (Description of Silesia and Wrocław in rhyme).

[13] Wawrzyniec Korwin, *Ode saphica endecasyllaba, dicolos, tetrastrophos peonice de Polonia et Cracovia*, Cracoviae 1502; Kosmogr. 1557; second ed. — Bratislaviae 1503; third ed. — Liptsk 1503; fourth ed. — Liptzck 1505; fifth ed. — Liptzck 1507; sixth ed. — Lipczk 1507; seventh ed. — Cracoviae 1507; eighth ed. — Lipsiae 1508; nineth ed. — Mogunciae 1508; tenth ed. — Spirae 1509; eleventh ed. — Liptzk 1509; twelvth ed. — Lipsiae 1511; thirtenth ed. — Argentinae 1512; fourteenth ed. — Lyptzik 1512; fifteenth ed. — Spirae 1512; sixtenth ed. — Lipsiae 1514; seventeenth ed. — Liptzk 1515; eighteenth ed. — Argentinae 1516; nineteenth ed. — Augusta 1516; twentieth ed. — Liptzk 1516; twenty first ed. — Cracoviae 1518; twenty second ed. — Lipsiae 1518; twenty third ed. — Argentine 1518; twenty fourth ed. — Lipsiae 1519; twenty fifth ed. — Viennae 1520; twenty sixth ed. — Basileae 1582, a laudatory ode

Lectures were also given by a Silesian, Jan de Głogów — Johannes Glogoviensis (1445–1507) with Ptolemaeus' maps as basis. In the Jagellonian Library there has survived one copy of Ptolemaeus' *Geographia* (issued in 1486 at Ulm), formerly owned by Jan de Głogów and containing his annotations written in 1494. A manuscript of his lectures[14] and his adnotations in an incunabulum has been preserved in the Jagellonian Library (Ms No. 2729 and Inc. No. 821). His textbook published in Cracow in 1506, *Introductorium Compendiosum in Tractatum Spherae Materialis mgri Joannis de Sacrobosco*[15], contains the first, rather vague information on the great geographical discoveries[16].

At that same time Martin Bylica de Olkusz (1433–1494)[17], astronomer, a graduate of Cracow University, delivered lectures at the Padua and Bologna Academies and, later, at Hungarian Academy also. He determined the co-ordinates of geographical latitude for a number of Hungarian towns. He bequeathed his collection of books and instruments to the Jagellonian University, a remarkable celestial globe from the fifteenth century is preserved there among the collection of ancient instruments.

News of the discovery of America was promulgated by Professor Jan

of the river Vistula, Cracow, Wieliczka and others, Polish transl. by E. Jędrkiewicz, ed. by E. Jelicz, Antologia poezji polsko-łacińskiej 1470–1543, Warszawa 1956; H. Barycz, *Ślązacy na Uniwersytecie Jagiellońskim od XV–XVIII w.* (The Silesians on the Jagellonian University from the XV to the XVIII c.), Katowice 1935; B. Olszewicz, *Najdawniejsze opisy geograficzne Śląska* (Oldest Geographical Descriptions of Silesia), Katowice 1936.

[14] F. Bujak, *Wykład geografii Jana z Głogowa w roku 1494* (John's of Głogów lecture in geography in 1494). Rozpr. A.U. Wydz. Filol., 33, 1901, reprinted in Studia geogr. hist., pp. 63–77; Ibid., *Traktat anonimowy* (Anonymous Treatise), Studia geogr. hist., pp. 33–41.

[15] Jan z Głogowa (1445–1507), *Introductorium Compendiosum in Tractatum Sphere materialis magistrii Joannis de Sacrobusto. Quem abbreviavit ex Almagesti Sapientis Ptolomei Claudij philosophi Alexandrini ex Pheludio progeniti... Feliciter Recollectum*, Cracoviae 1506; second ed. — Cracoviae 1513; third ed. — Argentinae 1518, commentary to J. de Sacrobusto's astronomy based upon Ptolemaeus geography, P. d'Ailly's compendium and others; Ibid., *Traktat geograficzny* (Geographical Treatise) a manuscript from the beginning of XVI century (four initial pages missing) it is a lecture embracing the introduction to Ptolemaeus' atlas.

[16] B. Olszewicz, *Polska a odkrycie Ameryki* (Res. La Pologne et la découverte de l'Amérique), Compt. rend. de la Soc. des Sciences et des Lettres de Wrocław, 2, 1947, Wrocław 1953, pp. 22–29.

[17] Martin Bylica of Olkusz (about 1433–1493); L. Birkenmajer, *Marcin Bylica of Olkusz*, Rozpr. A.U. Wydz. Mat.-Przyr., 25, 1893, F. Bujak, *Geografia na Uniwersytecie Jagiellońskim — Geografia astronomiczna* (Geography on the Jagellonian University — Astronomic Geography) Studia geogr. hist., pp. 58–62.; Z. Ameisenowa, *Globus Marcina Bylicy z Olkusza i mapy nieba na wschodzie i zachodzie*; Engl. transl., The Globe of Martin Bylica of Olkusz and Celestial Maps in the East and the West. Monografie z Dziejów Nauki i Techniki, 11, Wrocław 1959.

Fig. 3. First map printed in Cracow in 1512 in the work of Jan ze Stobnicy "Introductio in Ptholomei Cosmographiam...", copied from Waldseemüller (1507)

de Stobnica — Ioannes Stobnicensis (1470–1518), who published his book: *Introductıo in Ptolomei Cosmographiam* . . . in Cracow in 1512[18].

He added to his cosmography the excerpts from the geographical works by Aeneas Silvius Piccolomini and a description of the Holy Land by Anselmus, a Bernardine monk from Cracow. This author followed on the lines of a similar publication of Ringmann–Waldseemüller: *Cosmographiae Introductio*, published in 1507 at Saint Die in Lorraine; from Waldseemüller's map he drew a map of both hemispheres — the first maps printed in Poland (in 1512).

[18] Jan ze Stobnicy (about 1470–1518), *Introductio in Ptholomei Cosmographiam cum longitudinibus et latitudninibus regionum et civitatum celebriorum. Epitome Europe Enee Siluij.* — *Situs et distinctio partium totius Asiae per brachia Tauri Montis ex Asia Pij secundi. Particularior Minoris Asie descriptio ex ejusdem Pij Asia. Sirie Compendiosa descriptio; ex Paulo Orosio. Terre sancte et urbis Hierusalem apertior descriptio fratris Anselmi.* Cracoviae 1512; second ed. — Cracoviae (probably 1513); third ed. — Cracoviae 1519; fourth ed. — Cracoviae 1519 (variant); F. Bujak, *Jan Stobniczka,* Studia geogr. hist., pp. 41–47; B. Olszewicz, *Geografia polska w dobie Odrodzenia* (Polish Geography in the Renaissance Period), Prace geogr. IGPAN 12, p. 21. When the long discussed authorship of the Cosmography from Saint Die (1507) is concerned beside known works by J. Fischer see: Fr. Laubenberger, *Ringmann oder Waldseemüller? Eine kritische Untersuchung über den Urheber des Nahmens America.* Erdkunde, XIII (Bonn 1959), 3, pp. 163–179.

Fig. 4. Jagellonian globe from the year 1510 — Eastern Hemisphere

The interest shown at Cracow University in geographical discoveries is also illustrated by a gilded miniature globe preserved to this day and called the golden Jagellonian globe[19], dated from 1510, on which America discovered a short time before, has been already shown.

Cracow scientists contributed to an expansion of the geographical horizon by paying special attention to the Eastern Europe. Since the fifteenth century many authors in Poland, as well as abroad, have been interested, to a higher and higher degree, in the countries of Eastern Europe (Gemistus Pletho, Pomponius Laetus, Długosz, Callimachus, Nicolaus Rozemberski, Laurentius Międzyleski, etc.). But a radical turning point in opinions regarding the geography of Eastern Europe was made by Matthias Miechovita (1457–1523), professor at Cracow University, a physician and, at the same time, historian and geographer[20]. In 1517 he published in Cracow a book: *Tractatus de duabus Sarmatiis*[21], a precur-

[19] T. Estreicher. *Globus Jagielloński z początku XVI w.* (Jagellonian Globe from the Beginning of the XVI c.), Rozpr. AU. Wydz. Filolog., S. II, XVIII, Kraków 1901, pp. 1–18.

[20] *Maciej z Miechowa* (1457–1523) *Historyk, geograf, lekarz, organizator nauki* (Sum. Maciej of Miechow (1457–1523), Historian, Geographer, Physician and Organiser of Scientific Work), Wrocław 1960, 317 pp.; S. Wojciechowski, *Maciej z Miechowa jako geograf krajów litewsko-ruskich* (Matthias aus Miechów ein Geograph der Lituisch-ruthenischer Lander), Spraw. Nauk. Kola Geogr. U.J., 2, Kraków 1926, pp. 120–135.

[21] Maciej z Miechowa (1457–1523), *Tractatus de duabus Sarmatijs Asiana et Europiana et de contentis in eis...*, Cracoviae 1517; second ed. — Augustae Vindel 1518; third ed. — Augustae Vindel 1519; fourth ed. — Cracoviae 1521; fifth ed. — Basileae 1532; sixth ed. — Venetiis 1532; seventh ed. — Basileae 1537; eigth ed. — Venetiis 1542; nineth ed. — Basileae 1555; tenth ed. — Basileae 1582; eleventh ed. —
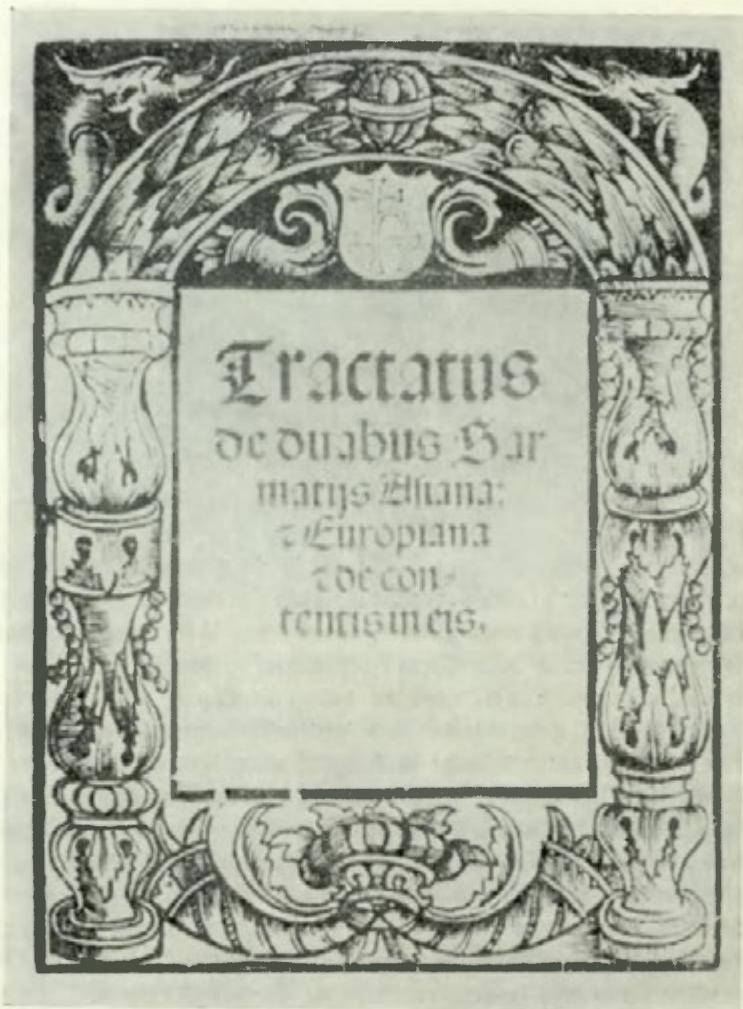
Fig. 5. Title page from "Tractatus de duabus Sarmatiis" by M. Miechowita edited in Cracow in the year 1517 (contains first description of Russian Lands)

sory work to a description by Z. Heberstein (1549), envoy of Emperor Maximilian to Moscow in the years 1518 and 1526. The publication of Matthias Miechovita went into some twenty editions and was translated into several languages; his views on the geography of Eastern Europe

Basileae 1582; twelvth ed. — Francofurti 1600; thirteenth ed. — Francofurti 1608; fourtheenth ed. — Varsoviae 1761 (some editions in different other works); new ed. — Berlin 1831; Moskwa 1936; Moskwa 1950 (parts). Translations: Polish — 1535, 1541, 1545, 1936, 1950; Italian — 1561, 1562, 1583, 1584; German — 1518, 1518, 1534; Dutch — 1563; Russian — 1855, 1936.

The oldest Polish map by B. Wapowski 1526

Fig. 6. Fragment of B. Wapowski's map from the year 1526

persisted in Europe throught the sixteenth and seventeenth centuries. *Tractatus de duabus Sarmatiis* did not appear in Polish until 1535, when it was published in Cracow by Andreas Glaber from Kobylin.

The development of Polish cartography also dates from the beginning of the sixteenth century. First place ought to be reserved here for Bernardus Wapowski (about 1450–1535), a Cracow canon, who while in Rome became acquainted with Italian cartography and co–operated in preparing a map of Central Europe by Marco Beneventano: *Tabula moderna Poloniae, Ungariae, Boemiae, Germaniae, Russiae, Lithuaniae*, two editions appeared in Rome, in 1507 and 1508[22]; in these maps Wapowski entered

[22] Bernard Wapowski, (about 1450–1535), *Tabula moderna Polonie, Ungarie, Bohemie, Germanie, Russie, Lithuanie*, Romae 1507, copper-plate map in Ptolemaeus Geographia Latine reddita, correcta a Marco Beneventano et Ja Cotta; second ed. — Romae 1508, (map known from several recasts and reproductions based to a large extent on the map of Mikołaj from Kuza (Cusanus — 1401–1464) half of the XV century, elaborated with help of J. Długosz, for example the location of place-names like Brzeźnica, Oleśnica or Turlo to indicate Dniestr river. On Beneventano's map elaborated B. Wapowski Polish lands east of the river Odra and north of Carpathians).

two small villages owned by his family — Radochonice and Wapowice. After returning to Poland he edited in the years 1526-1528 three maps, namely: 1. the map of Sarmatia in 1:2,900,000 scale — southern[23] and northern[24] parts, 2. the map of Polish Lands on the scale of 1:1,000,000[25] and 3. the map of Baltic Countries (?). The originals have not survived, but they are known to us from revised versions of these maps prepared by Wacław Grodecki — Wenceslaus Grodetius (1557-1565) and from atlases like those produced by Mercator (since 1585), Ortelius (since 1570), G. de Jode (1562-1593) and others. For those times, the 1:1,000,000 map od Polish lands was an exceptional achievement on an all-European scale. In consequence of the Cracow fire in 1528, in which Unglers' printing establishment was reduced to ashes, also Wapowski's maps, the maps became extremely rare objects; for many years a search for them continued in map collections the world over. It was not until 1932, that in the cover of an old account book of the salt-mine at Bochnia, by K. Piekarski eight fragments of these maps were discovered[26] it was fortunate that facsimile copies were made prior to the Second World War by K. Buczek, because the originals were destroyed during the war. Hence, none of Wapowski's original maps exist in Poland. There are preserved merely the facsimile copies and numerous adapted versions, together with the correspondence kept up by Wapowski with leading European cartographers[27]. Until the

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[23] Bernard Wapowski, *Tabula Cosmographie particularis nonnulla loca regni... Polonie et etiam Hungarie, ac Valachie, Turcie, Tartarie et Masovie* (Moscovie?) *continens*, Cracoviae 1526, Names of maps listed according to king's Sigismund the First privilege from 1526. According to K. Buczek they concern south-eastern Europe (Sarmatia) and were the base for maps of S. Münster. (Poland and Hungary — 1540) H. Zell (1535) G. Mercator (1554, 1572), K. Vopel (1555-1593) 6 editions, J. Gastaldi (1542).

[24] Bernard Wapowski, *Tabula Cosmographie particularis ducatus Prussie, Pomeranie, Samogithie et magni Ducatus... Lithuanie continens*, Cracovia 1526; a map of the Balkan countries, sent by Wapowski together with the map of Sarmacia to Eck in Augsburg in 1530 r. was used probably in maps of: H. Zell (1535), G. Mercator (1554), K. Vopel (1555), O. Magnus (1539) a.o. Unknown even in fragments.

[25] Bernard Wapowski, *Tabula seu mappa totum regnum (scil. Poloniae) et Masoviam, et pleraque alia loca complectens*, Cracoviae 1526; a detailed map of Poland and Lithuania, the most precise map untill the half of XVIII century.

[26] K. Piekarski, *Miscellanea bibliograficzne* (Bibliographic Miscellanea) Przegl. Bibl., 4 (1930), 331 pp.

[27] L. Birkenmajer, *Marco Beneventano, Kopernik, Wapowski a najstarsza karta geograficzna Polski* (Marco Beneventano, Copernicus, Wapowski and the Oldest Geographical Map of Poland), Rozpr. Wydz. Mat.-Przyr. A. U. Kraków 1901, 41 pp. 134-222; K. Buczek, *Bernard Wapowski, der Gründer der polnischen Kartographie*, "Comp. rend. Congr. Intern. de Geogr., Varsovie 1938, 4, pp. 61-63; Ibid., *Dzieje kartografii polskiej* (History of Polish Cartography) pp. 22-37, passim;

eighteenth century Wapowski's maps were the basis for European carto-
graphical editions of Eastern Europe. Wapowski was in close contact with
Nicolaus Copernicus (1473–1543), because the latter also paid attention
to maps, participating in determining geographical co–ordinates and col-
lecting source data for a map of Pomerania[28]. It was probably on the basis
of this material that in 1541 a map of Prussia was edited by Rheticus
(1514–1574)[29]. With Wapowski's maps and the Cracow geographical centre
as a base, a number of further maps of Poland were published at that
time, such as those of Johannes Honterus (1542), of Andreas Pograbius
Pilsnensis (1569), of Stanislaus Sarnicki (1584), and others.

Martin Bielski (1495–1575) published in 1551 *Kronika wszystkiego świa-
ta*[30] (Chronicle of the Universe). This was enlarged in the later edit-
ions of 1554 and 1564. This was the first outline of an universal history

there also about Copernicus' cartography works. The author in his works has
presented the entirety of problems concerned with the history of Polish carto-
graphy from XV to XVIII centuries.

B. Olszewicz, *Wzmianki o mapach Bernarda Wapowskiego w listach z r. 1529*
(Some Notes about the Maps of Bernard Wapowski in Letters of, 1529), Studia
nad książką poświęconą pamięci Kazimierza Piekarskiego (Studies on the book
devoted to the memory of Kazimierz Piekarski) Wrocław 1960, pp. 371-376.

[28] B. Olszewicz, *Kopernik jako geograf* (Copernicus as a Geographer), Spraw.
Wrocł. Tow. Nauk., Wrocław 1956, An. 8,92 pp.; B. Olszewicz, *I lavori cartografici
de Nicolo Copernico*, Actes du VIII Congrès Inter. d'Histoire des Sciences, Firenze
1957, pp. 425-426; S. Wędkiewicz, *Copernic et la découverte du nouveau monde.*
Etudes Coperniciennes, 1, Paris 1958, Bull. de l'Acad. Polon. des Sciences et des
Lettres. Centre Polonais des Recherches Scientifiques de Paris, 13-16, (1955-1957),
pp. 174-176.

[29] Rheticus Joachim Jerzy (Retyk) 1514-1574, *Chorographia*, a manuscript from
XVI century published by Hipler in "Zeitschr. für Mathem. und Physik", 21 (1876);
the text encloses data for a map of Prussia send in 1541 to prince Albrecht of
Prussia; J. Staszewski, *Chorographia Jerzego Joachima Retyka. Przełożył i wstę-
pem zaopatrzył Józef Staszewski* (The Chorography of John Joachim Retyk, Transla-
tion and introduction by Józef Staszewski), Zesz. geogr. Wydz. Geogr. WSP, Gdańsk,
3, 1961, pp. 153-176.

[30] Marcin Bielski (1495-1575), *Kronika wszytkyego swyata, na ssesc wyeków,
Monarchia cztery rozdzielona, a Kosmographią nową y z rozmaitemi Krolestwy
tak poganskimi Żydowskyemi yako y krześciańskyemi s Sybillami y proroctwy ich
polsku pisana s figurami. W którey też żywoty Cesarskye, Papyeskye y thych kro-
low z ich krolestwy, Asyryjskich, Egipskich, Żydowskich, Greckich, Perskich, Tu-
reckich, Węgyerskich, Czeskich y innych rozmaitych thak Krolow, Kxyążąt, yako
inych przełożonych od początku swyata aż do thego roku, który sie pisze 1551 są
napisane* (Chronicle of the Universe...), Kraków 1551; second ed. — Kraków 1554;
third ed. — Kraków 1564. In later editions titles were modified; J. Chrzanowski,
Marcin Bielski. Studium literackie, Warszawa 1906, second ed., Lwów 1926. On the
propagation of S. Münster Cosmography in Poland see also the study by W. Kon-
czyńska (Sebastian Münster's Letter to Stanisław Łaski and few details concerned
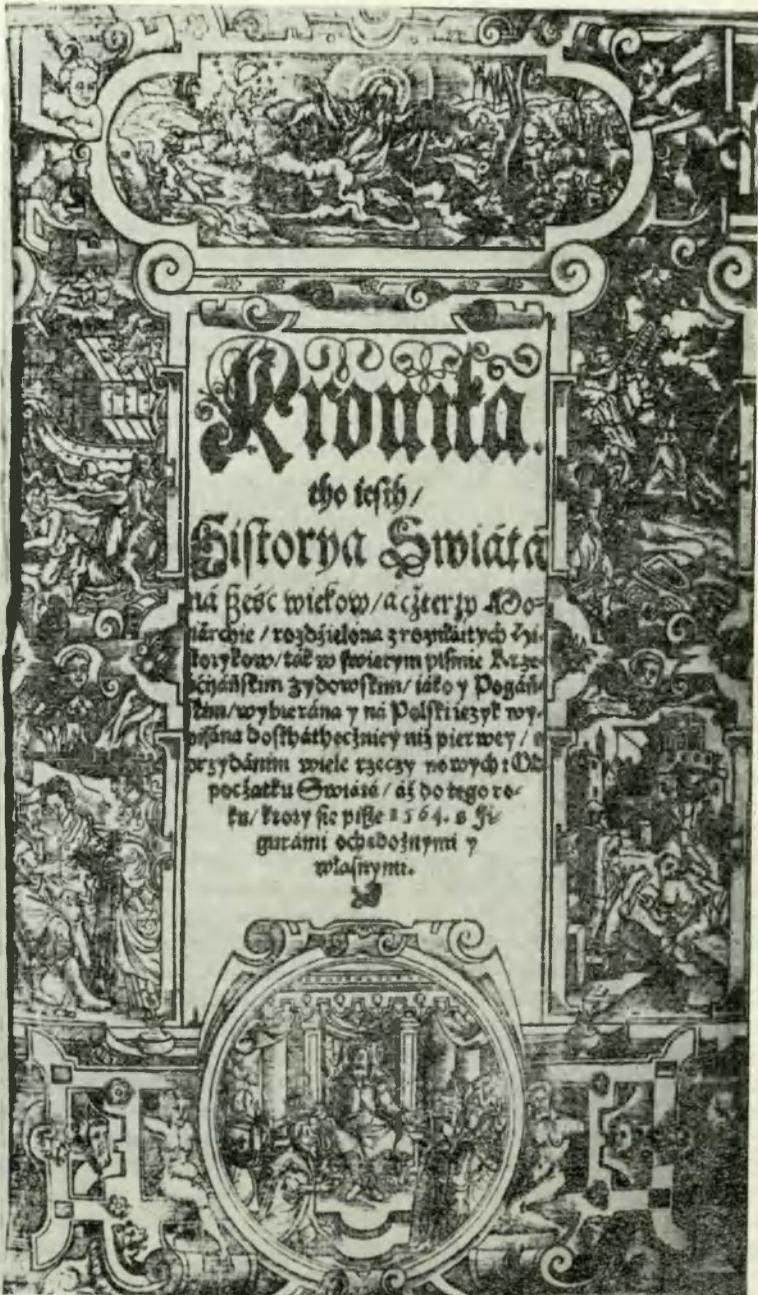with his Cosmography), Kraków 1935.

Fig. 7. Title page from the work by Martin Bielski "Kronika to jest historia świata...", edited in Cracow in year 1564 (three editions). It was the first description of the world (with America) printed in Polish

written in Polish and, at the same time, the first regional geography of the World, and the first lecture in Cosmography, patterned — to some extent — after Sebastianus Münster's popular *Cosmography*. Bielski's chronicle was translated into Russian by Ambrosius Breżewski and thanks to that information about lands newly discovered was passed on to Russia.

One of the graduates of Cracow University was Martin Cromerus — Marcin Kromer (1512–1589) who, in Basileae in 1577, published his book *Polonia*...[31], thus, after about a hundred years Jan Długosz's *Chorographia* was brought up to date. This author gave in his work a concise description of Poland, partly based on Długosz: he treated this topic as an introduction to his book, mainly intended for foreigners. Kromer's *Polonia* was edited ten times in the sixteenth and seventeenth centuries: it was also translated into other languages. In the two centuries mentioned, this was the fundamental description of Poland. Apart from Kromer, several further historical descriptions of Poland have been published: worth mentioning are the following books, also written by graduates of Cracow University: *Polonia sive status regni Poloniae descriptio*[32] by Simon Starowolski (1632) and, in Polish, *Kronika Polska, Litewska, Żmudzka*...[33] by Matthias Osostevicius Stryjkowski (1582). In the dedication of

[31] Marcin Kromer (1512–1589), *Polonia sive de situ, populis, moribus, magistralibus et republica Regni Polonici libri duo*..., Basileae 1577; second ed. — Coloniae 1577 with an introduction of M. Kromer; third ed. — Coloniae 1578; fourth ed. — Basileae 1582; fifth ed. — Coloniae Agripp. 1589; sixth ed. — Coloniae Agripp. 1595; seventh ed. — Lugduni Batav. 1628; eighth ed. — Lugduni Batav. 1627; nineth ed. — Lugduni Batav. 1642; tenth ed. — Varsoviae 1761; new critical ed. by Czermak with an extensive introduction — Kraków 1901; Translations: Polish by L. Kondratowicz (W. Syrokomla) — Wilno 1853; German — Dantisci 1741, Leipzig 1741; Spanish — Madrid 1588; Ibid., *Polonici regni cum. adiunctis provinciis descriptio*, Manuscript from the XVI century, edited by J. Korzeniowski in "Scriptor. Rer. Polon. XV". Kraków 1891 (first edition of the work "Polonia sive de situ..."); Ibid., *Poloniae gentisque et Reipublicae Poloniae descriptionis libri duo*... Francofurti 1575, an anonymous edition without Kromer's agreement; A. Eichhorn, *Der ermlandische Bischof Martin Kromer als Schriftsteller, Staatsmann u. Kirchenfürst*, Zeitschr. f. Gesch. u. Altertumskunde, Braunsberg Ermlands 1868.; C. Walewski. *Marcin Kromer*, Bibl. Warsz. 1873, and an offprint, Warszawa 1874.; L. Finkel. *Marcin Kromer, historyk polski XVI w., Rozbiór krytyczny* (Martin Kromer, XVI-th Century Polish Historian. An Critical Analysis), Rozpr. AU Wydz. Hist. Filozof. S. 1., 16 (1883), pp. 302–508, and an offprint.

[32] Szymon Starowolski (1588–1656), *Polonia*, Coloniae 1632; second ed. — Dantisci 1652; third ed. — Wolfenbyti 1656; fourth ed. — Gendani 1669 (?); fifth ed. — Brunsvigae 1730; sixth ed. — Vratislaviae 1733; seventh ed. — Vratislaviae 1734; eighth ed. — Varsaviae 1761. Translations: Polish by W. Gołębiowski — Wilno 1765; French — Amsterdam 1663; Spanish — Amsterdam 1668; A geographical description of Poland.

[33] Maciej Stryjkowski (1547– after 1582), *Kronika polska, litewska, zmodzka, y wszystkiey Rusi Kijowskiey, Moskiewskiey, Siewierskiey... y rozmaite przypad-*

POLONI·A

Siue

DE SITV, POPVLIS,

MORIBVS, MAGISTRATI
BVS, ET REPVBLICA
regni Poloniae libri duo.

Authore Martino Cromero,
Coadiutore, ac defignato
Epifcopo Varmienfi.

Adiuncta eft Sacerdotis cuiufdã Poloni ad lectorem admonitio, de Silefiorum nouis annalibus.

COLONIÆ.
Apud Maternum Cholinum.

M. D. LXXVII.

Cum Gratia & Priuilegio Cæf.Maieft.

Fig. 8. Title page from the work by Martin Cromer "Polonia sive de situ, populis
moribus..." edited in the year 1577 (Coloniae), the best known description of
Poland from the sixteenth century

his chronicle, and in his autobiographical poetry: *O sobie i przygodach swoich w zwiedzaniu rozmaitych krain świata*[34] (About myself and my adventures in visiting various lands of the world) Stryjkowski related reminiscences of his journey as a member of the diplomatic delegation of Jędrzej Tarnowski to Turkey in 1574–1575, Stryjkowski claimed to be the author of the book *Sarmatiae Europeae Descriptio*[35] which describes "The Polish Kingdom with all its states, principalities and provinces". In 1578, Alexander Gwagnin (about 1538–1614) from Verona published this work first in Latin, afterwards, in 1611, in Polish, under his own name[36]. This is a description of Polish lands, containing an abundance of details about towns, settlements, castles, estates, etc. S. Starowolski is also the author of the description of Constantinople[37].

ki wojenne y domowe, Pruskich, Mazowieckich, Pomorskich, y innych kraijn Królestwu Polskiemu y Wielkiemu Xięstwu Litewskiemu przyległych, według istotnego y gruntownego zniesienia pewnych dowodów z rozmaitych Historykow y Autorow postronnych y domowych y Kijowskich, Moskiewskich, Słowiańskich, Liflantskich, Pruskich, starych dotąd ciemnochmurną nocą zakrytych Kronik y Latopiszczow Ruskich, Litewskich, y Długosza Oyca dzieiów Polskich z inszymi, z wielką pilnością y węzłowatą pracą (osobliwie około Dzieiów Litewskich y Ruskich od żadnego przedtym nieruszonych przez Macieja Osostewiciusza Stryikowskiego dostatecznie napisane... przez wszystkie starożytne wieki, aż do dziesiejszego Roku 1582...) Chronicle of Poland, Lithuania, Samogitia and of all Ruthenia... (title cited after Warsaw reprint from 1766). Printed in Königsberg 1582, reprinted in Warszawa 1766.

[34] *Maciey Striikowski Osostevicius sam o sobie y przygodach swoich w zwiedzaniu rozmaitych krain świata* (Maciej Striikowski Osostevicius about himself and his adventures when visiting different countries...), Królewiec (1582) in an introduction to: *Kronika... która przedtym nigdy światła nie widziała...*; second ed. — Warszawa 1766; new ed. — Warszawa 1846. Description in rhyme of travels to Turkey and Greece in 1574–1575.

[35] Maciej Stryjkowski, *Sarmatiae Europeae descriptio*. Unpreserved manuscript edited with revisions by A. Gwagnin under his name.

[36] Aleksander Gwagnin (about 1538–1614), *Sarmatiae Europeae descriptio, Quae Regnum Poloniae, Lituaniam, Samogitiam, Russiam, Massoviam, Prussiam, Pomeraniam, Livoniam et Moschoviae, Tartariaeque partem complecitur,* Cracoviae 1578; second ed. — Spirae 1581; third ed. — Basileae 1582; fourth ed. — Francofurti 1584; fifth ed. — Lugduni Batav. 1626; sixth. ed. — Lugduni Batav. 1627; seventh ed. — Lugduni Batav. 1627; eighth ed. — Varsaviae 1761 (Stryjkowski cited as the author). Translations: Polish by Paszkowski M. — Kraków 1611, Warszawa 1768; new ed. by Turowski K. — Kraków 1860; German — Speir 1582; Italian — Venezia 1559, 1583 and 1606; Czech — Praha 1590, 1602 and 1786.

[37] Szymon Starowolski (1588–1656), *Dwór Cesarstwa Tureckiego y Residencya jego w Konstantynopolu* (The Turkish Empire Court and its Residence in Constantinople), Kraków 1646; second ed. — 1647; third ed. — 1649; fourth ed. — 1665; fifth ed. — 1695; sixth ed. — 1701; seventh ed. — 1715; new ed. Wilno 1844 and Kraków 1859; Russian transl. — five ed., some of them: Moskwa 1678, Petersburg 1883 (contains a description of Constantinople).

Joannes Broscius — Jan Brożek (1585–1652), professor of mathematics and astronomy, divulged much interest in geography and cartography[38]. He lectured on Ptolemaeus' *Geographia* and, at the same time, gave much attention to the history of the discoveries in America and to the theories of Copernicus. Well acquainted with geodesic surveying as done by Snellius in Holland, he intended to prepare, in an identical manner, a map of Poland; it is regrettable that he failed to carry this plan.

The transfer of the country's capital from Cracow to Warsaw, which took place towards the end of the sixteenth century could not but impede the Cracow University's further development and the seventeenth and eighteenth centuries witnessed a period of stagnation and decay. Lectures on geography were delivered from time to time but they brought no marked progress. Geographical and cartographical sciences rather became concentrated near the Royal Court in Warsaw, and at the residences of the nobility in other parts of Poland.

We are omitting, as less interesting, the further period of the history of geography at the Jagellonian University, until the middle of the nineteenth century.

Neverthless, worthy of mention is a certain revival of geography following the reform of the Jagellonian University introduced[39], according to the instructions issued by the Committee of National Education, by Hugon Kołłątaj (1750–1812), who was interested in geography himself and inaugurated the teaching of geography in schools[40]. Jan Śniadecki (1756–1830) was also prominent in stimulating geographical studies; working as an astronomer at the Cracow observatory he was the first to promulgate the theoretical bases of physical geography[41]. Jan Jaśkiewicz, naturalist and university professor was another scientist of importance[42].

[38] J. N. Franke, *Jan Brożek (1585-1652) akademik krakowski, jego życie i dzieła* (Jan Brożek, a Cracow academic, his life and work) Kraków 1884; H. Barycz, *Rozwój nauki w Polsce w dobie Odrodzenia* (Development of Science in Poland in the Renaissance Period), p. 121 and p. 130.

[39] Jadwiga Gertlerówna, *Geografia krakowska w epoce Kołłątaja* (Cracow Geography in Kołłątaj's Days), Wiad. geogr., 5 (1927), 6, pp. 86–90.

[40] W. Nałkowski, *Zasługi Kołłątaja na polu geografii* (Kołłątaj's Merits in the Field of Geography), „Ziemia i człowiek", Warszawa 1901, pp. 77–82.

[41] Jan Śniadecki, *Jeografia, czyli Opisanie Matematyczne i Fizyczne Ziemi* (Geography, or Mathematico-Physical Description of the Earth), Warszawa 1804; second ed. — Wilno 1809; third ed. — 1818; Józef Staszewski, *Geografia fizyczna Jana Śniadeckiego na tle epoki. W dwusetną rocznicę urodzin myśliciela i uczonego (1756-1830)*. (Sum. The Physical Geography of Jan Śniadecki. Against the Background of His Period), Przegl. geogr., 28 (1956), 4, pp. 685–720; M. Chamcówna, *Jan Śniadecki.* Kraków 1963. Wyd. Jubil. U.J., 5.

[42] *Studia z dziejów Katedr Wydziału Matematyki, Fizyki, Chemii Uniwersytetu Jagiellońskiego* pod red. St. Gołąba (Studies on the History of Chairs in the Depart-

The political partition of Poland and the loss of political sovereignty, had a negative influence on cultural progress. It was not until the middle of the nineteenth century, in 1849, that a chair of geography at the Jagellonian University was established, the first at a university in Poland, at the same time it was one of the few then existing in Europe. This chair was conferred on Wincenty Pol (1807–1872)[43], an enlightened and ardent naturalist and scientist, a well known poet besides, thoroughly acquainted with Polish lands by reason of much wandering. As far as geography was concerned, Pol was autodidact. He delivered interesting geographical lectures mainly dealing with Poland, conducted debating seminaries, and even made excursions with his students. Unfortunately, his didactic activity at the Jagellonian University lasted only four years, because in 1852 the chair of geography was abolished by the Austrian authorities. Pol's achievements are conspicuous in the domain of descriptive regional geography with regard to Polish lands.

Again geographical lectures became a rarity, being taken over by other scientists. It was not until 1877 that a chair of geography was reinstated, occupied by Franciszek Szwarcenberg–Czerny (1847–1917)[44], historian and geographer, graduated from Vienna and Berlin. This scientist held the chair for forty years. He lectured, conducted seminaries,

ments of Mathematics, Physics and Chemistry) under editorship of St. Gołąb. Wyd. Jubil. U.J., XV, Kraków 1964.

[43] Wincenty Pol (1807–1872), *Obrazy z życia i natury* (Pictures from the Life and Nature), 1-2, Kraków 1869/70; Ibid., *Północny wschód Europy* (The North-East of Europe), Kraków 1851; Ibid., *Rzut oka na północne stoki Karpat* (A Glimpse on the North Slopes of Carpathians), Kraków 1851; Ibid., *Historyczny obszar Polski* (The Historical Territory of Poland), Kraków 1869, Dzieła I–X, Lwów 1857–1877; S. Niemcówna, *Wincenty Pol jako geograf* (Wincenty Pol, his Life and Geographical Work), Kraków 1923, Prace geogr. U.J., 2, 61 pp.; H. Barycz, *Wincenty Pol jako profesor geografii na Uniw. Jagiellońskim* (Wincenty Pol as a Geography Professor at the Jagellonian University), Kraków 1949, PAU. Prace Kom. Hist. Med. i Nauk Mat. Przyr., 3,2, 88 pp. (offprint); J. Babicz, *Wincenty Pol, metodologiczne założenia jego geografii i wpływ Rittera na ich ukształtowanie* (Wincenty Pol, Metodologische Voraussettzungen seiner Geographie und der Einfluss Ritters auf ihre Gestaltung), Stud. i mat. z dziejów nauki polskiej, ser. C. Warszawa 1961, 4, pp. 105–139.

[44] Franciszek Szwarcenberg–Czerny (1847–1917), *Die Wirkung der Winde auf die Gestaltung der Erde*, Erganzungsheft zu Petermanns geogr. Mitt., 48, Gotha 1876; Ibid., *Zarys rozwoju wiedzy o Ziemi na tle historii odkryć geograficznych* (An Outline of the Development of the Science of the Earth against a Background of the History of Geographical Discoveries), Warszawa 1880, 166 pp.; A Krzymowska, *Franciszek Szwarcenberg–Czerny profesor geografii Uniwersytetu Jagiellońskiego (1847–1917)* (Szwarcenberg–Czerny, the professor of Cracow University), Prace geogr. IG PAN, 3, Warszawa (1954) 69 pp., *Polski Słownik Biograficzny PAU*, 4, Kraków 1938, 344 pp. (biography).

and wrote a textbook on commercial geography; apart from historical papers he published a number of essays on the history of geography and geographical discoveries and on physical geography. He represented the standing which European geographical knowledge had attained by the close of the nineteenth century.

In 1917 the chair of geography was taken over by Ludomir Sawicki (1884–1928)[45], doctor of geography, graduated from Vienna University, a geographer of comprehensive education, well acquainted with a number of European and other countries. In geomorphology he was an adherent to the concept of Davis, introducing them into Polish geography. He was a fervent traveller who visited some Asian and African countries.

In 1918 Poland regained its independence, and interest in geography of course immediately recovered strength. This enabled Sawicki to organize a modern Geographical Institute, which is still in existence and to inaugurate new methods in teaching and in geographical research[46]. He chose a staff of collaborators some of whom are still active in geography. Sawicki's scientific achievements are remarkable, comprising of over 130 publications dealing with all branches of geography.

Sawicki's closest collaborator was Jerzy Smoleński (1881–1940)[47]

[45] Ludomir Sawicki (1884–1928), *Frage des geographischen Zyklus im Karste,* Mitt. Geogr. Gesell. Wien 1909, 15, pp. 185–281; Ibid., *Z fizjografii Zachodnich Karpat* (On the Physiography of Western Carpathians) Arch. Nauk. Lwów 1909, 108 pp.; Ibid., *Rozmieszczenie ludności w Karpatach Zachodnich* (Distribution of Population in the Western Carpathians), PAU., Kraków 1910, 69 pp.; Ibid., *Badania limnologiczne w Polsce* (Limnological Research in Poland), Księga Pamiątkowa XI Zjazdu Lekarzy i Przyr., Kraków 1911, pp. 234–236; Ibid. *Hydrografia ziem polskich* (The Hydrography of Polish Lands), Encykl. A.U. Kraków 1912, pp. 249–298; Ibid., *Studia nad Abisynią* (Studies on Abyssinia), Prace Tow. Nauk., Warszawa 1913, II, 10, 251 pp.; Ibid., *On the geomorphology of Central Ceylon,* Prace geogr. U.J., 3, Kraków 1925, 31 pp., moreover about 130 treatises and articles, many maps, atlases and school textbooks; J. Smoleński, *Ludomir Sawicki. Życie i dzieło* (Ludomir Sawicki. Life and Work), Przegl. geogr., 9, Warszawa 1929, pp. 7–23; Ibid., (ed.), *Ludomir Sawicki jako uczony i działacz* (Ludomir Sawicki a Scholar and a Man of Action), Wiad. geogr., 8–10 (1928), 30 pp.

[46] *Geografia w ośrodku krakowskim* (Geography in the Cracow Centre), collection of papers, Wiad. geogr., 10, 6, Kraków 1927, pp. 83–126: J. Smoleński, *Rozwój i stan naukowej pracy geograficznej w ośrodku krakowskim* (Development and the State of Scientific Geographical Work in the Cracow Centre), Pamiętnik I. Zjazdu Koleżeńskiego Geografów Krakowskich, Kraków 1928, pp. 9–16.

[47] Jerzy Smoleński (1881–1940), *Krajobraz Polski* (The Landscape of Poland), Warszawa 1912, 98 pp.; Ibid., *O wysokich terasach dyluwialnych na zboczach Kotliny Sądeckiej* (On the High Diluvial teracess on the Slopes of Sącz Basin), Rozpr. Wydz. Mat. Przyr. A.U., Kraków 1918, 53; Ibid., *Przyrodzony obszar Polski i jego granice w świetle nowoczesnych poglądów* (Zus. Lage und Grenzen des natürlichen geographisch Politischen Raumes von Polen), Przegl. geogr., 6 (1926), pp. 33–44;

geologist by education, a professor of physical geography, who rather specialized in problems of geomorphology. He was the author of new concepts on the relief of the Carpathians and of new characteristics of the Polish landscapes. In population geography he advanced inventive methods of calculating surplusses and deficits in population, and of studying the potential of emigration. He was also engaged in political geography. Thus we see that in the period between the two World Wars there existed at Cracow two chairs of geography which, together with a readership for cartography, constituted an impressive Geographical Institute, editing two publications of its own: *Prace Instytutu Geograficznego U. J.* (Travaux de l'Institut Géographique de l'Université de Cracovie) of which twenty one volumes appeared[48] and *Komunikaty I.G.U.J.* (Contributions de l'Institut de Géographie de l'Université de Cracovie) — nine issues. After the second World War two further volumes were published in 1945.

L. Sawicki was, in 1918, one of the organizers of the Polish Geographical Society (Polskie Towarzystwo Geograficzne) and the founder and the first editor–in–chief of *Przegląd Geograficzny* (Geographical Review). The printing house he owned, he adapted mainly to geographical publications edited either by his own firm "Orbis" or by the Cracow branch of Polish Geographical Society[49].

In 1928, the management of the Geographical Institute was taken over by Jerzy Smoleński, aided for several years by Bohdan Zaborski[50], an anthropogeographer now residing in Canada. Wiktor Ormicki (1898–

Ibid., *Względne przewyżki i niedobory ludności polskiej na obszarze Rzeczypospolitej* (Zus. Die relativen Überschusse und Defizite der ponischen Bevölkerung in der Republik Polen), Prace geogr. U.J., 6, Kraków 1926, 33 pp.; Ibid., *Geopolityczne bariery nadmorskie* (Zus. Geopolitische Küsten Barrieren), Przegl. geogr., 14, (1934), pp. 132–152; Ibid., *L'accroissement naturel de la population et la pression demographique*, Congr.. Inter. de la Population, 7, Paris 1937; S. Leszczycki, *Jerzy Smoleński 1881–1940. Profesor geografii Uniw. Jagiell.* (Jerzy Smoleński 1881–1940. The Geography Professor of the Jagellonian University), Przegl. geogr., 19, Warszawa 1949, 23 pp.; M. Klimaszewski, *Jerzy Smoleński 1881–1940*, Rocznik Pol. Tow. Geolog. 19, Kraków 1949, pp. 255–262.

[48] Since the Second World War the publication has been continued in two series: one concerned with physical geography and the other with economic geography. Up to 1966 eleven new volumes have been published.

[49] Thus of the *Biblioteczka Geograficzna* (Geographical "Orbis" series) sixteen volumes were issued in four series, of *Krakowskie Odczyty Geograficzne (Kraków)* (Conferences Géographiques Cracoviennes), 14 fascicles, of *Sprawozdania naukowe Koła Geografów Uczniów U. J.* (Scientific reports of the Circle of geographers, students of Jagellonian University in Cracow), 3 papers.

[50] No references have been given to actually working geographers.

1941)[51], an economic geographer was their intimate and steady co-operator. The Geographical Institute of the Cracow University was progressing auspiciously until 1939. After the occupation of Cracow by Hitler's armies[52], the Geographical Institute, together with the whole University, were abolished; Smoleński and Ormicki perished in German concentration camps.

When Poland was liberated in 1945, only three senior assistants had survived namely M. Kimaszewski, S. Leszczycki and J. Szaflarski. In February 1945 lectures were resumed. However the first post–war years brought great hardship and much effort was spent on re–establishing the Institute. In charge of the Geographical Institute were successively: E. Romer[53], S. Leszczycki, J. Szaflarski until finally, in 1949, the management was taken over by Mieczysław Klimaszewski, to–day's president of the Jagellonian University.

After the war the Institute was expaned considerably: at present it boasts two chairs with five professors and lecturers as well as a score of assistants. The University's premises also contains the Department of

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[51] Wiktor Ormicki (1898-1941), *Rozprzestrzenienie ziemniaka w Polsce na tle kultury materialnej* (Zus. Die Verbreitung des Kartoffelanbaues in Polen im Verhältnis zur materiallen Kultur), Przegl. geogr., 7 (1927), pp. 53-71; Ibid., *Życie Gospodarcze Kresów Wschodnich R. P.* (Zus. Das Wirtchaftsleben der Ost-und Nordostdistrikte der Republik Polen). Prace geogr. U.J., 11, Kraków 1929, 308 pp. and an atlas with 75 maps; Ibid., *Rozwój polskiej myśli geograficzno-gospodarczej* (Res. Développement de la géographie économique en Pologne), Przegl. geogr., 12, Warszawa 1932, 12 pp.; Ibid., *Das Geldkapital als Gegenstand wirtschaftsgeographischer Forschungen*, Petermanns geogr. Mitt. 3 (1936); Ibid., *O polski program ludnościowy* (For a Polish Population Program), Warszawa 1939; Z. Figlewicz, *Wiktor Rudolf Ormicki (1898-1941)*, Przegl. geogr. 19 (1945).

[52] S. Leszczycki, *Geografia w Krakowie w okresie okupacji 1939-1945* (Geography in Cracow During the 1939-1945 Occupation), Przegl. geogr., 19, Warszawa 1945-46, pp. 113-114; J. Szaflarski, *Tajne nauczanie w zakresie geografii na U.J.* (Secret Teaching in Geography on the Jagellonian University), Przegl. geogr., 19, Warszawa (1945-46), pp. 115-116.

[53] Eugeniusz Romer (1871-1954), In the years 1960-1964 was edited in 4 volumes *Wybór Prac* (Choice of Works), which concernes physical geography and history of geography. Among now reprinted works should be noted: *Ziemia i Państwo* (Land and State), Lwów 1939, 384 pp.; *Rozmyślania na tematy regionalne* (Sum. Consideration on the Problems of Regionalism), Czas. geogr., 19, Wrocław 1948, pp. 3-49. Moreover Romer is the author of many maps and atlases. The whole bibliography embraces above 300 scripts and above 140 cartographical works.; J. Jeżewski, *Życie i dzieło Eugeniusza Romera* (Life and Work of Eugeniusz Romer), Wybór Prac, 1, Warszawa 1960, PWN, pp. 9-115; S. Leszczycki, *Eugeniusz Romer*, Petermanns geogr. Mitt. 1954; A. Zierhoffer *Eugeniusz Romer*, Przegl. geogr., 26 (1954), pp. 178-182.

Geomorphology and Hydrography of Mountains and Uplands of the Institute of Geography of the Polish Academy of Sciences, also directed by M. Klimaszewski. Altogether, the Cracow geographical centre consists of a staff of more than thirty. Their principal concern is Southern Poland and its areas of mountains and uplands. However, their study takes in all of Poland and in comparative investigations of other European countries (like the Carpathians, the Balkans, the Alps, Spitsbergen) and even China. Under the guidance of Professor Klimaszewski, research deals principally with geomorphology and hydrography. He himself is the initiator — among other topics — of comprehensive research methods based on detailed geomorphological and hydrographical maps. Having been repeatedly put forth at international meetings, these methods are well known to geographers the world over. Along the same line regional synthetic and methodical research is being carried but, and much of this work has appeared in print[54].

Climatological research deals chiefly with the Carpathians where the principal problem involves the variation of climatic conditions depending on altitude. This research was started by W. Milata[55] and continued by M. Hess.

Professor Antoni Wrzosek, who is holding the second chair of geography, lectures on economic geography, connected with industry, transport, population, recreation, etc.; these topics refer mainly to Poland, especially to its southern part[56].

Studies in the domain of the history of geography, especially for the period of the fifteenth and sixteenth centuries are conducted by lecturer Mrs Bożena Strzelecka, co-author of the present paper.

Ending our paper in which we attempted to present a review of the

[54] M. Klimaszewski, *Zespół katedr geografii U. J. w Krakowie w latach 1944-1954* (The Union of Geography Chairs at the Jagellonian University in Cracow in 1944-1954), Przegl. geogr., 26 (1954), pp. 144-149.

[55] Władysław Milata (1911-1954), *Geograficzne modelowanie plastyczne* (Geographical plastic modelling), Mies. Pedagog. 44, 1 (1935), pp. 39-41; Ibid., *Geografia lotnicza świata* (Sum. The geography of the world airways), Czas. geogr., 18 (1947), pp. 103-113; Ibid., *Liczba dni z przymrozkami w Polsce* (Sum. The number of days slight frost in Poland), Czas. geogr., 20 (1949), pp. 268-274; Ibid., *Trwałość pokrywy śnieżnej w Polsce* (The number of days with snow-cover in Poland), Przegl. geogr., 22 (1950), pp. 201-211; S. Leszczycki, *Władysław Milata (biography)*, Przegl. geogr., 27 (1955), pp. 444-449.

[56] M. Klimaszewski, A. Wrzosek, *Zespół katedr geografii Uniwersytetu Jagiellońskiego w Krakowie w okresie XX-lecia* (The Union of Geography Chairs at the Jagellonian University in Cracow Since the Second World War), Przegl. geogr., 36 (1964), pp. 537-548.

600 years' history of geography at the Jagellonian University, we beg the forebearance of the reader. We had to limit ourselves to present those tasks, problems and persons that played the most important parts in the evolution of Cracow's Geography Department. A wider study required many comments and explanations on the background of the evolution of geography in all of Poland and in the world at large, for which there is no space in such a short paper.

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POLISH PLACE–NAMES IN THE U.S.A.

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The origin of place–names in the U.S.A. is as complex and heterogeneous as American society itself. The intricate geographical nomenclature in that country includes many foreign names, among them some of Polish origin.

We have limited the scope of this paper to places that bear Polish names, and have excluded those settlements that either no longer exist or have been swallowed up by larger conurbations. We have not paid attention to names such as *Stanisławowo* or *Wojciechowo*, commonly used by the American *Polonia* denoting only districts within large urban agglomerations, furthermore, towns whose names have been changed from Polish to American forms were omitted from this analysis.

Towns and settlements bearing names of Polish origin have been correlated with the distribution pattern of Americans of Polish descent in the U.S.A.

This article presents a synthesis of the research which has been carried out so far; the work is by no means completed.

METHOD

There is no source available giving a complete list of all towns and settlements in the U.S.A. The first step in the realization of the project consisted of completing, as far as possible, a list of all the places in the U.S.A. that bear Polish names, or names that might be of Polish origin, making use of geographical dictionaries, monographs on particular counties and states, and other historical material.

Since we consulted a number of old works, some of them published in the 19th century, it was necessary to check whether particular places mentioned in these works still existed, whether their names had been changed, or whether they had been swallowed up by larger conurbations. The "Standard Oil" maps and the "Commercial Atlas" proved to be indispensable sources.

In order to collect as comprehensive a gazetter as possible a special questionnaire was devised and sent to libraries, archives, societies, private persons and post offices in the places under scrutiny. 70% of the letters were answered, but only 45% included any complete and thorough information. A series of visits to about 25 places were also undertaken.

LITERATURE

A work closely related to the subject of this research is a list made by the Rev. Franciszek Bolek, "Settlements founded by Poles in the United States" [3]. This work proved to be very helpful even with its serious deficiencies. It includes a list of places in each state, arranged in alphabetical order. In many instances the author gives not only the name of a place, but also the county in which it is situated, the year of its foundation and the name of its founder. The author's uncritical approach to the subject matter is a serious drawback to the work; he was unable to resist the attraction of Polish–looking and Polish–sounding onomastic forms which in reality were far from being names of Polish origin. However, Bolek's work constitutes the only attempt so far to list all American place–names of Polish origin. It has provided a source of information on Polish names in the U.S.A. for other investigators such as J. Wąsowicz [32].

Substantial material on this subject can be found in the studies of authors concerned with the immigration of Poles to the United States. The following authors deserve mention in this connection: M. Haiman [9, 10], W. Kruszka [15, 16], F. Niklewicz [19, 21] and H. Sienkiewicz. Some works by American philologists and geographers also provide important, though not always complete and reliable information. Among these the basic work is a bibliography on the history of over 3,000 counties in the United States [24]. Such states as Indiana, Missouri, Nebraska, New York, Ohio, Pennsylvania and Wisconsin have published monographs.

There are a few works which aim at a synthesis of all American place-names. Although these have only a limited value for a research on Polish place-names in the U.S.A., none of them can be ignored. The most important among them are studies by H. Gannet [7], A. Holt [12] and G. R. Stewart [29].

Furthermore, there exists for every state at least one monograph on its geographical names. It should, however, be emphasized that none of them is completely comprehensive where place–names of Polish origin are concerned. The same is true of some general studies that deal with the United States as a whole.

The history of Polish place–names in the U.S.A. may be divided into

two periods. The first began at the turn of the 18th century and lasted until the mid-19th century. The second covers the period from the fifties of the 19th century up to the present day. The process by which American places acquire Polish names is by no means finished, although it is no longer as productive as it used to be. The Polish names that appeared during the first period resulted from the sympathetic attitude of Americans towards Poland and their appreciation of Tadeusz Kościuszko and Kazimierz Pułaski. However, though the former has always been extremely popular in the States, only two places and one county bearing his name are to be found there: *Kosciusko county* in Indiana, *Kosciusko* in Attala county, Mississippi, and in Wilson county, Texas. Though W. Kruszka mentions another place named *Kosciusko* in Day county, South Dakota [16], it has proved impossible to establish whether it actually exists. Of the three places called *Kosciusko* only the one in Texas was founded and named by Poles. The name of *Kosciusko* in Mississippi originated on the initiative of William Dodd, the grandson of General Dodd who, together with Kościuszko, had participated in the American War of Independence under the command of General Green. Before the place was named Kosciusko it had had several other names: Greenville, Prentice, Pekin and Paris.

The name of *Pulaski* appears more frequently on American maps than that of *Kosciusko*. We were able to find 22 places named after the hero of the battle of Savannah while the existence of another 5 remains to be confirmed. The largest town called *Pulaski* is situated in the county of the same name in Virginia. *Warsaw* is the most popular name of Polish origin in the United States. The history of 19 places of this name is known to us at the present stage of our research, and 15 more await more detailed documentation. The capital of Gallatin county, Kentucky, is the oldest of all the places bearing the name of *Warsaw*.

During the second period the initiative to give Polish names to certain places in the United States came from Polish immigrants. The oldest settlement founded and named by Poles is *Panna Maria*, Karnes county, Texas. Edward Dworaczyk [5] has written the history of that place and of some other Polish settlements in Texas.

Since the second half of the 19th century a great number of towns bearing Polish names have appeared on maps of the United States. They usually indicate from which region of Poland a particular group of pioneering settlers came. Names of the following Polish towns appear in America: *Cracow* or *Krakow* (five times), *Lublin Opole* and *Cestohowa* (twice), *Tarnow, Torun, Radom, Chojnice* and *Gniezno* (once each).

As well as *Kosciusko* and *Pulaski* a few American places have been given the names of famous Poles. A settlement founded by the actress

Helena Modrzejewska in California appears as *Modjeska,* since this is the Americanized form of her name. There are four places in Minnesota, Michigan and Wisconsin bearing the name of *Sobieski,* while in Wisconsin there is settlement called *Poniatowski.*

<div align="center">LINGUISTIC ASPECTS</div>

All the place–names of Polish origin which appear on American maps have been subject to assimilation. The Americanization of these names is brought about by the following processes:

(a) translation, for example, *Polska — Poland, Warszawa — Warsaw;*

(b) orthographic modification, i.e. by leaving out all diacritical marks not to be found in the English alphabet. Thus ą — a, ę — e, ł — l, ć — c, ś — s, ń — n, ó — o, ż — z, ż — z.

In many cases orthographic adjustment has been unnecessary as, for example, in *Lublin* and *Opole,* but such names have become adapted phonetically, i.e. place–names of Polish origin have come to be pronounced in accordance with the orthoepic rules of the English language;

(c) contraction, i.e. word–shortening as, for example, *Pułaski — Plaski, Modrzejewska — Modjeska.*

(d) addition of the — ville ending, for example, *Paveleksville, Pulaskiville.*

A research worker on place–names in the United States must be particularly sensitive to the phenomenon of homophony. F. Bolek, misled by the sound and orthographic form of some American place–names, interpreted them as being of Polish origin, though in fact they were not. Thus, for example, he included the following place–names in his list:
Polacca (Navajo county, Arizona), *Waleska* (Cherokee county, Georgia), *Hanska* (Brown county, Minnesota) and *Chokolaskee* (Lee county, Florida). All these names, when more closely scrutinized, have proved to be of Indian origin.

<div align="center">AMERICAN PLACES BEARING POLISH NAMES IN RELATION
TO THE GEOGRAPHICAL DISTRIBUTION OF AMERICANS
OF POLISH ORIGIN</div>

Fig. 1. illustrates the distribution of Polish immigrants in the United States on the basis of absolute figures [13]. The characteristic feature of the geographical pattern revealed is the dispersion of Americans of Polish origin over the whole country, their greatest concentration being in the North–East and a slightly lesser concentration around the Great Lakes. Such states as, for example, Minnesota and Texas are comparatively small
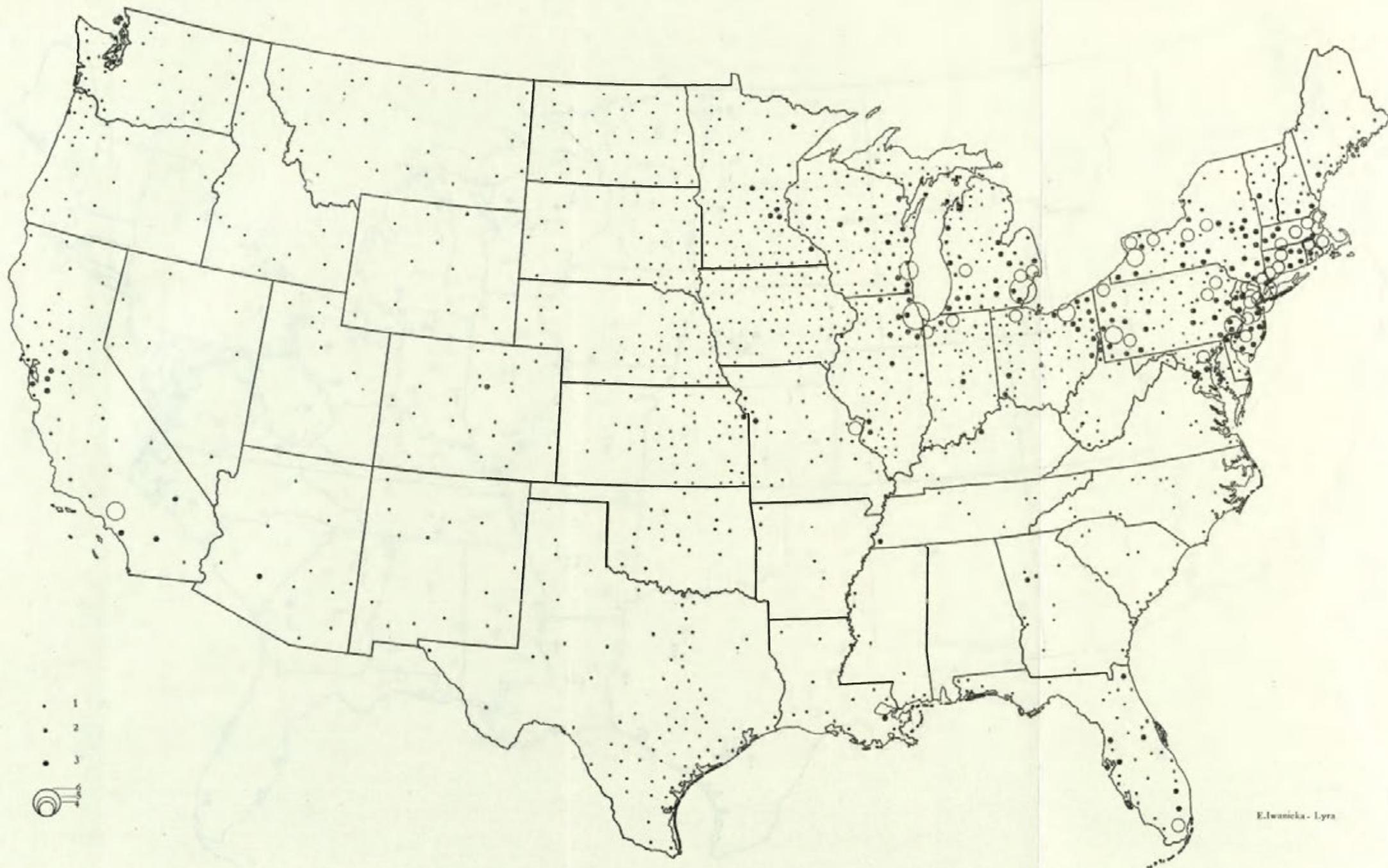
Fig. 1. Distribution of Americans of Polish descent in the United States in 1960

1 — less than 500 persons in a country, 2 — 500-1000 persons, 3 — 1000-10 000 persons, 4 — 10-50 thousand persons, 5 — 50-100 thousand persons, 6 — more than 100 thousand persons
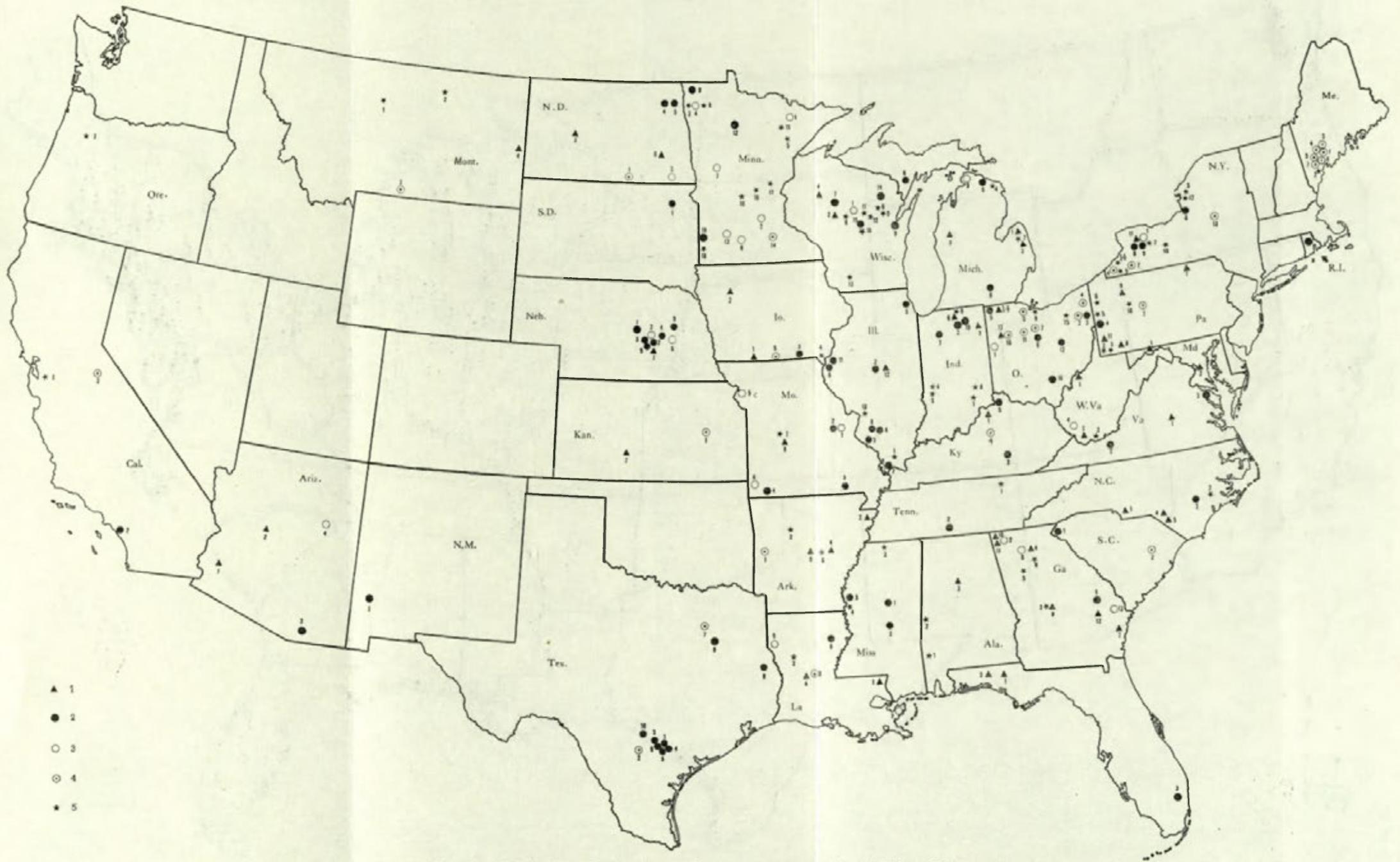
Fig. 2. Distribution of American place-names suggesting Polish origin

1 — places no longer in existence, 2 — existing places, 3 — places with names incorrectly interpreted as being of Polish origin, 4 — origin of the place-name heterogeneously interpreted, 5 — information on the origin of the place-name not available, numbers indicate place names listed in Table 3

centres of the American *Polonia* if we consider the total number of immigrants in these states. However, they are distinguished by the concentration and homogeneity of the Polish communities, which undoubtedly accounts for the presence of Polish names. Polish immigrants living in Mississippi, Kentucky, Nebraska and Utah are the least numerous.

The pattern of disribution of places bearing Polish names does not parallel that of the Polish immigration (Fig. 2). They appear mostly in the Middle West and in the Western areas of the Eastern states. Most of the Southern states have only one place with a Polish name in each, with the exception of Mississippi, in which there are three, and of Alabama and Arkansas, in which no places bearing Polish names were found. The westernmost concentrations of settlements with Polish names are found in Texas, Nebraska and California.

There are no Polish place–names in Connecticut, where the percentage of Americans of Polish origin in relation to the total number of inhabitants in particular counties, is the highest in the whole of the United States (36,8% in Hudson county), and where the number of Americans of Polish origin per square mile amounts, in the most extreme instances, to 800 persons (Hudson county), 264 (Union county), 241 (Essex county). Similarly, there is a total absence of settlements bearing Polish names in Massachusetts, where the number of Americans of Polish origin (136,961) is higher than that in Connecticut (117,663) and in Rhode Island [13]. The lack of Polish names in this part of the country can be explained by the fact that these states were already densely populated and their nomenclature had been established before the process of giving Polish names to American places began. In a state such as New York, for example, Polish names appear only in its Western area, which has a relatively low number of Polish immigrants.

Concentrations of places bearing Polish names are to be found in Texas and, to a lesser extent, in the southern part of Illinois and the central part of Wisconsin. Other Polish names are scattered all over the South and Middle West.

If we compare the two maps it can clearly be seen that there is no close correlation between the distribution of Polish immigrants and Polish place–names. The existence of Polish place–names depends less on the absolute number of Polish immigrants living in a given area than on the degree of ethnic homogeneity of their environment and on certain factors that have no connection with Polish immigration. Thus, for example, Texas, in which 18,000 Americans of Polish origin live at present, has eight places bearing Polish names, whereas New York with 700,000 Americans of Polish origin has only three.

Hitherto research has revealed that 67 places with Polish names exist

in the United States (Fig. 2.). Their distribution is as follows: Illinois — 8, Texas — 8, Nebraska — 7, Ohio — 5, Wisconsin and Minnesota — 4 in each, Michigan, Kentucky, New York and Mississippi — 3 in each, Virginia, North Dakota, Missouri and Indiana — 2 in each, and one to be found in each of other states.

The data provided by the questionnaire survey helped to establish that, out of the 67 places bearing Polish names, 37 were founded by Poles and 23 by Americans, while in 7 cases it was impossible to establish the nationality of the founders.

50 places from a list of 228 place-names no longer exist. The geographical distribution of the places which have disappeared strikes us as very interesting, since most of them, i.e. as many as 15, were in the South and the Middle West, 12 in the North–West and 8 in the West. The greatest number of places that have disappeared were in the following states: Georgia (6), Pennsylvania (4), Arkansas (3) and Michigan (3).

TABLE 1. THE PRESENT STATE OF RESEARCH ON AMERICAN PLACE-NAMES OF POLISH ORIGIN

	Total number of places under scrutiny	Existing places with names of			Places no longer existing	Information not available
		Polish origin	other origin	uncertain origin		
Number of places	228	67	24	28	50	59

The data illustrating the present state of research (Table 1) lead to the conclusion that there is still much work to be done on the problems we have discussed, since the origin of more than 1/3 of the places has not yet been settled (i.e. places with names of uncertain origin or about

TABLE 2. THE RESULTS OF RESEARCH ON PLACES WHOSE NAMES APPEAR AT LEAST TWICE

Names of places	Number of places	Existing places with names of			Places no longer existing	Information not available
		Polish origin	other origin	uncertain origin		
Warsaw	34	12	—	5	7	10
Poland	28	4	2	10	7	5
Pulaski	25	17	1	—	1	6
Sandusky	12	1	—	5	2	4
Wilno	7	2	—	—	4	1
Wanda	6	—	3	—	1	2
Cracow	5	2	—	—	2	1
Sobieski	4	3	—	1	—	—
Kosciusko	3	2	—	—	—	1
Boles	3	—	—	1	—	2
Cestohowa	2	1	—	—	1	—
Vistula	2	—	—	—	—	2

TABLE 3. LIST OF TOWNS AND SETTLEMENTS PROVED TO BEAR NAMES OF POLISH ORIGIN

states	numbers indicating the place-name on the map	place-name	county
Ariz. Arizona	3	Polaco	Santa Cruz
Cal. California	2	Modjeska	Orange
Fla. Florida	3	Korona	Breward
Ga. Georgia	1	Pulaski	Candler
Ill. Illinois	2	Mt. Pulaski	Logan
	3	Poland	Randolph
	4	Posen	Washington
	5	Posen	Cook
	6	Pulaski	Hancock
	7	Pulaski	Pulaski
	8	Radom	Washington
	11	Warsaw	Hancock
Ind. Indiana	2	Kosciusko	Kosciusko
	7	Pulaski	Pulaski
	10	Warsaw	Kosciusko
Io. Iowa	3	Pulaski	Davis
Ky. Kentucky	3	Pulaski	Pulaski
	5	Warsaw	Gallatin
La. Louisiana	6	Warsaw	Franklin
Mich. Michigan	5	Posen	Presque Isle
	6	Pulaski	Jackson
Minn. Minnesota	9	Opole	Kittson
	12	Sobieski	Beltzami
	15	Wilno	Lincoln
Miss. Mississippi	1	Kosciusko	Attala
	2	Pulaski	Scott
	5	Wiczynski	Washington
Mo. Missouri	2	Krakow	Franklin
	3	Pulaski	Ripley
	4	Pulaskifield	Barry
Neb. Nebraska	1	Boleszyn	Valley
	2	Chojnice	Howard
	4	Krakow	Nance
	5	New Posen	Howard
	8	Tarnow	Platte
	9	Warsaw	Howard
N. M. New Mexico	1	Wilno	Grant
N. Y. New York	6	Pulaski	Oswego
	8	South Warsaw	Wyoming
	9	Warsaw	Wyoming
N. C. North Carolina	2	Warsaw	Duplin
N. D. North Dakota	4	Poland	Walsh
	5	Warsaw	Walsh
O. Ohio	3	Poland	Mahoming
	5	Pulaski	Williams
	6	Pulaskiville	Morrow
	12	Warsaw	Coshocton
	16	Zaleski	Vinton

3*

c. Table 3

1	2	3	4
Pa. Pennsylvania	4	Pulaski	Beaver
R. I. Rhode Island	1	Sobieski	Clearfield
S. C. South Carolina	1	Pulaski	Oconce
S. D. South Dakota	1	Kosciusko	Day
Tenn. Tennessee	2	Pulaski	Giles
Tex. Texas	1	Cestohova	Karnes
	3	Kosciusko	Wilson
	4	Panna Maria	Karnes
	5	Paveleksville	Karnes
	6	Pulaski	Karnes
	8	Warsaw	San Augustine
	9	Warsaw	Henderson
	10	St. Hedwig	Bexar
Va. Virginia	2	Pulaski	Pulaski
	3	Warsaw	Richmond
Wisc. Wisconsin	7	Lublin	Taylor
	9	Poland	Brown
	14	Sobieski	Oconto
	15	Torun	Portage

which "information is not available"), and for most of these places there is little or, no documentation available.

Most of the settlements investigated are very small places, not only in comparison with metropolies in the United States but also with settlements in Poland. The total number of inhabitants of the five biggest towns with Polish names amount only to a few thousands and the largest of these is *Pulaski* in Pulaski county, Virginia, with 10,000 inhabitants.

In some cases the name is applied only to a few houses concentrated at a cross–roads, to a small settlement, a railway station or a trading centre which is neither a village in the Polish sense, nor a settlement, but which consists of a post–office, a general store and a gasoline station, and which is, in fact, a service centre for farmers scattered over a large surrounding area.

Further research will undoubtedly call for some modifications of the data presented in Table 2, since all the settlement points that have been marked on the map as "uncertain" will fall into one or other of the remaining groups. At the same time it may prove possible to trace some other places bearing Polish names, or to throw a different light on those that have already been examined.

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STORM REGIONS IN POLAND

Maria Stopa

The detailed analysis of the spatial distribution of the individual features of storm phenomena (e.g. number of days with storms, number of storms, local index of storm activity, hourly differences in storm occurrence periodicity of storms, index of storm duration, etc.), points to the fact, that Poland is characterized by considerable variations with respect to the features enumerated above [22]. However, the chart of the isarithms is similar in all instances, showing that their course depends principally on the influence of the ground surface which either obstructs or fosters the evolution of storms. This is particularly the case with storms of local character (intramass storms connected with zones of stationary fronts or fronts migrating very slowly), in which the frequency and development of storms are mainly linked with the character of the ground surface, variable according to the season and the time of day. On the basis of the isarithm pattern one may identify regions, where the values of the individual features are mutually correlated — an observation particularly striking in regions of extreme values. Thus, areas with the lowest number of days with storms also show the lowest number of storms, the lowest indices of storm activity, the least frequency of storm occurrence, the lowest periodicity in storm development, etc.; while, inversely, areas with the greatest number of days with storms are characterized by highest values of all the features mentioned. In the former instance a ground surface must exist on which agencies obstructing the evolution of storm features prevail whereas, in the latter, agencies furthering such evolution predominate. Even so, regions with certain divergences also occur e.g., regions showing a high number of days with storms combined with a low index of storm activity — indicating, that in those regions the character of the ground surface is complex (slope exposure, relative altitudes, etc.).

The spatial differentiation of the features discussed occurs in practically all seasons of the year; however, areas of most intensive and least intensive storm activity can be distinguished most obviously in summer, when storm intensity is highest. During that season, even relatively in-

significant differences in the relief of land forms lead to a relatively large differentiation in the number of days with storms, the number of storms, the index of storm activity, and to changes in evolution and duration of storms, etc. — those conditions enable us to distinguish regions of different storm activity. In long–range calculations of the mean values of individual storm features, it is important to select time divisions in such a manner, that their respective scope would include maximum differences. It appears for example, that the number of days with storms and the total number of storms show in Poland the greatest mean differentiation for a full year, a smaller mean differentation for seasons, and the smallest for separate months.

The local index of storm activity behaves inversely, a larger spatial differentiation is observed in the smaller time divisions such as months, while for the full year the differences for this index are to some extent obliterated.

The high spatial differentiation mentioned above in the mean number of days with storms and the number of storms, when observed for longer periods of time, must be ascribed to the fact, that during the stormy season the isarithm pattern is characterized by a certain stability, while only the values of the isarithms differ. For this reason one can make use of the isarithm pattern of the number of days with storms and the number of storms for dividing Poland into regions of divergent storm activity. By reason of the close correlation between the number of days with storms and the number of storms there has been adopted, as principal criterion, the number of days with storms, and as auxiliary criterion the local index of storm activity, that is, the ratio of the number of storms to the number of days with storms. Further arguments in favour of selecting the number of days with storms and the index of storm activity as criteria for the division of Poland into storm regions are as follows:

1. A storm is a phenomenon that rarely escapes the notice of an observer, even an observer of limited routine. Records of storms, concerning the number of days with storms, are therefore fairly reliable from all stations (both synoptical and climatological). Thus, in case of doubt, one can always rely on data supplied by climatological stations.

2. Taking into consideration the ratio of the number of storms to the number of days with storms one eliminates instances, wherein the development of storms has not been largely dependent on the character of the land forms.

It results from these reflections that, in any attempt at a more accurate regionalization or identification of storm regions in other countries, the number of days with storms and the index of storm activity are likely

Fig. 1. The distribution of meteorological stations

1 — data available for the period 1946-1955, 2 — data available for the period 1947-1955, 3 — data available for the period 1948-1955, 4 — data available for the period 1949-1955

to provide the answer, even if they fail to give a full characteristic of the region thus identified.

The remaining parameters have also been utilized as auxiliary criteria for characterizing different regions.

In view of the fact, that in the ten–year period of observations (from 1946 to 1955) the distribution of the observation points has been fairly uniform, the mean values obtained from all stations for the different storm features can be considered representative for all–Poland (the distribution of the meteorological stations is shown in Fig. 1.). It can be seen, that these stations are situated in areas of divergent conditions, and that each of them covers approximately the same area.

Therefore, as a basis for defining separate zones mean values were adopted for all–Poland and, for defining separate regions, mean values for each zone were taken. The boundaries of zones and regions were defined by the deviations between the data obtained from the points of observations and the mean all–Poland values and the mean zonal values. Here the number of days with storms were taken for the whole year, while the values for the local index of storm intensity were taken for the storm season only.

On the basis of the criteria discussed, three principal zones were distinguished, the third zone consisting of two subzones (Table 1). By analogy, within each of the zones were distinguished regions (Table 1).

TABLE 1. THE STORM ZONES AND STORM REGIONS

	Number of days with storms from to	
ZONES		
Zone I — with the number of storms lower than the all–Poland mean value	$< -1\,0$	
Zone II — with the number of storms equalling the all–Poland mean value	$-1\,0$	$+2\,0$
Zone III–A — with the number of storms higher than the all–Poland mean value	$+2\,0$	$+5\,0$
Zone III–B — with the number of storms much above the all–Poland mean value	$> +5 \cdot 0$	
REGIONS		
— Regions with the number of storms lower than the mean value of the zone	$< -2\,0$	
— Regions with the number of storms equalling the mean value of the zone	$-2\,0$	$+2 \cdot 0$
— Regions with the number of storms higher than mean value of the zone	$> +2\,0$	

Due to the specific distribution of the deviations mentioned and the values of the auxiliary criteria, we observe in some of the zones an absence of the mean value regions (where the number of storms equals the mean value of the zone), or the presence of more than one region with similar storm activity. Although all storm regions distinguished in the different zones have been assigned to some places in the classification schedule presented, in every region the number of storm features is dependent on the influence of different features of the topography — a fact which led to assigning geographical names to the different regions. The distribution of 16 fairly distinct storm regions mapped on Polish territory is shown in Fig. 2.

In delineating the boundaries of the individual storm zones and regions, prime importance was given to the value of the deviations, but also taken into account was the whole geographical region represented by the given station: its relation to neighbouring regions, and the question of the nature and extent of their differences. This made it possible to adapt, to some extent, the boundaries of the storm regions distinguished to the boundaries of geographical regions. The latter, however, do not

always match; it often happens that one storm region comprises more than one geographical region, and vice versa.

In dubious cases the work sheets were also consulted, recording the distribution of the number of days with storms during individual months, seasons and full years within a 10-year period extrapolated by 5 years (from 1951 to 1960), because by then the number of meteorological stations had trebled. These work sheets were prepared in order to prove the stability of the boundaries of the storm zones and storm regions delineated.

In general, the pattern of the isarithms shown in the auxiliary maps resembles the pattern shown in another author's paper (20).

The characteristics of storm zones and storm regions

Zone I. (The number of storms lower than the all–Poland mean.) This zone covers the northern part of Poland, extending southward as far as the 53° parallel of latitude. The numerical characteristics of this zone are given in Table 2.

TABLE 2. THE NUMERICAL CHARACTERISTICS OF THE ZONE I

	Mean number of days with storms (ld)				Index
	Spring	Summer	Autumn	Year	May–August season
Zone I	4·3	12·6	1.4	18·5	17
all-Poland	5·2	14·5	1·6	21·3	19
Difference	—0·9	—1·9	—0·2	—2·8	—2

Within this zone, five regions were distinguished: two with the number of storms lower than the mean — the Western Baltic and the Warta–Noteć Region; two with the number of storms equalling the mean — the Pomeranian and the Masurian Region; and one with the number of storms higher than the mean — the Lower Vistula Region.

Zone II. (The number of storms equalling the all–Poland mean). This zone embraces almost the entire centre of the country. The numerical characteristics of zone II are shown in Table 3.

Within this zone, three regions were distinguished: the first with the number of storms lower than the mean — the Greater Poland Region; the second–with the number of storms equalling the all–Poland mean — the Masovia–Podlasie Region; and the third — with the number of storms higher than the mean — the Zielona Góra Region.

Zone III–A. (The number of storms higher than the all–Poland mean).
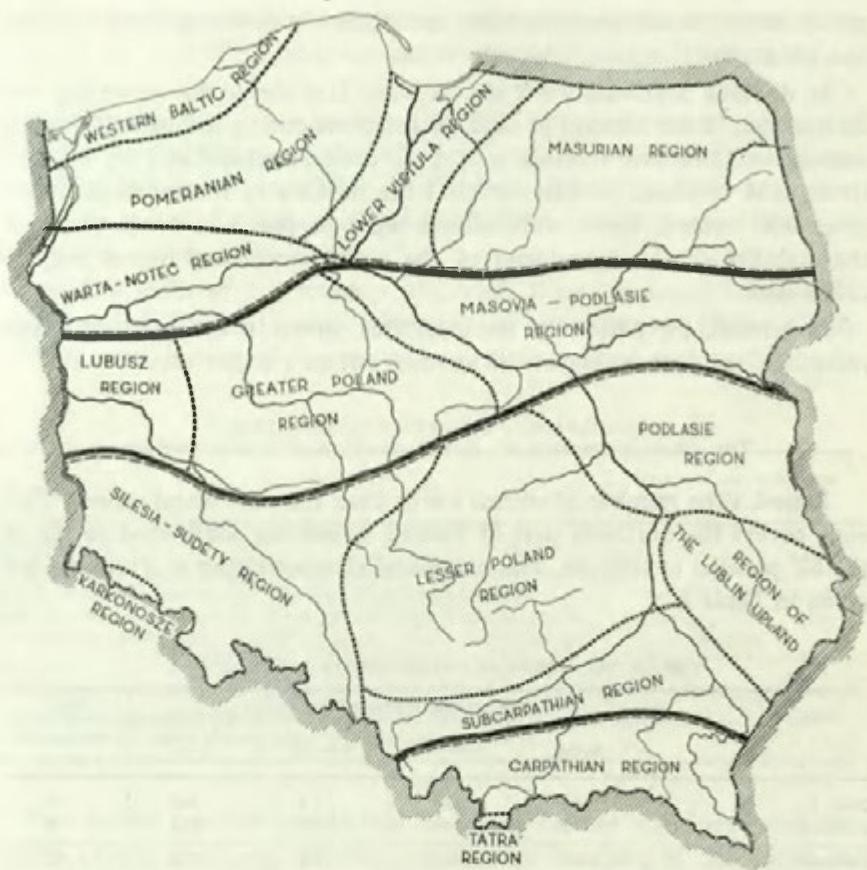
Fig. 2. Division of Poland into storm regions

This zone comprises the belt of southern uplands including the Sando-
mierz Basin, the Silesian Lowland and the Sudety Mountains (excluding
the Karkonosze Range). The boundaries of this zone are probably the most
definite, in the north running along the margin of the Podlasie Plateau,
the Lesser Poland Upland and along the Kocie Góry Hills and in the south

TABLE 3. THE NUMERICAL CHARACTERISTICS OF THE ZONE II

	Mean number of days with storms (Id)				Index
	Spring	Summer	Autumn	Year	May–August season
Zone II	5·3	14·1	1·4	21 0	19
all–Poland	5·2	14·5	1·6	21·3	19
Difference	0·1	—0·4	—0·2	—0·3	00

TABLE 4. THE NUMERICAL CHARACTERISTICS OF THE ZONE III-A

	Mean number of days with storms (Id)				Index
	Spring	Summer	Autumn	Year	May–August season
Zone III–A	5·6	15·3	1·7	22·8	20
all–Poland	5·2	14·5	1·6	21.3	19
Difference	0·4	0·8	0 1	1·5	1

along the line of the Carpathians. The numerical characteristic of Zone III–A are given in Table 4.

In this zone as in zone I, five regions were distinguished: two with the number of storms lower than the all–Poland mean — the Lesser Poland Region and the Lublin Upland; two with the number of storms equalling the all–Poland mean — the Silesia–Sudety Region and the Podlasie Region; and one with the number of storms higher than the all–Poland mean — the Subcarpathian Region.

Zone III–B. (The number of storms well above the all–Poland mean). This zone embraces the Carpathians and the highest part of the Sudety Mountains — the Karkonosze Range. The numerical characteristics of Zone III–B are shown in Table 5.

TABLE 5. THE NUMERICAL CHARACTERISTICS OF THE ZONE III-B

	Mean number of days with storms (Id)				Index
	Spring	Summer	Autumn	Year	May–August season
Zone III–B	6·7	17·9	1·9	26·8	29
all–Poland	5·2	14·5	1·6	21·3	19
Difference	1·5	3·4	0·3	5·5	10

Within this zone, three regions were distinguished: two with the number of storms equalling the all–Poland mean — the Carpathian Region and the Karkonosze Region; and one with the number of storms much higher than the all–Poland mean — the Tatra Region. The numerical characteristics of the regions are given in Table 6.

In conclusion it should be added, that by analogy one can distinguish regions based on other meteorological phenomena or elements. Thus, the application of an identical criterion to other meteorological features correlated with each other would result in a comprehensive apportionment of climatic regions.

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TABLE 6. THE NUMERICAL CHARACTERISTICS OF STORM REGIONS DISTINGUISHED

No.	Name of region	Mean number of days with storms				Index of storm activity			Period of storm occurrence			Ratio of number of hail storms to total number of storms per year in %	Mean duration of storms in minutes
									start	end	mean duration of period in number of days		
		Spring	Summer	Autumn	Year	Spring	Summer	Storm Season	mean time	mean time			
1	Western Baltic	3·2	10·1	1·6	15·2	7·0	11·2	8·0	26.IV	5.IX	133	24	62
2	Warta-Noteć	4·1	10·3	0·5	14·5	13·5	12·5	12·5	15.IV	29.VIII	136	15	71
3	Pomeranian	4·2	12·8	1·6	18·8	18·4	18·9	17·6	22.IV	12.IX	146	20	91
4	Masurian	4·1	12·5	1·1	17·7	7·5	16·8	14·5	25.IV	3.IX	131	18	72
5	Lower Vistula	5·2	14·2	1·6	21·1	18·5	16·8	16·5	17.IV	13.IX	148	23	68
	Zone I	4·3	12·6	1·4	18·5	14·5	17·2	17·0	20.IV	8.IX	141	22	75
6	Zielona Góra	5·7	15·9	1·2	22·9	15·0	32·0	27·5	15.IV	5.IX	142	23	77
7	Greater Poland	4·8	12·5	1·3	18·7	18·2	17·7	18·0	23.IV	5.IX	139	16	74
8	Masovia-Podlasie	5·3	14·4	1·5	21·4	8·8	15·8	13·1	20.IV	15.IX	146	22	76
	Zone II	5·3	14·1	1·4	21·0	14·0	19·0	19·0	23.IV	9.IX	142	20	76
9	Lesser Poland	5·2	15·4	1·8	22·5	13·8	16·3	15·7	18.IV	11.IX	151	25	68
10	Lublin Upland	5·4	15·0	1·2	21·7	14·6	20·0	19·4	16.IV	16.IX	150	26	63
11	Podlasie	5·4	15·4	2·0	22·8	23·3	20·6	22·6	20.IV	13.IX	147	30	60
12	Silesia-Sudety	5·9	15·1	1·7	22·8	17·9	21·6	21·5	15.IV	11.IX	145	18	78
13	Subcarpathian	5·8	15·7	1·6	23·5	16·4	24·0	22·8	12.IV	9.IX	140	22	66
	Zone III-A	5·6	15·3	1·7	22·8	16·1	19·7	20·0	13.IV	10.IX	147	22	70
14	Carpathian	6·7	17·2	1·8	26·2	19·4	27·3	26·2	12.IV	11.IX	144	24	70
15	Karkonosze	5·1	17·3	1·8	24·3	20·0	31·0	29·0	24.IV	12.IX	141	74	94
16	Tatra	8·3	22·9	2·3	33·6	34·0	48·0	48·0	9.IV	17.IX	161	62	83
	Zone III-B	6·7	17·9	1·9	26·8	20·4	30·3	29·0	12.IV	11.IX	146	35	77

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THE PROPOSAL FOR A MAP OF WORLD SETTLEMENT
ON THE SCALE 1:1,000,000

Franciszek Uhorczak

Since the beginning of geography, settlements have been the object of interest, and during the last few decades they have been dealt with by geographers from many points of view. Among many problems dealing with the geography of settlement — ranging from the origin of settlement to a contemporary functional typology — the distribution of settlements on a macroregional (continental) scale has been rather neglected, although settlements connected by roads constitute one of the most interesting anthropogenic problems of our globe.

One of the reasons why the geographical distribution of settlements has been overlooked may be accounted for by the lack of detailed and accurate topographic maps for many areas, and difficulties resulting from diversified forms of settlements, i.e. from single scattered buildings or homesteads, on the one hand, to large conurbations, on the other.

Different methods of classification, inadequacy or even lack of uniform criteria of classification, lack of census data in some countries, are the reason that the number of settlements on the globe, which is approximately estimated to be 4 million, remains still tentative. For example the number of settlements in Turkey is 35,000, in India 560,000, and in the Soviet Union is 710,000 respectively. But small settlements, numbering 236,000, i.e. one third of the number of settlements in the Soviet Union, are located in Estonia and Latvia, which constitute just 0·5% of the territory of the Soviet Union.

Still less adequate is our knowledge of the area occupied by settlements in the world. In Poland for example the settlement–areas constitute 2·6% (8,100 sq. km) and areas occupied by the transportation facilities amount to 3·1% (9,600 sq. km) of the total surface. Thus only two types of anthropogenic areas constitute almost 5·7% of the total surface in Poland, i.e. 17,000 sq. km, while waters, a natural element of geographical environment 2·5% of the surface. If we accept that only 2% of the world surface is covered by settlements in all the continents inhabited by man

(except for the Antarctica) the total surface would amount to 2·7 million sq. km. This number is rather underestimated and it will increase with the growth of population.

It is worth while to obtain a geographical pattern of this unusually diversified phenomenon which is created by man, and which takes up about one fortieth of the continents.

Among the problems of geographical settlement distribution on a macroregional scale, one of the main points is that of the boundary settlement in the arctic, desert and mountainous areas. Within the limits of inhabited areas two opposed settlement types dominate — agglomerated and scattered — with all intermediate forms in between. Excluding theoretical considerations on the problem of settlement, the interest of the author of this paper was concerned with the cartographic pattern of settlement distribution on a macroregional scale. The problem seems to be simple. Topographic maps present the cartographic pattern of settlement distribution but only within the limits of a large topographic scale. If we wish to present the cartographic pattern of settlement on a scale smaller than that used in topographic maps but still geographically correct (the differentiation of the settlement character being preserved), we face serious difficulties, the main obstacle in applied cartography, is that of generalization.

The presentation of agglomerated settlement drawing by contour of built up areas is not difficult. Much more difficult is the problem of how to present dispersed settlement patterns without missing its character in using it in scales which are smaller than the scales of basic maps. During the last 30 years the author of this paper has attempted to work out, and to apply, the method of objective generalization in presenting a cartographic pattern of settlement.

METHOD

At the XII International Geographical Congress in Paris in 1931 my equidistants method of representing the distribution and character of settlement was demonstrated. The main principles of drawing the equidistants from homesteads; the radius of the equidistant depending on the scale of basic map and the degree of proposed photomechanical reduction of the settlement patterns. Some examples of applying various equidistants in maps of various scales, are given in Table 1.

Thus by aggregation and enlargement of the settlement patterns in the limits of applied equidistants one can obtain a clearly visible although greatly reduced picture which is topographically correct. Here in lies the value and superiority of the equidistant method as compared with car-

TABLE 1. APPLICATION OF VARIOUS EQUIDISTANTS TO MAPS ON VARIOUS SCALES

Scale	equidistant in m	2r		diameter of dot*—2r in mm after reduction to scale			
		in field m	on map mm	1:300,000	1:500,000	1:1,000,000	1:2,000,000
1:25,000	25	50	2 0	0 17	0 1	0 05	0 025
	50	100	4 0	0·33	0·2	0 1	0 05
1:50,000	25	50	1 0	0 17	0 1	0 05	0 025
	50	100	2 0	0·33	0.2	0 1	0 05
1:100,000	50	100	1 0	0·33	0·2	0 1	0 05
	75	150	1·5	0·5	0·3	0 15	0 075
1:200,000	75	150	0·75	0·5	0·3	0 15	0 075
	100	200	1 0	0·66	0·4	0·2	0 1

* Dots represent one bulding or homestead in various scales. It is anticipated that a dot can be seen having a diameter at least 0·1 mm.

tographic generalization. The cartographic generalization reduces the scale and enlarges the topographic pattern of settlement, but it deforms the pattern especially in areas with dispersed settlements.

Application of the Method

In the interwar period the equidistants method was used for the making of maps of settlement of two large regions of Poland on the basis of the map 1:100,000 and the equidistant of 100 m (diameter = 200 m). War prevented the publication of the maps. In the years 1952–1956 a map of settlement was made based on the map 1:100,000 and the equidistant 50 m (diameter = 100 m), with the final photoreduction to scale 1:1,000,000. The map was prepared as a part of General Map of Land Utilization in Poland and published [1]. It was demonstrated at a Cartographic Exhibition in Rio de Janeiro in 1956. In 1956 a map of settlement was made in the scale 1:1,000,000 for the sheet Krakow — NM 34, of the International Map of the World 1:1,000,000, on the basis of the map 1:200,000 and the equidistant 75 m (diameter = 150 m).

An attempt to obtain the upper boundary of settlement in high mountains was based on a map of Switzerland, on the scale: 1:100,000 and the equidistant 75 m. It has been reduced photographically to four scales: 1:300,000, 1:500,000, 1:1,000,000 and 1:1,700,000. In none of those maps generalization was applied. The upper boundary of settlement with regard to the contour line 1000 m is very interesting.

Taking as a basis topographic maps on the scale 1:200,000 and the equidistant 75 m a map of settlement was made for six sheets of the
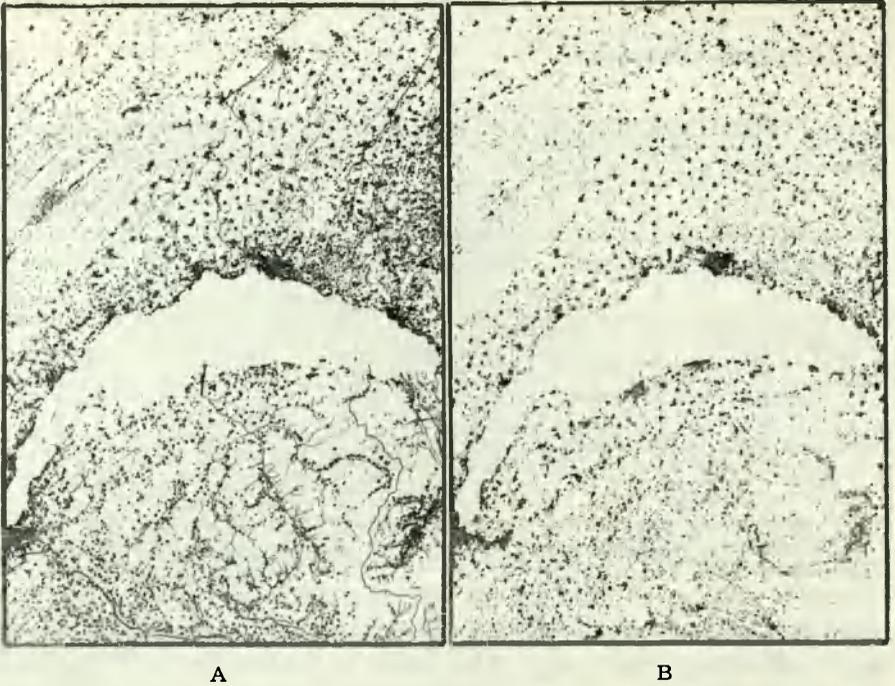
Fig. 1. Settlement pattern at Lake of Geneva (Switzerland), based on 1 : 100,000 (A) and 1:200,000 (B) maps using the 75 m equidistant, reduced to the scale 1:1,000,000
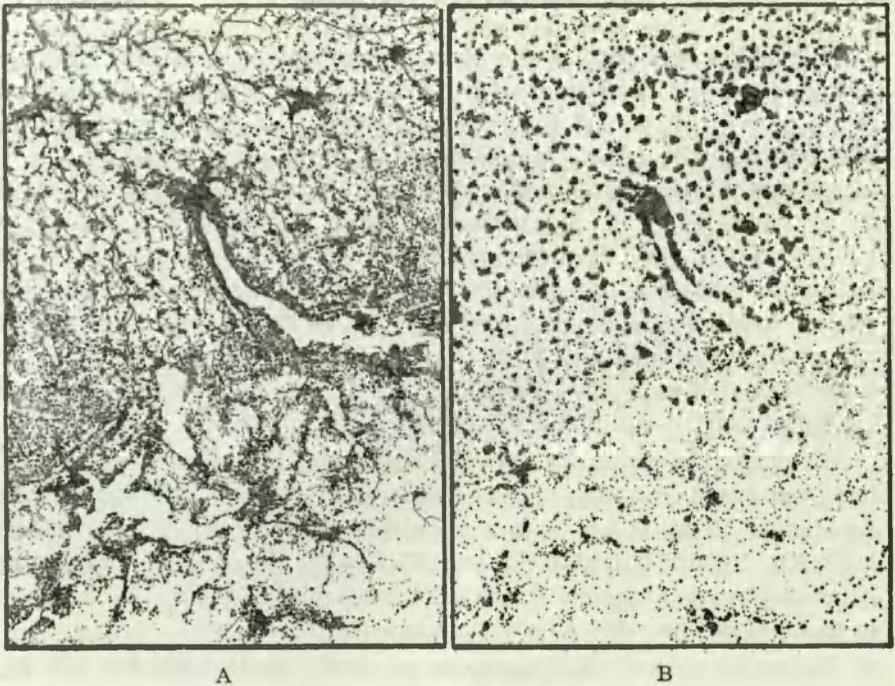

Fig. 2. Settlement pattern at Lake of Zurich and Lake of Lucerne (Switzerland), based on 1:100,000 (A) and 1:200,000 (B) maps using the 75 m equidistant, reduced to the scale 1:1,000,000
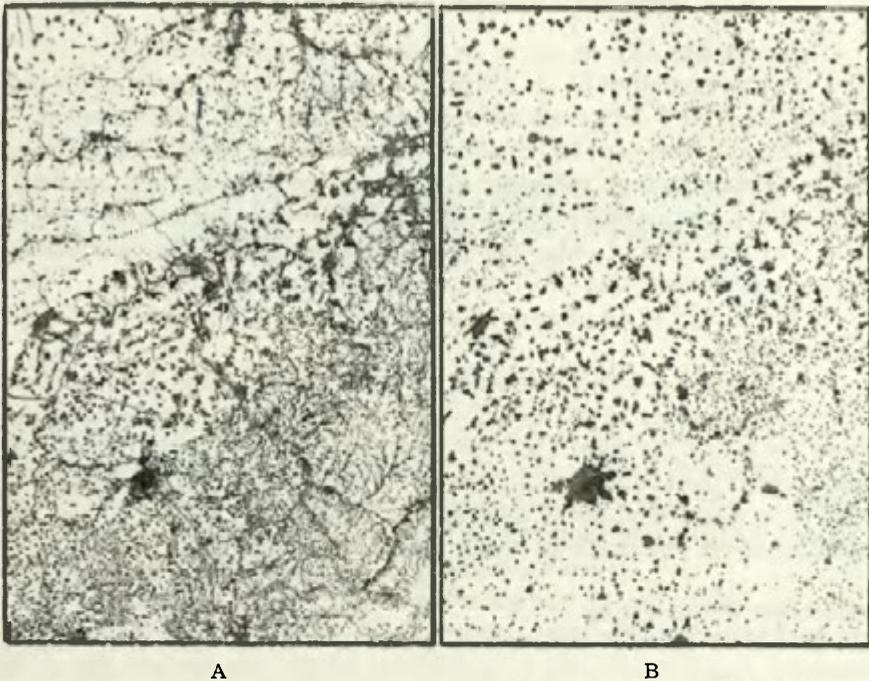
<div align="center">A   B</div>

Fig. 3. Settlement pattern around Bern (Switzerland), based on 1:100,000 (A) and 1:200,000 (B) maps using the 75 m equidistant, reduced to the scale 1:1,000,000

International Map of the World 1:1,000,000: NL-31 Lyon, NL-32 Milano, NL-33 Trieste, NM-31 Paris, NM-32 München, NM-34 Krakow; total cover of area is 1,200,000 sq.km (Including the new published sheet Paris). The above sheets consist of areas which are geographically very different, they include the Alps and the Carpathians, on the one hand, and the plains of Lombard, Hungary, and Poland, on the other. Geographical differentiation is reflected by the varied character of settlement. The results obtained are as follows:

1. Topographic maps 1:200,000 are adequate basic material permitting one to obtain a pattern of geographical distribution and regional differentiation of world settlement in order to present it on the scale 1:1,000,000.

2. The cartographic pattern of settlement obtained by use of equidistant 75 m and the basic map of 1:200,000 reflects the character of settlement sufficiently correctly (upper boundary, agglomerated and dispersed settlement), although in comparison with the pattern based on the 1:100,000 map it is less detailed (Figures 1–3 sections from the map of Switzerland: the left hand section is based on the map 1:100,000, and the right hand one is based on the map 1:200,000).

Proposal for a Map of World Settement

The proposed map of world settlement may make possible:

1. The presentation of an actual pattern of geographical distribution of settlement as a document showing the existing state of settlement.

2. The provision for obtaining the relationship and correlation between the settlement pattern and other elements of geographical environment, for example: settlement + waters, settlement + forests, settlement + roads.

3. The provision of unlimited scope for investigating the relationship between settlement and other forms of man's activity.

4. The supply of an adequate basis for preparing a map of the world population.

One sheet of a settlement map 1:1,000,000 takes about 200 hours of work plus expenses of photography and printing. It is feasible for those areas for which the maps 1:200,000 have been already made. Taking this into account the author considers that it is desirable to begin the preparation of a world settlement map on the scale of 1:1,000,000 under the auspices of the International Geographical Union (I.G.U.).

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[1] *Poland, General Land Utilization Map* 1:1,000,000, Warszawa 1957.

INDEX OF "THEORETICALLY" EMPLOYED WORKERS.
A CRITERION IN DEMARCATING INDUSTRIAL
CENTRES ON MAPS

LECH RATAJSKI

The correct choice of a criterion defining magnitudes of industrial centres on maps is still an open question, despite numerous attempts that have been made to solve this problem. The complex problematics of industry, its means of production and its output, are being set out in different ways and measured by different units of measurement.

In cartography we note most frequently the following five principal criteria, by which the magnitude of industrial centres is defined: 1 number of workers employed, 2 gross production, 3 net production, 4 value of fixed assets, and 5 production in physical units. Apart from these, occasionally other criteria are used, such as, productive capacity, power installed, electric energy consumed, etc. Observations in this paper are confined to the five first–named criteria.

The number of workers employed is treated in different ways: some figures take only workmen into consideration, others take the whole personnel of a plant. Even so, it seems that in view of the enormous progress achieved in production processes, one cannot consider the workmen alone; productive work is effected just as much by the activities of the management and the office staff, as well as by representatives of various special functions like work organization, psychology, sociology, plastic art, etc. Further, the cost of production includes salaries and other benefits for the entire plant personnel, not the wages of the workmen alone.

In the evaluation of industrial centres, the criterion of the number of workers employed loses increasingly its former significance, since progress is being made in mechanization and automation of production and, due to this, output per worker is also increasing — because a shorter time is required per operation. The mistake made in continuing to use the criterion discussed is also emphasized by the large difference in work efficiency which appears, when in the various groups of industry produc-

tion is measured by value (its cost). This shows, that this criterion exalts unduly the importance of plants retarded in mechanization.

On the other hand, this criterion is fully justified wherever it is a question of labour, its structure and balance, and when it is intended to illustrate industrial employment on maps, as a logical element tied in with further data revealed on the map.

Even so, the value of this criterion, often decisive for its being applied, is the ease of obtaining numerical data, because all statistics contain these figures. The number of workers employed is readily used the world over as a general index — requiring no transformation by regions and suitable for direct comparison — for maps of the world and of continents, even for maps of countries and smaller regions[1].

Gross production expresses the value of work done, including the cost of the raw material and of other semi–products used by the plant and brought in from outside. In instances, when a map shows separately plants, where some raw material is given preliminary treatment only, and plants that do the final manufacture, it is difficult to avoid considering the same material several times, once where it is created, again where preliminary work is done on it and, finally, where it is given its finished form. Various industries are characterized by marked differences in the relation between the value of the raw material used and the work applied in creating the final product. Industrial plants working up high–priced raw materials with expensive auxiliary constituents and relatively low manufacturing costs are shown on the map as large, although in fact the productive work done is rather insignificant. In certain factories like those of the foodstuff industry, the new value created is but 5–10% of the value of gross production, while in others, like in machinery construction, it is 60–90%[2], and here the value of gross production per worker is correspondingly like 2 to 1[3].

Often the value of this production also depends on the price policy, both as to raw material and to the final product. However the criterion of gross production also has its good points. Measured in prices it is comparable for all branches, groups and types of industry; moreover, it is widely introduced into statistical accounting and, therefore, it is freely used by planners and by the staffs of economic agencies.

Net production omits the cost of the raw material, indicating merely

[1] For example: *World Atlas*, by PWN; the German Planungsatlanten; the Austrian Atlas Niederoesterreich, Salzburg Atlas, etc., G. Alexandersson's "The Industrial Structure of American Cities", Stockholm 1956.

[2] N. N. Baranskij, A. I. Preobrazenskij, *Ekonomicheskaya kartografiya*, Moscow, 1962, pp. 284.

[3] After Central Statistical Office.

the created value. Under Polish conditions it is difficult to apply this criterion, because for groups and types of industry subventioned by the State, statistical evidence indicates minus values. For this reason, the official prices charged for products appear to be lower than the cost of production. Further, for some groups of industry net production is not calculated at all; for individual power plants, for instance, production costs are summarized for the entire domain of the Power Ministry. This is the reason, why such data can not be taken into consideration in preparing maps.

Value of fixed assets means, in other words, the investments made by a plant. This index favours new plants with expensive equipment — an investment not always tantamount with higher production figures. This is so, because the means of production of a plant are not utilized on an identical scale, not even within the same industrial group. The problem of making full use of the capacity of the plant equipment is connected with differences in ability of operating it at full capacity, in the utilization of reserve capacity available, in a suitable work organization, in the number of shifts operating (1 to 3 per working day), etc. The index for the value of the fixed assets is their cost, and therefore this index is easily comparable in the scale of the country's currency.

Production in natural units, or the product created measured by physical units like tons, pieces, litres, metres, etc. This index can merely be applied on analytical maps, that is, in analysing one type of industry only. Its application is simple, and practical. However, it cannot be used for maps covering a variety of types of industry, or on which the industry of a given centre and its internal structure of production is represented by a single diagram. The reason is, that no comparable value for physical units can be found in the diversified nomenclature used in the chemical, machinery, foodstuff, etc. industry, respectively. In generalizing processes, this index must be replaced by another, more universal one.

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The purpose of the present paper is to point out the mutual correlation between the different criteria, and to attempt the determination of the criterion most suitable for practical use, with Poland's economic conditions as example. Statistical data dealing with the number of workers employed, the gross production and the net production[4], the value of the fixed assets, and the production measured in physical units were used.

[4] In view of the arguments put forth on page, the net production was left out in a number of our observations.

The present investigations were limited to the study of 23 industrial centres. State—owned enterprises were taken into account separately. They were selected so as to include large centres with complex industrial structures, some small centres, and a few of intermediate size as well.

Fig. 1. Flour milling industry
Size of centres according to the number of persons actually employed. 1 sq mm = 10 persons.

For determining the mutual relation of magnitude of these centres, 8 maps and 7 graphs were compiled. The maps consist of two parts: one group for but one type of production (flour milling) which has successively been defined by the number of workers employed, production in physical units (tons), gross production, in million Zlotys and value of fixed assets, in million Zlotys. Net production was omitted for the reasons mentioned above. For case of comparison, a circle of constant size was adopted to designate the lowest values in each of the four groups con-

sidered. This made it possible to perceive changes occurring on all four maps for the remaining centres in relation to the smallest centre. This smallest centre is in Fig. 1 — Ostrów Wlkp., in Fig. 2 — Ostrowiec Świętokrzyski; in Fig. 3 — it is Ostrowiec Świętokrzyski again, and in Fig. 4 —
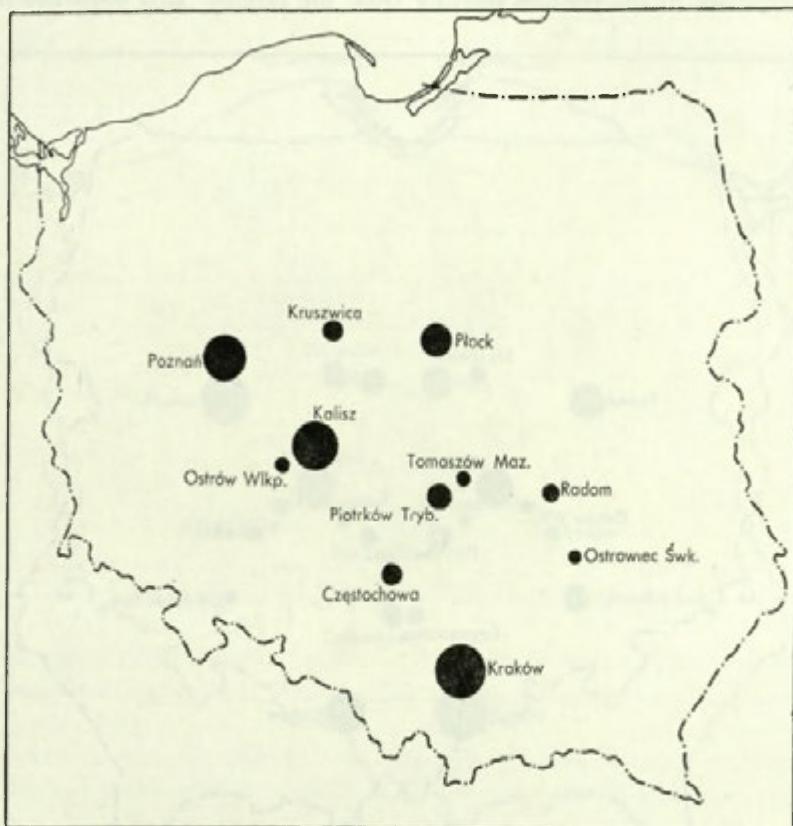
Fig. 2. Flour milling industry
Size of centres according to physical production.
1 sq mm = 2·5 thousand tons.

it is Tomaszów Mazowiecki. All centres of this industrial group, shown on the maps, operate one mill each, only Cracow has two in operation.

An analysis of these maps yields the following observations:

a) the differences between respective sizes of centres are smallest in Fig. 1 (number of workers employed);

b) the differences are largest in Fig. 4 (value of fixed assets);

c) 2 maps are very similar with regard to the sequence of expansion

of the centres with regard to the smallest centre (production in physical units, and gross production);

d) in sixe sequence of the centres it is Fig. 4 that differs most distinctly from the remaining maps.

These observations are more definite in Table 1, in which is presented the sequence of the centres starting from the largest. This sequence has

Fig. 3. Flour milling industry
Size of centres according to gross production.
1 sq mm = 5 million tons.

been arranged according to the number of workers employed, and by numerals in the columns is given the sequence number for each of the respective indices.

The above tabulation shows that, in the study of a single type of production, among the criteria distinguished those of production in physical units and of gross production run practically parallel; thus it

may be concluded, that of these two criteria one would suffice. Closest to the criteria mentioned is that of the number of workers employed. In this only one centre appears to be radically divergent, that is Ostrowiec Świętokrzyski. Evaluation on the basis of fixed assets in plants of identical production differs too widely from the remaining three criteria to be applicable in preparing maps intended to show true proportions
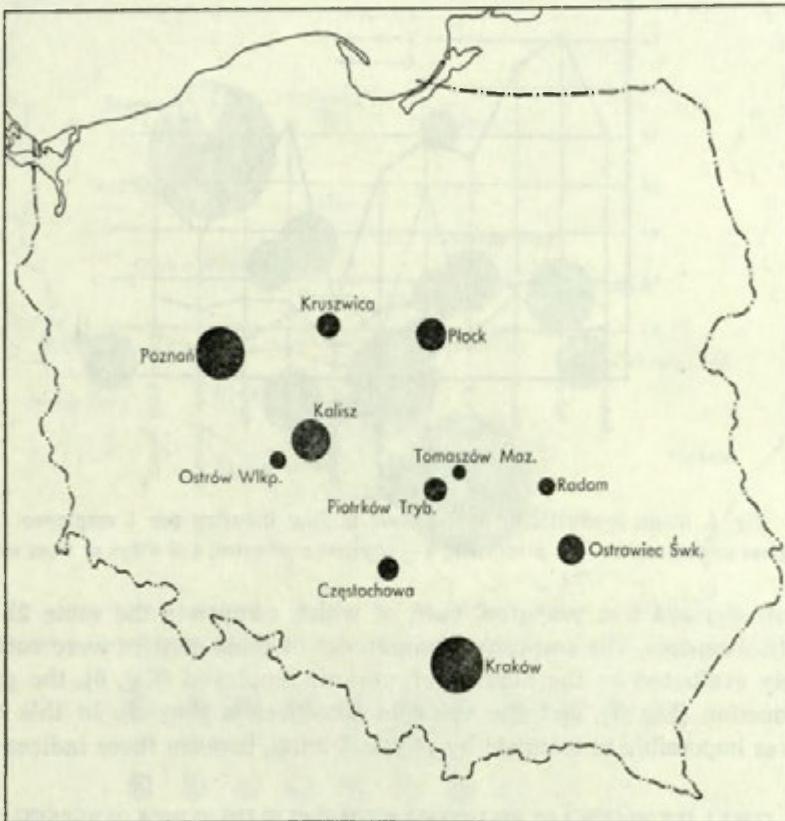
Fig. 4. Flour milling industry
Size of centres according to the value of fixed assets.
1 sq mm = 1 million Zlotys.

between industrial centres. Further, the disadvantage of the fixed assets criterion is also indicated by a graph showing this value per worker employed (Fig. 5). Three lines of this graph (gross production, net production, and production in physical units) define the coefficient of labour efficiency, while the fourth represents the value of the fixed assets per worker. In this table it is easy to perceive the similarity in the rhythm

of the production data and the arhythmic pattern of the lines referring to values of the fixed assets.

Let us now study the situation when not one industrial group is investigated, but rather the whole assemblage of industrial branches encountered within a given industrial centre. For this purpose a second
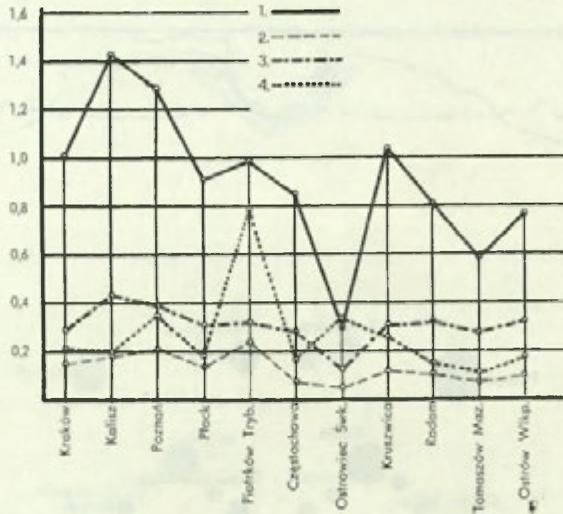
Fig. 5. Mean productivity in the flour milling industry per 1 employee
1 — gross production, 2 — net production, 3 — physical production, 4 — value of fixed assets.

group of maps was prepared, each of which comprises the same 23 industrial centres. The respective magnitudes of these centres were successively evaluated by the number of workers employed (Fig. 6), the gross production (Fig. 7), and the value of fixed assets (Fig. 8). In this case it was impossible to estimate by physical units, because these indices are

TABLE 1. THE SEQUENCE OF THE CENTRES ACCORDING TO THE NUMBER OF WORKERS

Centre	number of workers employed	production in natural units	gross production	value of fixed assets
Cracow (Kraków)	1	1	1	1
Kalisz	2	2	2	3
Poznań	3	3	3	2
Płock	4	4	4	4
Piotrków Tryb.	5	5	5	7
Ostrowiec Świk.	6	11	11	5
Częstochowa	7	7	7	8
Kruszwica	8	6	6	6
Radom	9	8	8	9
Tomaszów Maz.	10	10	10	11
Ostrów Wlkp.	11	9	9	10
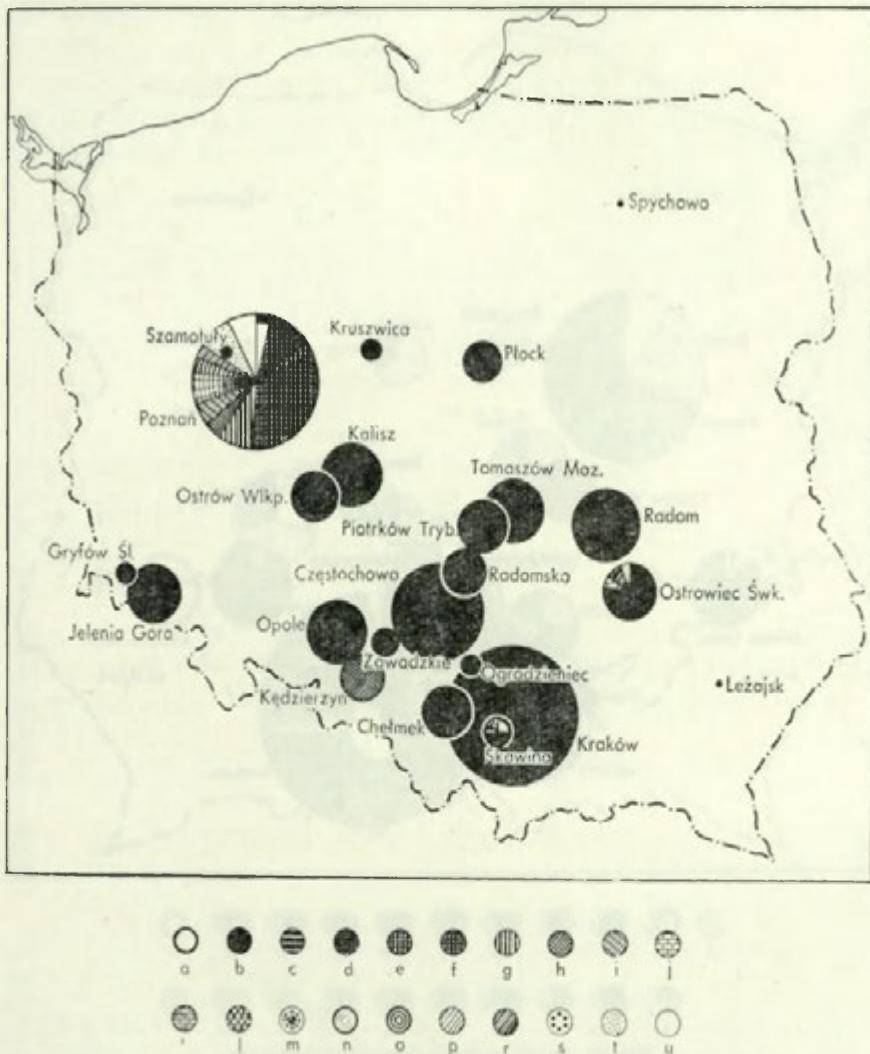
Fig. 6. Scale and structure of industry (given for four centres: Poznań, Ostrowiec Świętokrzyski, Skawina and Kędzierzyn, other centres are represented in gross data only)

Size of centres according to the number of persons actually employed; industrial branches: a — electric and thermal power production, b — iron metallurgy, c — non-ferrous metallurgy, d — engineering industry and metal construction, e — electrical engineering industry, f — means of transport production, g — metal industry, h — chemical industry, i — rubber industry, j — building materials industry, k — glass industry, l — pottery and china-ware industry, m — timber industry, n — paper industry, o — printing industry, p — textile industry, r — clothing industry, s — leather and footwear industry, t — food industry, u — other industrial branches.
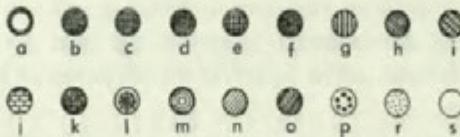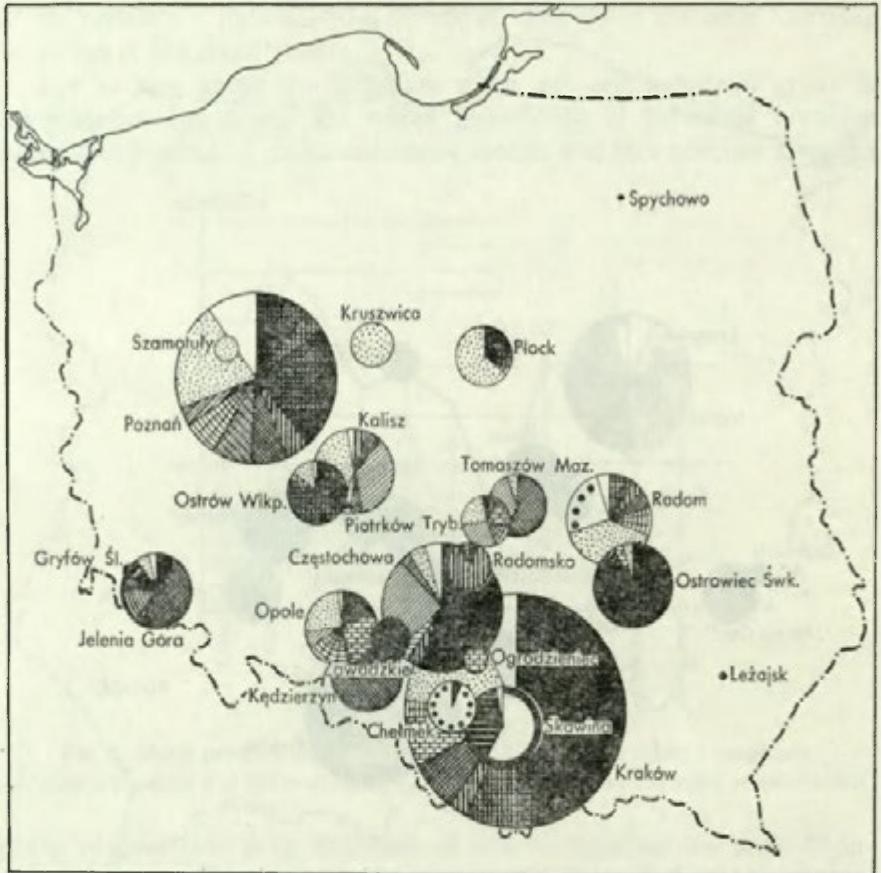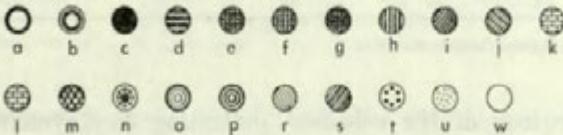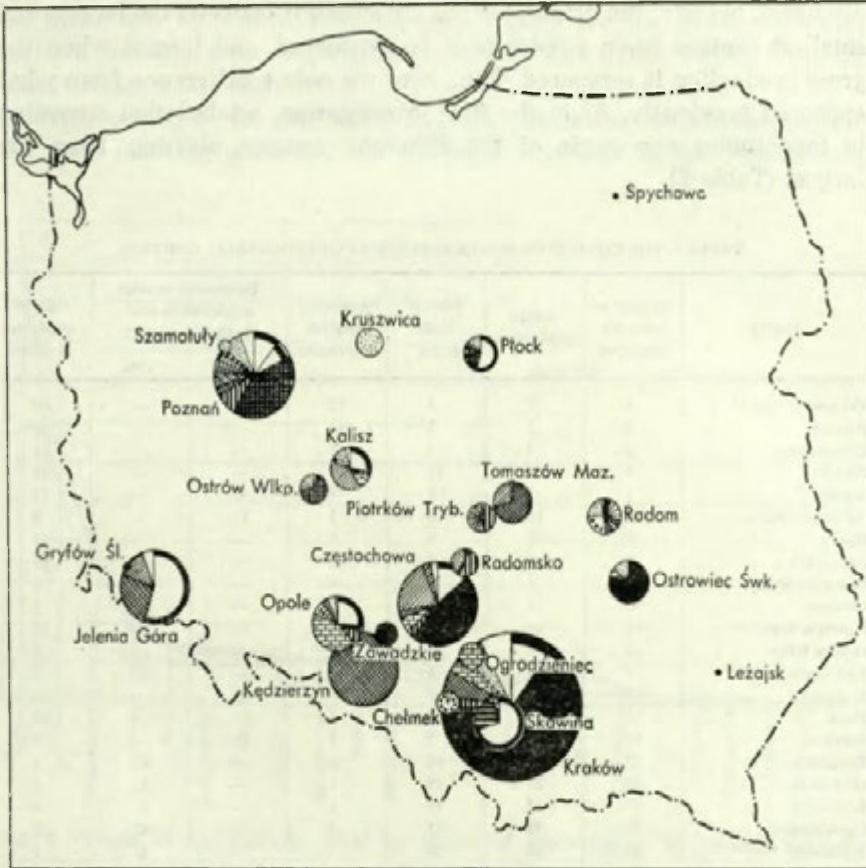
Fig. 7. Scale and structure of industry

Size of centres according to gross production; industrial branches: a — electric and thermal power production, b — iron metallurgy, c — non-ferrous metallurgy, d — engineering industry and metal construction, e — electrical engineering industry, f — means of transport production, g — metal industry, h — chemical industry, i — rubber industry, j — building material industry, k — glass industry, l — timber industry, m — paper industry, n — textile industry, o — clothing industry, p — leather and foot-wear, industry, r — food industry, s — other industrial branches.

not comparable. The principle adopted in preparing these maps was the same as for the group discussed previously. However, the concurrence between gross production and production in natural units as determined previously, suggests that in these new maps the gross production shown

Fig. 8. Scale and structure of industry

Size of centres according to the value of fixed assets, industrial branches: a — electric and thermal power production, b — fuel industry, c — iron metallurgy, d — non-ferrous metallurgy, e — engineering industry and metal construction, f — electrical engineering industry, g — means of transport production, h — metal industry, i — chemical industry, j — rubber industry, k — building materials industry, l — glass industry, m — pottery and china-ware, n — timber industry, o — paper industry, p — printing industry, r — textile industry, s — clothing industry, t — leather and footwear industry, u — food industry, w — other industrial branches.

is likely to picture the production in natural units also, assuming cost figures to be comparable. Our mutual comparison of the new three maps confirms the first observation made as regards the maps previously

discussed, namely: the disproportions are smallest between the largest and smallest centres when employment is considered, and largest when the gross production is compared. Thus here we note a difference from what appeared previously. As in the first investigation, a tabulation according to magnitudes was made of the different centres, starting from the largest (Table 2).

TABLE 2. THE CONCORDANCE IN SEQUENCES OF INDUSTRIAL CENTRES

Centre	Number of workers employed	Gross production	Value of fixed assets	Number of branches of industry	Number of workers employed in one branch exceeds*:		Number of plants in centre
					50%	75%	
Cracow (Kraków)	1	1	1	12	—	—	68
Poznań	2	2	2	12	—	—	56
Częstochowa	3	3	3	7	—	—	23
Radom	4	4	11	10	—	—	18
Kalisz	5	5	8	9	L	—	17
Tomaszów Maz.	6	11	10	3	C	—	9
Opole	7	10	6	8	—	—	15
Jelenia Góra	8	8	5	10	—	—	12
Ostrowiec Świk.	9	6	9	4	—	C	5
Chełmek	10	13	18	2	—	L	2
Piotrków Tryb.	11	14	13	6	—	—	11
Ostrów Wlkp.	12	15	14	5	—	C	8
Kędzierzyn	13	9	4	1	—	C	1
Radomsko	14	16	15	4	L	—	4
Płock	15	12	12	7	—	—	10
Skawina	16	7	7	3	C	—	3
Zawadzkie	17	18	19	1	—	C	1
Gryfów Śl.	18	21	21	1	—	L	1
Kruszwica	19	17	16	1	—	L	4
Ogrodzieniec	20	19	17	1	—	C	2
Szamotuły	21	20	20	1	—	L	1
Leżajsk	22	22	23	1	—	C	1
Spychowo	23	23	22	1	—	C	1

* heavy industry is marked C, light industry L.

The comparison of the columns indicating employment and gross production shows a concordance in sequence for the large centres (Nos. 1–5 and 8); these are centres characterized by a diversified profile of production (more than 9 branches) and a large number of plants. In none of these centres, excepting Kalisz, does one particular branch of industry predominate. On the other hand, the differences are greatest in medium–size centres where one branch clearly predominates.

The same problem, but considered from the viewpoint of values, is presented in the form of a graph comparing the magnitude of the industrial Centres (Fig. 9). The sequence of centres according to the number of workers employed, is given in descending order, and shown

on the graph by a line. Also shown by lines are the three remaining criteria for this same sequence of centres. This graph tallies with the observations made earlier.

With regard to the line indicating the number of workers employed, the lines marking gross and net production as well as the fixed assets
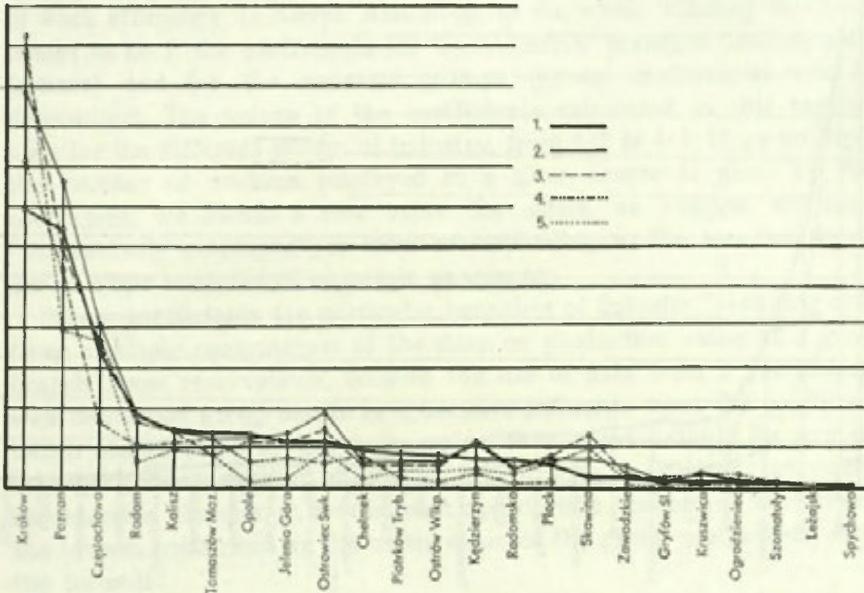

Fig. 9. Graph of correlations with the index of the number of persons actually employed

1 — actually employed, 2 — theoretically employed, 3 — gross production, 4 — net production, 5 — value of fixed assets.

Values on "y" axis equivalent to the sizes of circle diagrams radii.

show arhythmic deviations, especially in the middle part of the graph. In the large centres where industry is much diversified, the large differences occurring in the various kinds of industry (both plus and minus) compensate each other, and the line illustrating this levelling effect runs approximately parallel with the line of employment. In the smallest centres comprising, in general, one type of industry only, there is also a tendency toward parallelism; additionally, in this case the differences in comparison with the remaining centres are usually so small that they are barely discernible on the graph.

A characteristic feature of this graph is a certain — more or less concurrent — rhythm of deviations between gross production and value of fixed assets. The next graph (Fig. 10), prepared with gross production

5*

as a basis, again in descending order, shows that the line of fixed assets does not always keep on one side of the line of gross production, though its deviations appear to be relatively small. This serves to confirm the conclusion, that the size interrelation between certain industrial centres can be defined by either of the two criteria, as long as in their rhythm
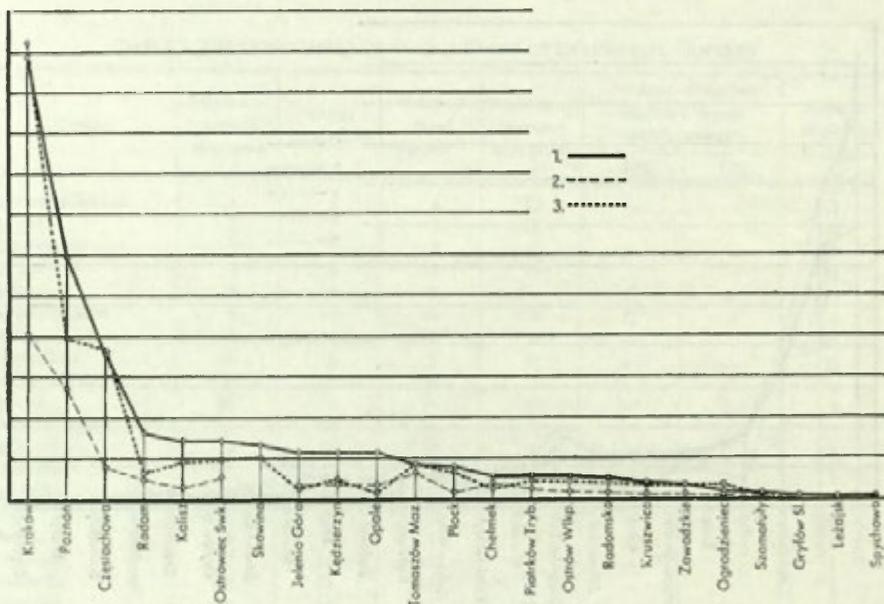

Fig. 10. Graph of correlations with the index of gross production
1 — gross production, 3 — net production, 3 — value of fixed assets. Value on "y" axis equivalent to the sizes of circle diagrams radii.

the lines of these two criteria are parallel on the graph. The line of net production is smoother than that of gross production and emphasizes the run of the latter. Therefore, the net production line might be taken into consideration, were it not for the reservations mentioned above.

It seems most appropriate to use data on hand, or easy to obtain, provided that they do not express costs. This is because a cost index threatens to complicate comparisons both with regard to time (price changes) and to foreign trade (inadequate relation of official exchange rates to actual value of products). For this reason the most suitable data are figures referring to the number of workers employed. However, because with the indices mentioned before, this index shows excessive variations, it becomes necessary to adopt adjusted values, that is, values approaching those mentioned above. Thus, after eliminating net production as being (under Polish conditions) an unreliable index reliable,

production in physical units as a non–comparable index, and the values of fixed assets as an index which strongly disagrees with the remaining criteria, there remains the index of gross production. Bearing all these considerations in mind, two indices can be taken into account for determining resultant values: the number of workers employed, and the gross production. Dividing the gross production by the number of workers employed during the respective period of time, one finds the coefficient of work efficiency, in Zlotys. Assuming for the whole industry this coefficient to be 1, the coefficients for the industrial branches (branch coefficients) and for the separate groups (group coefficients) can be determined. The values of the coefficients calculated in this manner vary for the different groups of industry, from $0 \cdot 2$ to $4 \cdot 3$. If we multiply the number of workers employed in a given centre or plant by this coefficient, we obtain a new value for which we suggest the term "theoretically employed", a term corresponding to the terminology in use in other branches of economic geography.

These coefficients for particular branches of industry, resulting only from a simple computation of the data on production value of a given branch rouse reservations, because the use of data from a particularly well developed group can have a decisive influence upon the coefficient which would raise or lower its value to a great extent. As soon as another group advances markedly, the branch coefficient can suffer considerable changes. It seems most appropriate, therefore, to calculate the branch coefficient as the mean value of the group coefficients, from the formula:

$$K_g = \frac{\sum_{i=1}^{k=n} k}{n}, \text{ where}$$

K_g = branch coefficient, k = group coefficients, and n = number of group coefficients.

In our calculation of the proper branch coefficient the industry of manufactured goods was only taken into account. The values of the modified branch coefficients calculated by this method are given in Table 3.

A further advantage of adopting modified coefficients is, that in generalizing, consisting of combining individual branches of industry, new coefficients for new groupings can be created in the same way.

The criterion of the number of "theoretically" employed workers has also been adopted by Miroslav Strida[5] for his map of the Czechoslovak

[5] M. Strida, "Mereni a znazornovani velikosti a struktury průmyslu v hospodarskom zemepisu", *Sbor. Ceskoslov. Spol.* Zemepisne, 1959, pp. 143–152.

industry; he used the term "average numebr of workers". In spite of the fact that he calculated this coefficient somewhat differently, he obtained results very similar to ours. Thus one may anticipate, that the above coefficient may also reveal similar values in other socialist countries, whose economic structure and statistical recording methods — in view of their participation in the Council of the Mutual Economic Cooperation — are very similar. From this a further conclusion may be drawn: the criterion of the number of workers "theoretically" employed, expressed by a modified coefficient, may be of use in preparing maps of industrial regions exceeding the boundaries of a single country.

TABLE 3. THE COEFFICIENTS

Industrial branch	branch coefficient, after simple conversion	range of group coefficients in given branch	branch coeffficient, modified after formula $$K_g = \frac{\sum\limits_{k=1}^{k=n} k}{n}$$
fuel industry	0·7*	0·4–3·9	3·45
iron an steel milling	1·7*	0·2–1·9	1·55
milling of non-ferrous metals	1·7*	0·4–2·9	1·65
machinery and steel construction industry	0·8	0·6–1·2	0·77
electrotechnical industry	1 0	0·5–2·6	1 12
industry of means of transport	1 0	0·6–1·3	1·33
metal industry	0·7	0·3–3·8	0·91
chemical industry	1·3*	0·8–2·2	1·39
rubber industry	1·3	0·6–2·0	2·40
building materials industry	0·6*	0·4–1·5	0·81
glass industry	0·5	0·5–0·6	0·53
china and glazed pottery industry	0·4	0·3–0·4	0·35
wood and timber industry	0·8	0·2–3·0	0·88
paper industry	1·1	1·0–1·2	1·07
typographical industry	0·5	0·5	0·50
textile industry	0·7	0·5–1·4	0·64
garment industry	0·8	0·6–0·8	0·70
leather and shoe industry	0·7	0·7–1·1	0·90
food industry	1·9	0·4–4 3	1·62
miscellaneous industries	1·1	0·4–2·7	1·06

* jointly with the raw products industry, as applied in the classification of the Central Statistical Office.

For obtaining a more accurate picture, the coefficient referring merely to branches of industry may prove insufficient, especially with regard to minor industrial centres embracing only a few, often only one, industrial group. Because the range of the values of this coefficient for groups within one branch is fairly wide, the evaluation of a given centre is bound to suffer a considerable error. This is the reason why, wherever possible, one should operate preferably with group coefficients. For this purpose the author has calculated this kind of coefficient for all groups and
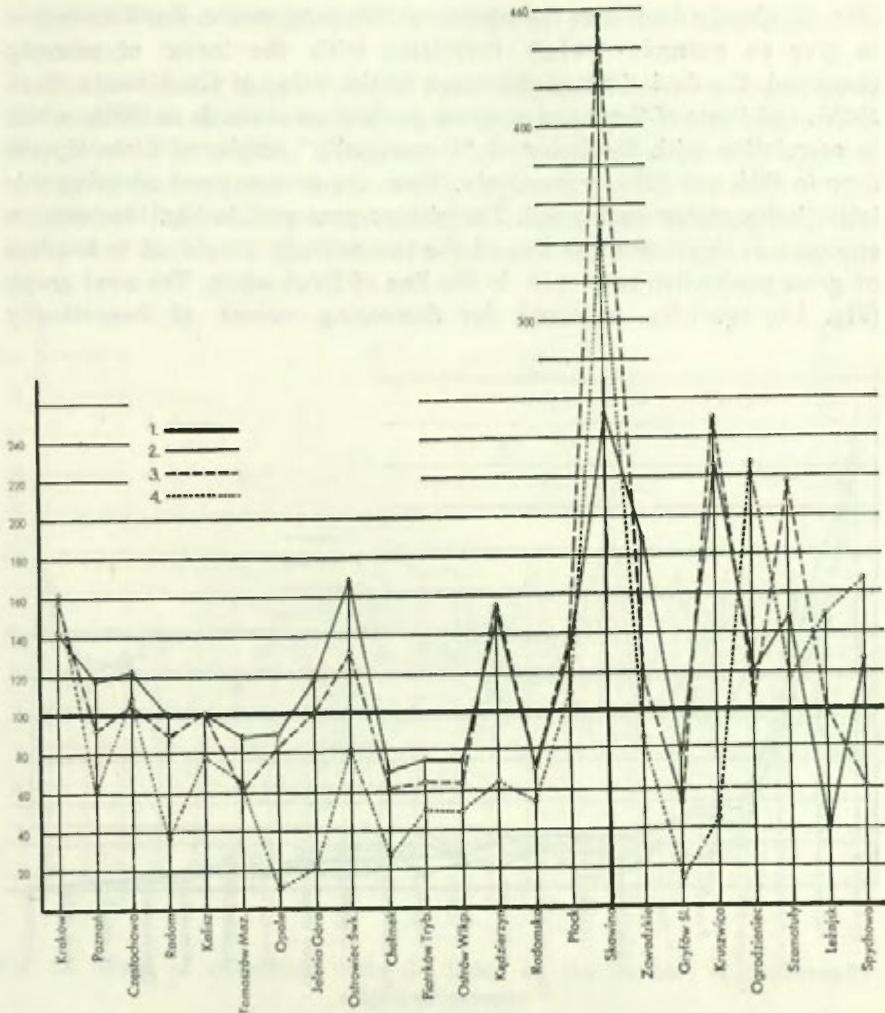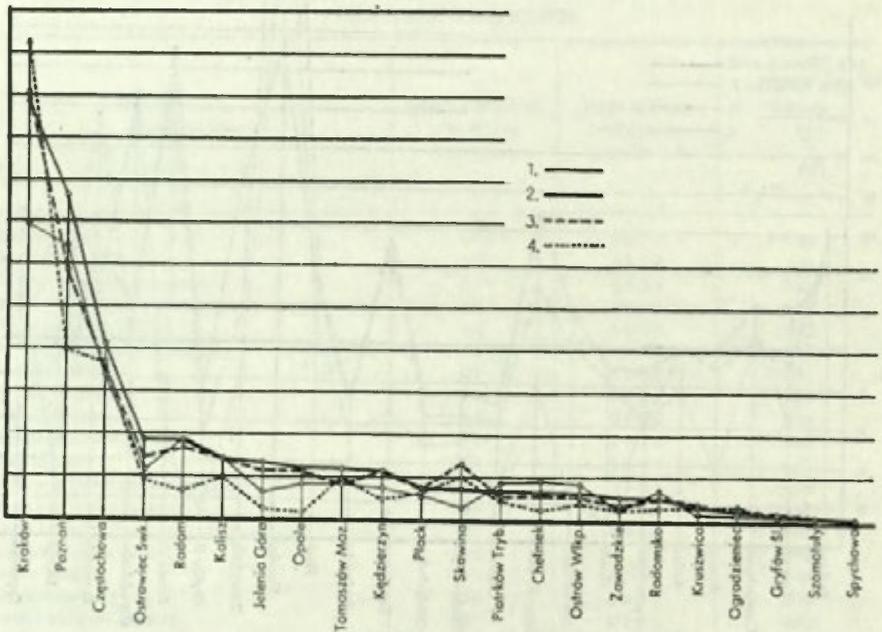
Fig. 11. Deviations from the index of actual number of employees
1 — actually employed, 2 — theoretically employed, 3 — gross production, 4 — value of fixed assets.

branches mentioned in the classification of the Polish industry as recorded by the Central Statistical Office.

The criterion of the number of workers "theoretically" employed is, as mentioned before, some sort of compromise between the number of actually employed and the value of gross production; or, to be exact, a certain correction of the former taking into account the effect of production. A comparison between the graphs of deviations from the index of actually employed (Fig. 11) and "theoretically" employed

(Fig. 12) clearly illustrates the essence of this compromise. For Skawina —
to give an example — when correlated with the index of actually
employed, the deviations of the index of the value of fixed assets reach
252%, and those of the index of gross production as much as 358%, while
in correlation with the index of "theoretically" employed these figures
drop to 40% and 82%, respectively. Thus, the advantage of adopting this
latter index seems undisputed. The picture presented in Fig. 12 shows an
approach in rhythm of the line of the theoretically employed to the line
of gross production and, even, to the line of fixed assets. The next graph
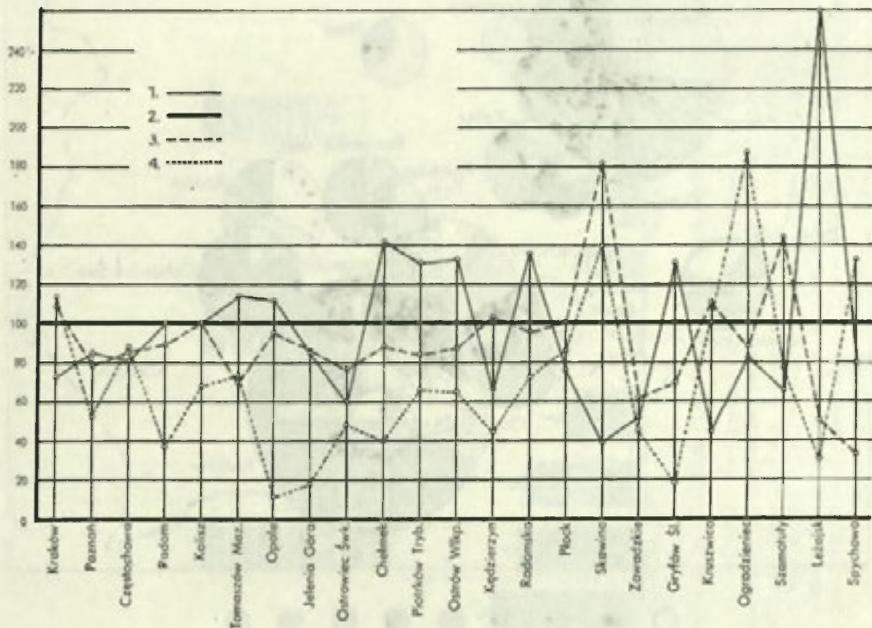(Fig. 13), specially prepared for decreasing values of theoretically

Fig. 12. Deviations from the index of the number of theoretically employed
persons

1 — actually employed, 2 — theoretically employed, 3 — gross production, 4 — value of fixed
assets.

employed, shows a deviation of the remaining lines in one direction only,
downward — except in one instance where the deviation is the opposite,
upward. This one exception involves Skawina, where the modern
aluminium plant has up-to-date, highly efficient and very costly equip-
ment, requiring a very limited operating staff.

With the criterion of the number of theoretically employed as basis,
a map (Fig. 14) was compiled illustrating the true proportions between

industrial centres and presumably, correctly picturing their respective importance.

The problem of the part played by individual branches in determining the magnitude of a centre and its influence on changes of this role is illustrated by a totalling histogram (Fig. 15), compiled for four selected industrial centres, with four criteria applied. For the criterion of the number of theoretically employed two coefficients were applied, the group and the branch coefficient. In all instances, the branch coefficient

Fig. 13. Graph of correlation with the index of the number of theoretically employed persons

1 — actually employed, 2 — theoretically employed, 3 — gross production, 4 — value of fixed assets. Value on "y" axis equivalent to the sizes of circle diagrams radii.

led to a diminution of the magnitude of the centre, compared with the group coefficient; moreover, for a large centre with a variegated structure this difference is smaller (11% for Poznań) than for smaller centres, especially those with one branch predominating (18% for Ostrowiec Świętokrzyski, or 41% for Skawina). The relatively small difference (only 8%) in the case of Kędzierzyn is caused by the small difference in the coefficient (1·5) of the only group of the chemical industry existing at Kędzierzyn in respect to that of the whole branch (1·3). Even so, it must be assumed that, in similar instances elsewhere, this relation may appear
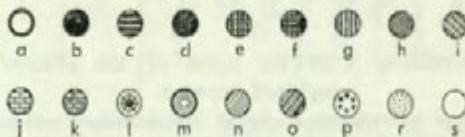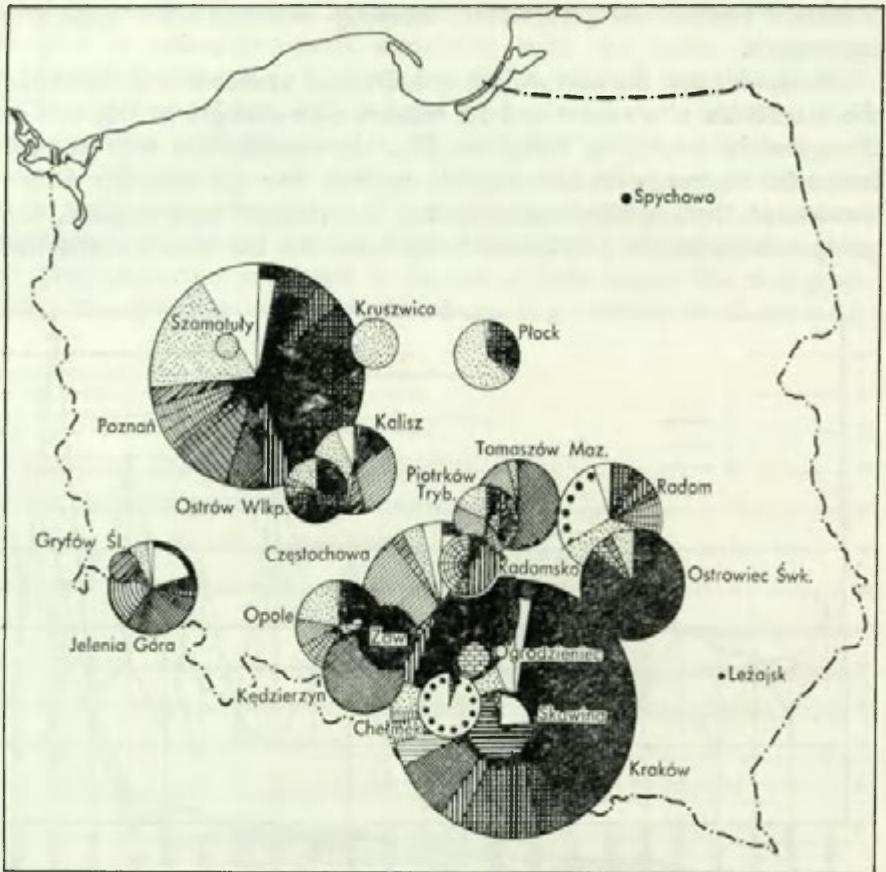
Fig. 14. Scale and structure of industry

Size of centres according to the number of theoretically employed persons; industrial bran-
ches: a — electric and thermal power production, b — iron metallurgy, c — non-ferrous me-
tallurgy, d — engineering industry and metal construction, e — electrical engineering indu-
stry, f — means of transport production, g — metal industry, h — chemical industry, i —
rubber industry, j — building materials production, k — glass industry, l — timber industry,
m — paper industry, n — textile industry, o — clothing industry, p — leather and footwear
industry, r — food industry, s — other industrial branches.

quite differently. Further, the graphs discussed illustrate, how one
industrial branch is apt to affect the evaluation of the magnitude of the
whole centre; thus, for example at Ostrowiec Świętokrzyski any change
in the evaluation of steel milling bears directly on the evaluation of the
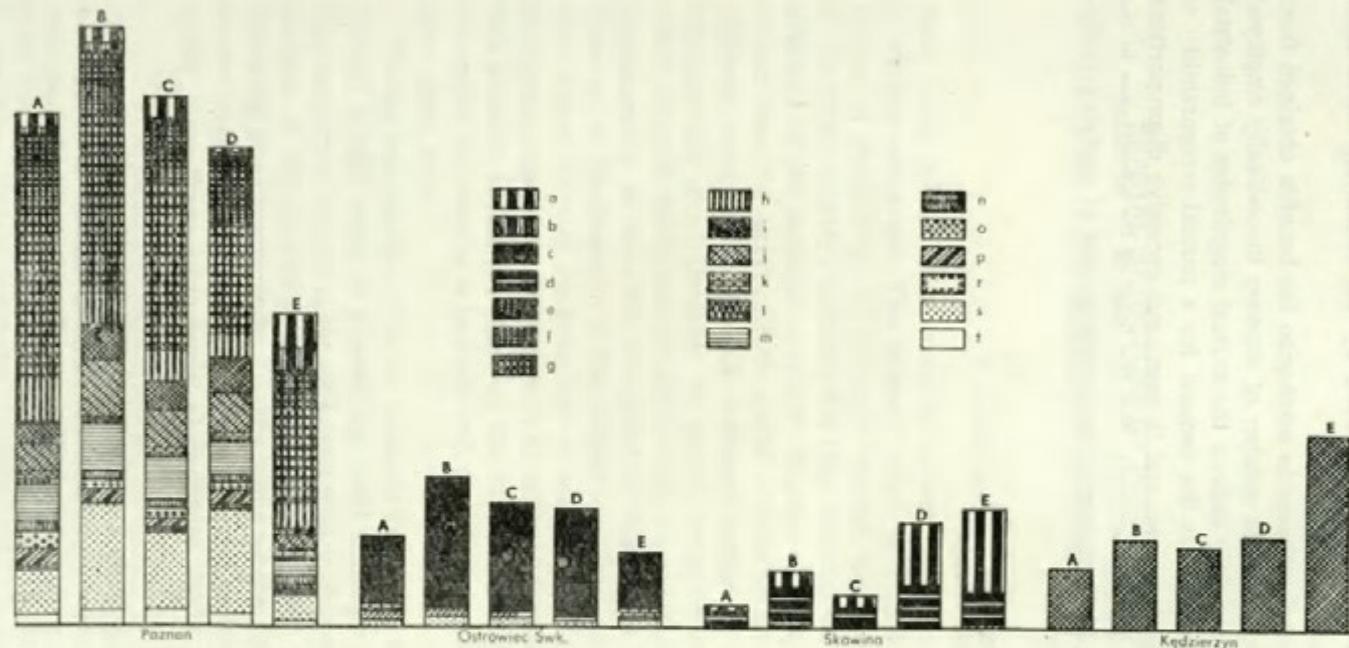
Fig. 15. Structure of industry in Poznań, Ostrowiec Świętokrzyski, Skawina and Kędzierzyn

Estimate of the size of centres criteria: A — number of actually employed persons, B — number of theoretically employed persons after the group index, C — number of theoretically employed persons after the branch index, D — gross production, E — value of fixed assets; industrial branches; a — electrical and thermal power production, b — fuel industry, c — iron metallurgy, d — non-ferrous metallurgy, e — engineering industry and metal construction, f — electric engineering industry, g — means of transport production, h — metal industry, i — chemical industry, j — rubber industry, k — building materials production, l — glass industry, m — timber industry, n — paper industry, o — printing industry, p — clothing industry, r — leather and footwear industry, s — food industry, t — other industrial branches.

whole centre, because the part played by the remaining three local industrial branches is insignificant.

The above research appears to emphasize the benefits obtained from adopting the criterion of the number of workers theoretically employed as an index, that correctly defines the mutual magnitudes of industrial centres. This index answers the demand for a mutual comparability of industrial plants and centres, and it evens out excessive disproportions between the various other criteria. Not the least of its advantages is the ease of obtaining all fundamental data required and of applying ready--made coefficients.

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SPATIAL STRUCTURE OF POLAND'S ECONOMY

Stanisław Leszczycki

Introduction

Many works in the field of economic regionalization have been carried on in various countries[1]. The present paper constitutes one such work. Instead of delimitation of economic regions, here the spatial structure of the whole country's economy has been investigated. The term "spatial structure of the national economy" denotes economy as a whole, considered from the aspect of both spatial differentiation and inter–regional relations. Because the national economy comprises a wide variety of economic and social elements, its spatial structure can be investigated either as areal differentiation (statically), or as inter–regional relations (dynamically), or from the viewpoint of changes in time (historically). However, as the structure of the national economy is of high complexity, there arises the need for some sort of selection of its components; from their great number a selection must be made of the most important ones. This depends, on the one hand, on the purpose for which the analysis of the spatial structure is to be made and, on the other, on the data available for a given area.

Taking into consideration the material available, the author confines himself in this paper to present the areal structure as it was in 1961. The territory of Poland is the area dealt with in this analysis. The spatial analysis of the country's structure has been based principally on the following three components: 1 — the value of the fixed assets, 2 — the created national income, and 3 — the distributed national income; synthetically these three components characterize fairly well the national

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[1] Bibliography from: "Methods of Economic Regionalization" — *Geogr. Polon.*, 4, Warsaw 1964; "Aims of Economic Regionalization" — *Geogr. Polon.*, 8, Warsaw 1965; Berry B. and Hankins T. — "A bibliographic guide to the economic regions of the United States" Chicago 1963; Konstantinov O. — "Sovietskoye rayonirovaniye k sorokaletiyu Velikoy Oktiabrskoy Socyalisticheskoy Revolucii" — *Bull. All-Un. geogr. Soc.* 89, 1957, pp. 426-444.

economy. The source material was obtained from the Central Statistical Office[2]. These data refer to individual voivodships, that is to the highest administrative units. In its administrative division, Poland consists of seventeen territorial and five urban voivodships; the latter being autonomous voivodship capitals. In order to gain data comparable for all–Poland, the data referring to the five autonomous voivodship capitals (Warsaw, Łódź, Cracow, Wrocław, Poznań) were incorporated in the respective territorial voivodships. In this manner the analysis was based on seventeen items of reference, and therefore one can speak of a static spatial macrostructure only of Poland's economy in 1961[3,4].

METHOD OF PROCEDURE

The standard of Poland's national economy has been determined on the basis of the three components mentioned above:

1. The value of fixed assets, embraces all investments made over a long period of years in the respective areas; these investments are, on the one hand, evidence of the level of the technical equipment of the given region and, on the other, they constitute the sum of the population's activities in adapting a given geographical environment so as to satisfy the economic and social needs of its inhabitants. The fixed assets include the investments in the sphere of material production as well as the others activities outside material production which constitute the material basis for rendering the services. The value of the fixed assets is taken in its entirety regardless of the form of ownership: socialized (State-owned or co–operative), or private.

[2] See: Central Statistical Oficce — *Statistical Yearbook of Poland,* as well as other publications issued in Polish.

[3] An analysis based on a greater number of data dealing with administrative units of lower rank would characterize the meso- and micro structure of Poland's economy.

[4] a. Value of fixed assets on Jan. 1, 1961, at July 1, 1960 prices, b. Created and distributed national income in 1961, at current prices, c. Areas of particular voivodship, on Dec. 31, 1961, in thousands of sq.km, d. Population on Dec. 31, 1961, e. Number of employees (economically active) on Dec. 31, 1961, f. Net investment outlays at 1961 prices, g. All data given are based on publications of the Central Statistical Office, h. The synthetic indices have been calculated as sums of deviations from the all–Poland mean, taken as 100, i. The figures shown on the maps refer to voivodships including the autonomous voivodship capitals, j. Figures given in parentheses refer to autonomous voivodship capitals only, k. Figures in ovals — to voivodships with data for the autonomous voivodship capitals left out.

2. The created national income comprises the sum of net production obtained from the individual branches of the national economy, thus: of industry — 48·4%, agriculture — 23·7%, trade — 8·9%, construction — 8·8%, transport and communication — 6·7%, forestry — 2·4%, and the "remaining production" — 1·4%. The value resulting from the balance of foreign trade is added to this sum of net production. The qualitative structure of the created income characterizes the basis of the national economy.

3. The distributed national income is divided, in its principal breakdown into consumption — 72·8% and acumulation — 27·2%. Consumption, in turn, is divided into: 1. consumption of material goods from personal incomes — 65·2% and 2. "remaining consumption" — 7·6%. Accumulation, on the other hand, involves 1. increase in stock, and reserve — 7·5% and 2. net investments — 19·7%. This breakdown indicates the purposes for which the created national income has been used, while the amount of consumption defines roughly the level of the people's standard of living.

All data have been grouped according to three different aspects:

a) by the per cent share of each voivodship in the country's national economy, in order to illustrate its role and significance. This is in line with the present–day tendency of the Polish authorities, who are aiming to decentralize the management of the economy by passing it on to the voivodship authorities. Nowadays, the regional economy (the voivodships) controls from one fifth to one third of the various branches of the national economy.

b) in terms per 1 inhabitant or 1 employee in order to obtain comparable data, because the individual voivodships differ in numbers of population. This resulted in indices for: social significance (per 1 inhabitant) and labour productivity (per 1 employee);

c) by calculating per 1 sq.km, in order to obtain comparable data, because the individual voivodships also differ in area. In this manner the index of spatial concentration has been obtained.

Since it is the author's aim to establish the internal differentiation in spatial structure, to point out similarities or dissimilarities in the level of the national economy and in the standard of living of the inhabitants., all data referring to the components of the national economy have been calculated as deviations from the mean all–Poland level.

The three principal components already mentioned: 1. the value of fixed assets, 2. the created national income and 3. the distributed national income, have been synthetically characterized by considering for each of them their five most typical features; in this manner a conventional all-

Poland mean amounting to 500 was obtained. For determining the overall level of the national economy, all fifteen features were totalled thus creating a conventional index of 1500, denoting the mean level of Poland's economy. In order to indicate the standard of living of the population, only the three most significant features calculated per 1 inhabitant were totalled, thus giving an index of 300 for defining the mean level of the standard of living in Poland.

THE VALUE OF FIXED ASSETS

In 1961, the fixed assets of Poland amounted to 2321 billion Zlotys; of this, the socialized economy owned 69·4%, while 30·6% was still held in private ownership. The sphere of material production accounted for 59·7%, and the sphere of other activities (beyond material production) — for 40·3%. The largest were the shares of industry — 20·8%, transport
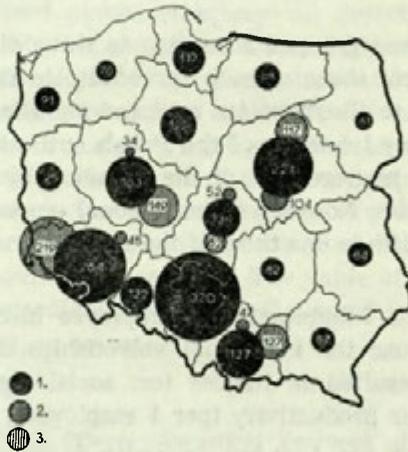
Fig. 1. Value of fixed assets, total — in billions of Zlotys

1 — voivodships (autonomous voivodship capitals included), 2 — autonomous voivodship capitals, 3 — voivodships without autonomous voivodship capitals (Poland 2,321 billions Zl., voivodship mean = 136·6 billion Zl.).

and communication — 19·8%, agriculture — 15·7%; much smaller were the per cent figures covering other branches of the national economy. Buildings were of highest value — 55·7% (the breakdown being dwelling houses — 31·3%, buildings and constructions — 25·1%, and machinery and equipment — 10·5%). In the period from 1961 to 1964, the value of the fixed assets increased by 14·3% and amounted to 2650 billion Zlotys.

As in many other countries the spatial structure of the fixed assets

in Poland is unequal. This is illustrated in Fig. 1., in which the value of fixed assets in billions Zlotys is shown. Here the highest figures (exceeding 100 billion Zlotys and 5⁰/o of the all–Poland figure) are grouped in a "central block" consisting of nine voivodships, reaching from the Sudety Mountains and the western part of the Carpathians northward across the central area of Poland as far as Gdańsk Bay. On three sides, west,

Fig. 2. Value of fixed assets — in the sphere of material production–percentage held by socialized economy
(all - Poland mean = 80·2⁰/o)
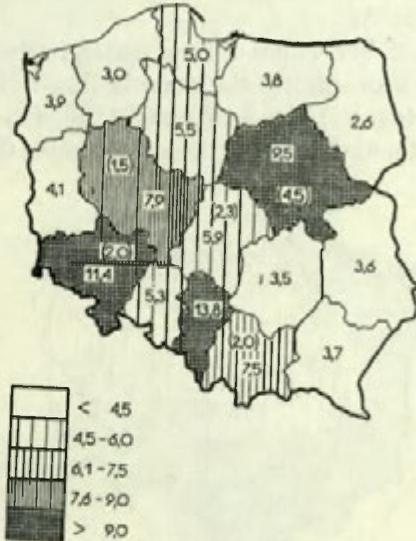
Fig. 3. Value of fixed assets, total — in per cent shares of particular voivodships

north and east, the "central block" is bordered by peripheral voivodships with their economy less efficiently developed. This "central block" areal pattern is repeated several times in our further analysis, and it has been designated type A.

Of interest is the spatial structure of ownership as regards the fixed assets. Fig. 2. shows the percentage of these assets held by socialized economy — evidence to the features of socialism. The mean figure for all–Poland is 80·2⁰/o. The highest (more than 90⁰/o) are the figures for Katowice voivodship (94·0⁰/o) and for the urban voivodships (98–99⁰/o). High mean per cent figures (80⁰/o) are also general in the western part of Poland. Eastward these figures grow less and are the lowest (less than 70⁰/o) in the eastern part of Poland. Fig. 2. shows the spatial pattern in the shape of three "meridional belts" for which the values of indices grow smaller from west to east. This pattern has been designated type B.

As mentioned before, the spatial structure of the fixed assets has been based on a synthetic index calculated from the following five most typical features:

1. The per cent share of the respective voivodships in the total value of the fixed assets, presenting the differences existing in the regional economic development of the country. Fig. 3. shows the distribution of the fixed assets as discussed above, and it presents a spatial pattern of type A.

2. The values of fixed assets, in thousands of Zlotys per 1 inhabitant — this constitutes the material basis of the standard of living. The mean value of fixed assets per 1 inhabitant is 78 thousand Zlotys, ranging from 45·0 to 131·8 thousand Zlotys, the ratio being 1:2·9. Fig. 4. presents

Fig. 4. Value of fixed assets, total — in thousands of Zotys per 1 inhabitant

(all - Poland mean = 78·1 thousand Zl.)
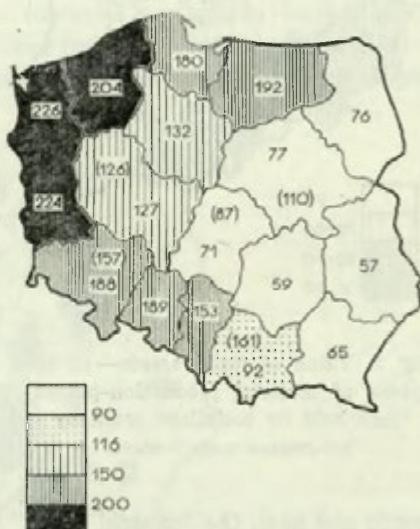
Fig. 5. Value of fixed assets, in the sphere of material production, in thousands of Zlotys per 1 employee

(all - Poland mean = 115·7 Zl.)

the pattern of three meridional belts, and may therefore be assigned to type B. This pattern is the result of the unequal distribution of the population and of a higher degree of economic development in the southern part of the country and in the urban voivodships.

3. The value of the fixed assets in the sphere of material production, in thousands of Zlotys per 1 employee in the following branches of the national economy: industry, construction, agriculture, transport and communication, trade — as a material basis for employment. The mean all–

Poland figure per 1 employee is 116 thousand Zlotys. This index varies between 57 and 226 thousand Zlotys that is as 1:4. The spatial pattern shown in Fig. 5. may be considered as a modification of type B in which, compared with the mean all–Poland value, Poland is divided into two parts, a western part with an index higher than all–Poland's mean and an eastern part with a lower index than the country's mean. This pattern has been designated type C.

4. The value of the fixed assets in the sphere of activities outside of material production thus embracing the communal economy, housing, education, culture, science, social welfare, physical training, in thousands of Zlotys per 1 inhabitant. This index illustrates the level of the material
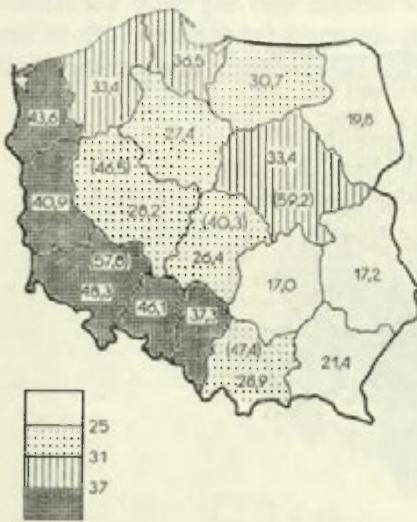
Fig. 6. Value of fixed assets — in the sphere of activities outside of material production, in thousands of Zlotys per 1 inhabitant
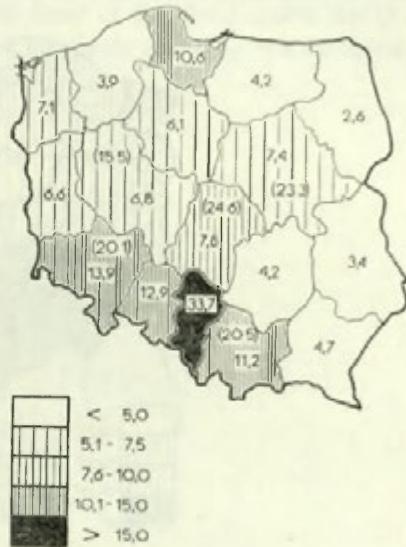
(all - Poland mean = 31,030 Zl.)

Fig. 7. Value of fixed assets, total — in millions of Zlotys per 1 sq. km

(all - Poland mean = 7.5 million Zl.)

basis for providing all social services. Fig. 6 shows a pattern of type B indicating, in sharp contrast with the remaining voivodships, conditions in the four eastern voivodships least intensively equipped with the means of rendering social services.

5. The value of the fixed assets in millions of Zlotys per 1 sq. km, as index of the spatial concentration. Fig. 7. shows that the southern voivodships are best equipped. The voivodships containing the larger urban

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agglomerations or the more important seaports also disclose higher indices. Economic development in the northern and eastern voivodships is the lowest. This pattern has been designated a mixed type A/E.

SPATIAL STRUCTURE OF FIXED ASSETS

By summing up the values of the above five components we obtain what is called the synthetic index. The mean synthetic index for all–Poland has been taken as 500; in particular voivodships it varies between 281 and 1105 — evidence of the unequal distribution of fixed assets in the country, since the ratio between the worst and the best equipped voivodship is almost as much as 1 to 4.

Fig. 8. Value of fixed assets — synthetic index (with 500 = the all–Poland mean)

The spatial distribution of the synthetic index has been illustrated in Fig. 8.; it is a result of the preceding spatial patterns. This figure shows Poland divided into two parts: the western part with a higher, and the eastern part with a lower fixed assets equipment (the latter comprising the four voivodships mentioned above). This pattern is called type C. The index values decrease from west to east, and in the central part of Poland they are nearest the all–Poland mean.

If the data for the cities of Warsaw and Łódź were eliminated from their respective voivodships, the Warsaw and Łódź voivodships would have to be added to the eastern group of less equipped areas (see the figures in ovals in Fig. 8.). This emphasizes the contrast in economic de-

velopment between these two large cities and their surrounding voivod-
ships.

The disproportions thus clearly seen in Poland's economic develop-
ment can be diminished by the appropriate perspective planning of future
investments.

THE CREATED NATIONAL INCOME

The national income created in 1961 was 417 billion Zlotys. In recent
years the national income has been growing rapidly, by about 5·4%
annually; in 1964 it was 478 billion Zlotys. 73% of the national income
was created in the socialized economy and 27% in the private sector.
Comparing these per cent figures with those of the fixed assets (69·4%
and 30·6% respectively) it appears that, relatively speaking, the socialized
fixed assets yield a higher national income.
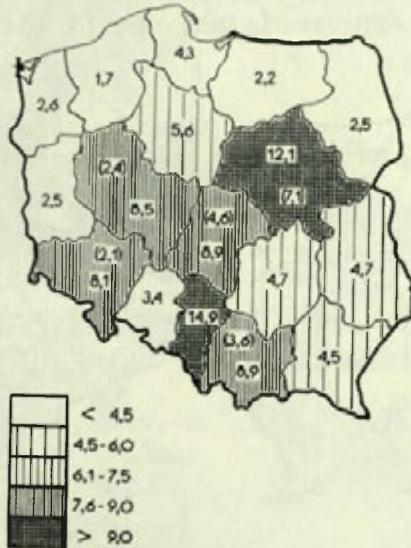
Fig. 9. Created national income — in per cent shares of particular voivodships

The average, per one voivodship of the created national income was
24·6 billion Zlotys ranging from 7·3 to 62·3 billion Zlotys. The spatial
differentiation was very considerable, with its range as much as 1:8·5.

The synthetic index characterizing the created national income has
been based on the following five features:

1. The per cent participation of the voivodships in the created all–
Poland national income, thus expressing their respective importance in
the all-Poland economy. Fig. 9. illustrates the spatial pattern which

might be called a "southern–central block". In contrast with the "central block" (type A), the "southern-central block" fails to extend northward as far as Gdańsk Bay, being smaller in size and including only six voivod-ships. It consists of the Katowice voivodship and five further voivodships that contain the autonomous voivodship capitals. Opole voivodship with its much lower index figure remains outside this block. The "southern–central block" may be enlarged by its neighbouring voivodships, espe-cially those in the south–east. In contrast the northern voivodships emerge with the lowest created national income. This pattern has been designated type D.

2. The created national income in thousands of Zlotys per 1 inhabitant. It illustrates the potential level of the standard of living of the population. The average income per 1 inhabitant in Poland amounts to 13·9 thousand Zlotys. The range of this income varies from 9·4 thousand to 20·9 thou-sand Zlotys and therefore it is much smaller, the ratio being merely 1:2·2. These smaller differences in income per 1 inhabitant are the result

Fig. 10. Created national income — in thousands of Zlotys per 1 inhabitant
(all-Poland mean = 13·9 thousand Zl.)

Fig. 11. Created national income — in thousands of Zlotys per 1 employee
(all-Poland mean = 34,834 Zl.)

of identical wages paid and identical prices charged all over the country. The spatial pattern as discussed here presented in Fig. 10., has been designated type E in which the highest income is supplied by the southern voivodships and the voivodships including the autonomous voivodship capitals or the main sea ports.

3. The created national income, in thousands of Zlotys per 1 employee in productive employment illustrates the labour productivity. On average it is some 35 thousand Zlotys for all–Poland, ranging from 20 thousand to 49 thousand Zlotys that is the ratio 1:2·4. Fig. 11., showing the differentiation of labour productivity represents a pattern of the mixed type A/E.

4. The created national income, in millions of Zlotys per 1 sq. km — as an index of the spatial concentration of production. The mean income obtained from 1 sq. km is 1·3 million Zlotys varying within the range 442 thousand to 6,551 thousand Zlotys. This difference is enormous, al-

Fig. 12. Created national income — in thousands of Zlotys per 1 sq. km
(all-Poland mean = 1,340 thousand Zl.)

Fig. 13. Utilization of fixed assets of the sphere of material production

The 1000 Zl. value of productive fixed assets produces the national income created amounting to 301 Zl.

most 1:15. A much higher income per 1 sq. km is obtained in the urban voivodships. This spatial differentiation is shown in Fig. 12., the pattern of which may be assigned to type E[5].

5. The degree of utilization of productive fixed assets by the created national income. On the average in Poland the 1000 Zlotys value of pro-

[5] In passing it seems worth mentioning, that the differences are greatest when comparing indices of spatial concentration, that is, indices calculated per 1 sq. km. On the other hand, the differences in social importance, that is, indices referred to 1 inhabitant are smallest. In comparisons of voivodships as territorial economic units, the differences found are of intermediate magnitude.

ductive fixed assets produces the created national income amounting to 301 Zlotys. Fig. 13. illustrates the distribution of the degree of utilization of the productive fixed assets. The spatial pattern of this distribution reveals a modified type D ("southern central block"). The utilization of the productive fixed assets is least effective in the northern and in the western voivodships.

Spatial structure of the created national income: summing up the above five indices indicating deviations from all–Poland mean values, one obtains the synthetic index of the created national income. With a mean figure of 500 for all–Poland, the synthetic index ranges from 281 to 1140; thus the divergence is fairly high, amounting to 1:4. This spatial pattern,
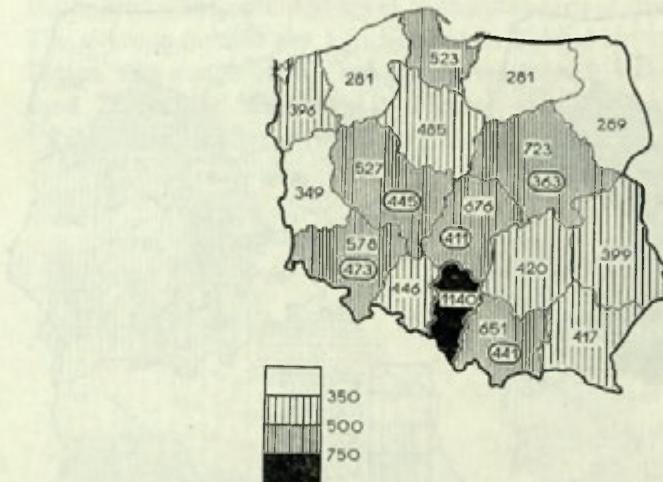
Fig. 14. Created national income — synthetic index (with 500 = the all–Poland mean)

shown in Fig. 14., is characteristic of mixed type A/D that is the highest created national income has been attained in Katowice voivodship, in the five voivodships containing autonomous voivodship capitals, as well as in Gdańsk voivodship by virtue of its two great ports, Gdynia and Gdańsk. The area of higher national income created may be enlarged by the south–eastern voivodships and Szczecin voivodship, which includes the largest Polish port, Szczecin.

THE DISTRIBUTED NATIONAL INCOME

The distributed national income indicates how the created income has been used. As stated above, some 73% have been absorbed by consumption and 27% by accumulation. In 1961, the distributed national

income was 419 billion Zlotys, 2 billion Zlotys greater than the created
national income, because in 1961 the foreign trade balance was nagative.
The index of the growth of the distributed national income in 1964 was
260 compared with 1950 index=100.

On an average, each voivodship spent 24·6 billion Zlotys, with a range
from 9·5 to 58·2 billion Zlotys, a ratio of 1: 6.

Determination of the synthetic index of the distributed national income
has been based on the following five features :

1. The per cent participation of the voivodships, in the distributed
all–Poland national income, this being the mark of their respective role in
the national economy and the approximate basis of the regional economy.
The spatial structure is shown in Fig. 15. This is a pattern of type A/D
modified in such a way that the "central block" may be enlarged by the
south–eastern voivodships. The northern voivodships have at their dispo-
sal the smallest part of the distributed national income.

Fig. 15. Distributed national income —
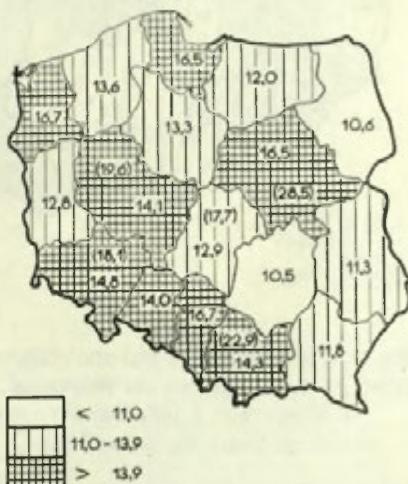in per cent shares of particular voi-
vodships

Fig. 16. Distributed national income —
in thousands of Zlotys per 1 inhabitant
(all-Poland mean = 14·0 thousand Zl.)

2. The distributed national income, in thousands of Zlotys per
1 inhabitant. It reflects to a certain degree the standard of living of the
population. The mean income per 1 inhabitant was 14 thousand Zlotys
varying between 10·5 and 16·7 thousand Zlotys; this does not include
the autonomous voivodship capitals where the income was much higher,

e.g. in Warsaw greater than 28 thousand Zlotys. The range limit is fairly narrow, amounting to the ratio 1 : 1·6. The pattern of distribution is shown in Fig. 16., representing type E, this means, that the distributed national income was concentrated in the southern voivodships and in the voivodships including the autonomous voivodship capitals or main seaports. The higher rate of the distributed income per 1 inhabitant in the larger towns accounts for the strong townward migration of the people in their aim at bettering their living conditions.

Fig. 17. Consumption of material goods from personal incomes in thousands of Zlotys per 1 inhabitant

(all-Poland mean = 9·1 thousand Zl.)

Fig. 18. Net investment outlays in 1961 — in per cent shares of particular voivodships

3. Consumption of material goods from personal incomes, in thousands of Zlotys per 1 inhabitant. This being the portrayal of direct consumption. The mean value per 1 inhabitant drops to 9·1 thousand Zlotys and the divergences are within the range 7·2 to 10·9 thousand Zlotys (autonomous voivodship capitals excluded), reducing the ratio to 1 : 1·5. The spatial pattern shown in Fig. 17. represent the mixed type C/E.

4. The per cent participation of the voivodships in investments outlays in 1961. This reflects the feasibility of changing the current level of economic development. As mentioned before, some 20⁰/o of the created national income is allotted to investments. Whereas a one–year period seems unsuitable for evaluating investments, further calculations covering an

11–year period (two long-range plans from 1950 to 1960) also indicate, that 1961 differed but little from the preceding years, and that the spatial pattern is hardly altered. Fig. 18. indicates that marked spatial disproportions exist in this respect. Six voivodships, distinctly privileged, absorbed in 1961 two thirds of the sum of investments, while barely one third was left for the remaining eleven voivodships. This pattern of spatial distribution of investments, kept up for a number of years, has hardly contributed to the diminution of the disproportions in Poland's economic development.

Fig. 19. Net investment outlays in the socialized economy, in 1961 — in thousands of Zlotys per 1 inhabitant

(all-Poland mean = 2,756 Zl.)

The pattern pictured in Fig. 18. is of type E — indicating, that investments go principally to the voivodships which have the highest economic development.

5. Investment outlays in 1961, in thousands of Zlotys per 1 inhabitant — an aspect of the feasibilty of equalizing the standard of living in Poland. Respective to 1 inhabitant, the spatial disproportions in investments are conspicuous. The all–Poland mean is $2 \cdot 8$ thousand Zlotys per 1 inhabitant, with a range of $1 \cdot 7$ to $3 \cdot 9$ thousand Zlotys (the autonomous voivodship capitals excluded); thus the ratio is $1 : 2 \cdot 3$. The spatial distribution of investments per 1 inhabitant is illustrated in Fig. 19., showing a pattern of modified type E — with the proviso, however, that the least share in investments goes to the eastern voivodships.

Should an endeavour be made to reduce the spatial disproportions in the standard of living of the people, future investment programes would have to allot relatively more investments to those voivodships which up to now have been most neglected economically.

The spatial structure of the distributed national income was determined by summing up the deviations from the all–Poland mean of the five
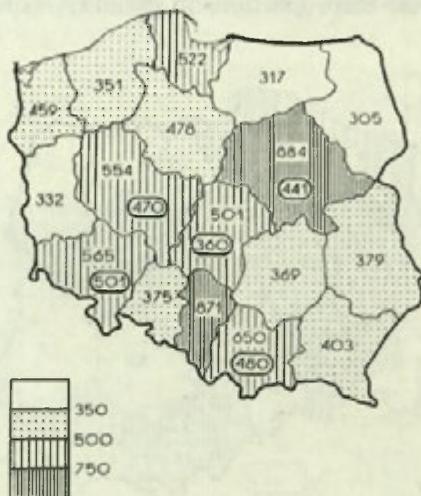

Fig. 20. Distributed national income — synthetic index (with 500 = the all–Poland mean)

features discussed above. The synthetic index obtained in this manner varies from 305 to 884, thus its range shows the ratio 1 : 2·9 — evidence, that in the privileged voivodships the distributed income is almost three times higher than in the most handicapped voivodships. The spatial pattern is shown in Fig. 20., it is similar to the pattern of type A, that is, it forms the "central block", which, however may be enlarged by the north–western and south–eastern voivodships. The distributed national income is the lowest in the north–eastern voivodships.

The problem of equalizing the standard of living conditions throughout Poland by a centrally directed planned economy is worth to be stressed. It might prove valuable here to compare the percentages of the created and the distributed national incomes in particular voivodships. The differences are relatively small, nowhere exceeding 2·0%. Even so, it should be noted, that nine voivodships with greater production pass on a part of their created income to the remaining eight voivodships. This problem

is spatially illustrated in Fig. 21. where the pattern of voivodships is very characteristic. In this case Poland is divided into two parts: a) a southern and western part, better developed economically and producing more, therefore relinquishing a part of its created national income, — and b) a northern and eastern part, less developed economically and producing
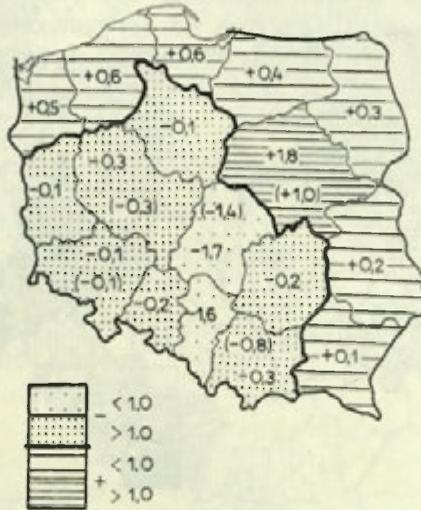

Fig. 21. Ratio of percentage of created and distributed national income in particular voivodships

less, to which an additional part of the created national income is transferred. Still, this principle does not refer to Warsaw nor to the main Polish ports to which — in spite of their high economic development and high production — additional funds are allotted from other voivodships.

SPATIAL STRUCTURE OF NATIONAL ECONOMY

To define the level of the national economy, the synthetic index was calculated using the deviations of all the fifteen features discussed from the all–Poland means. The synthetic all–Poland mean was assumed to be 1500. For the individual voivodships the deviations lie within 876 and 3116 as limits, thus the range is as 1 : 3·5. This is a wide range indicating, for example that Katowice voivodship represents an economic level three times higher than that of Białystok voivodship. This differentiation in the level of the national economy has been illustrated in Fig. 22. This figure shows, that the spatial pattern of Poland's national economy con-

stitutes a "central block" a modified type A), which additionally includes
the western voivodships. This "central block" is featured by a higher
level of economy, and Poland's future depends on the production of this
block. From north and east the "central block" is bordered by a belt of
peripheral voivodships representing an economic level by 20⁰/₀ lower.

Fig. 22. Level of national economy —
synthetic index (with 1500 = the all-
Poland mean)

Fig. 23. Level of national economy —
with data referring to autonomous
voivodship capitals left out; synthetic
index (with 1500=the all-Poland mean)

The synthetic index is particularly high for the five urban voivodships,
because here an intensive economy is accumulated on small areas. In
order to demonstrate this, and simultaneously to disclose the manner in
which the large cities bear upon the spatial structure of the national
economy, the data pertaining to the autonomous voivodship capitals were
left out. The result of the calculations thus made is shown in Fig. 23. Due
to this elimination, the spatial pattern of the voivodships underwent
a change: in place of the "central block" (type A) there now appears
a division of Poland into two parts (type C): a) a western part of higher
level, and b) an eastern part with a lower level of national economy.
Particularly striking is this change in the Warsaw and Łódź voivodships
where, alongside of autonomous voivodship capitals with a very high
economic level, the hinterlands constitute areas with a low level of
national economy. Disregarding the two autonomous voivodship capitals,
both voivodships would have to be assigned to the eastern part of
Poland.

THE POPULATION'S STANDARD OF LIVING

The standard of living of Poland's population has been calculated using a synthetic index derived from the sum of deviations from the all–Poland indices pertaining to: a) the value of the fixed assets, b) the created national income and c) the distributed national income — all calculated per 1 inhabitant. The all-Poland mean is 300. The deviations from the synthetic index vary for the particular voivodships (autonomous voivodship capitals excluded), from 205 to 395; thus the difference is not so great, its ratio being 1 : 1·9. Even so, the disproportions are
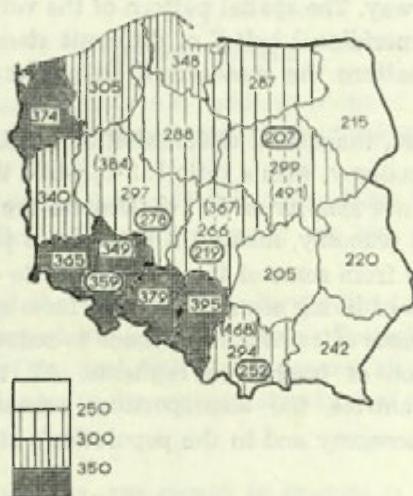

Fig. 24. Population's standard of living — synthetic index calculated per 1 inhabitant (with 300=the all–Poland mean)

relatively high, because the standard of living in Katowice voivodship is almost double that of Kielce voivodship. These differences are severe considering the socialist system and in executing further investment programmes an effort should be made to lessen them by an appropriate distribution of investments. Conditions as they existed in 1961 are shown in Fig. 24. This map indicates, that the spatial pattern of the standard of living in Poland takes the shape of three meridional belts (type B). This pattern proves that the differences are due, to a certain degree, to the uneven distribution of the population and uneven investment equipment. In effect, the severe differences in the standard of living are the cause of internal migrations, of a displacement of the population from east to west, and of an influx of people from the countryside to the towns, as well as from villages and smaller towns to larger towns, especially to the largest and those most intensively industrialized areas.

SUMMARY

Our analysis of various component factors of the national economy, enabled us to define the level of the economy by means of a synthetic index revealing that the spatial structure of the national economy forms a "central block" bounded on the north and east by a belt of peripheral voivodships of a lower economic level. At present, it is this "central block" that is the decisive factor in the further economic and social development of Poland.

Our analysis of the standard of living of the population was undertaken in a similar way. The spatial pattern of the voivodships shows, that in Poland three "meridional belts" of different standard of living exist, and that in this pattern the standard of living decreases from west to east.

As matters stand, the spatial differentiation is still rather high in the level of national economy, with a ratio 1: 3·5, while the differences in the standard of living are smaller as 1 : 1·9. Despite the marked advantages gained by planned economy, making it possible to pass on a part of the country's resources from some of the voivodships to others, the differences in the standard of living are still to large for a socialist country. For this reason a strenuous effort should be made to reduce the disproportions by suitable location of further investments. All the same, compared with capitalist countries, the disproportions revealed in the level of Poland's national economy and in the population's standard of living are relatively slight.

This study has supplied some sort of synthesis of the spatial differentiation in the national economy of Poland in 1961 — at the same time it constitutes a new attempt at an economic regionalization of the country[6].

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[6] Kukliński A., The inter-regional differentiation of Poland's national economy. *Geogr. Polon.*, 7, 1965, pp. 49–56.

CHANGES IN REGIONAL STRUCTURE OF INDUSTRY IN PEOPLE'S POLAND

ANTONI KUKLIŃSKI

GENERAL REMARKS

The problem of regional structure of industry is one of the most important in the set of problems regarding regional structure of the national economy of the country [7, 12].

While considering the theme of this paper from this point of view, it seems worth while to draw attention to the two following levels of the analysis:

I. The analysis of the basic facts featuring the trends of changes in the regional structure of industry in People's Poland.

II. The analysis of the evolution of the general ideas defining the rate and the targets of changes in the regional structure of industry in People's Poland.

I. BASIC FACTS FEATURING THE TRENDS OF CHANGES IN THE REGIONAL STRUCTURE OF INDUSTRY IN PEOPLE'S POLAND

As a basis for the analysis the country has been divided into 32 spatial units in an attempt to define the regional differentiation in industrialization levels of particular regions of Poland in 1960 [4]. The data given in Table 1 show that the number of people employed in industry and handicraft per 1 sq. km. have been taken as the leading criterion for the classification of the established spatial units. The delimitation of the established industrial districts, industrial areas, industrialized areas have been shown in Fig. 1.

After having prepared this set of statistical and cartographical data we may start analysing these information from the dynamic point of view.

1. Static pattern relating to 1960

One could assume that the data given in Table 2 properly feature the main proportions of the regional structure of industry in Poland in 1960. Then according to our classification 64.4% of the area of the country has

TABLE 1. INDUSTRIALIZATION

Types of areas	Area		Employment in industry and handicraft in 1960			Total population	
	in thous. sq. km	%	in relation to:			1946	1960
			1 sq. km	100 inhab.	total of employed (%)	in thous.	in thous.
1	2	3	4	5	6	7	8
A. Industrial districts	30·7	9·9	54·5	19·6	42·6	6 269	8 541
1. Upper Silesia	5·2	1·7	115·5	24·5	56·4	1 819	2 455
2. Cracow	3·8	1·2	51·5	17·0	35·8	818	1 142
3. Wałbrzych	2 1	0·7	49·7	22·8	54·8	419	457
4. Częstochowa	2·2	0·7	41·3	21·1	44·6	325	431
5. Bielsko	2·5	0·8	41·0	21·5	43·3	370	477
6. Łódź	8·0	2·6	39·5	20·2	42·1	1 275	1 562
7. Warsaw	6·9	2·2	38·4	13·2	28·5	1 243	2 017
B. Industrial areas	35·5	11 4	17·5	13·4	31·0	3 429	4 649
8. Gdańsk	5·9	1·9	19·9	11·7	31 5	521	1 000
9. Wrocław	5·6	1·8	19·3	13·2	29·7	512	824
10. Western Sudety	2·7	0·8	18·8	16·2	39·4	283	314
11. Opole	4·3	1·4	18·1	15·5	27·6	395	501
12. Bygoszcz	7·7	2·5	16 1	13·9	33·7	664	892
13. Kłodzko	1·6	0·5	15·4	14·8	36·7	237	167
14. Old Polish	7·7	2·5	15·3	12·4	27·7	817	951
C. Industrialized areas	44·6	14·3	10 1	10·8	23·8	3 384	4 160
15. Eastern Sudety	3 0	1 0	11·4	11·7	24·4	320	292
16. Greater Poland	20·2	6·5	10·6	11 0	26·8	1 605	1 945
17. Rzeszów	10·9	3·5	10·6	9·6	17·8	1 109	1 209
18. Legnica	4·1	1·3	9·1	12 0	28·5	193	311
19. Zielona Góra	6·4	2 0	7·7	12·3	28·8	157	403
D. Unindustrialized areas	200·9	64·4	2·8	4·7	9·7	10 544	12 011
20. Szczecin	19·3	6·2	4·9	8·8	21·2	453	1 058
21. Southern Lublin	16·0	5·1	4·6	5·6	10·0	1 261	1 331
22. Central	14·6	4·7	4·4	5·4	9·8	1 170	1 197
23. Eastern Cracow	8·2	2·6	4·1	4·0	8·4	803	850
24. Greater Poland — Silesian borderland	12·8	4·1	3·1	4·8	10·5	752	843
25. Białystok	23·1	7·4	2·2	4·6	8·8	942	1 090
26. Koszalin	28·4	9·1	2·1	5·3	13·5	1 018	1 151
27. Olsztyn	23·6	7·6	2·1	5·0	11·5	549	1 037
28. Southern Kielce	8 0	2·6	2·1	2·5	4·7	712	669
29. Eastern Rzeszów	8·7	2·8	1·9	3·1	5·8	571	546
30. Southern Mazovia	7·6	2·4	1·8	2·8	6·0	499	498
31. Northern Mazovia	15·0	4·8	1·5	2·5	6·0	880	874
32. Northern Lublin	15·5	5·0	1·4	2·6	4·4	934	867
Poland total	311·7	100·0	10·6	11·1	24·2	23 930*	29 731**

* 304 thousand people were not taken into consideration in the territorial distribution
** 370 thousand people were not taken into consideration in the territorial distribution
Source: A. Kukliński, M. Najgrakowski [4].

Urban population		Employment in industry		Dynamics of increase in 1946–1960					
1946	1960	1946	1960	Increase of population per 1 sq. km			Index of increase in 1946–60 (1946 = 100)		
in thous.	in thous.	in thous.	in thous.	popula-tion	urban popula-tion	employ-ment in industry	popula-tion	urban popula-tion	employ-ment in industry
9	10	11	12	13	14	15	16	17	18
3 128	6 156	757	1 596	74 0	98·6	27·3	136	197	211
944	2 048	331	583	122·3	212·3	48·5	135	217	176
383	703	68	184	85·3	84·2	30·5	140	183	271
221	346	63	102	18 1	59·5	18·6	109	156	162
123	245	38	87	48·2	55·5	22·3	133	199	229
87	191	40	97	42·8	41·6	22·8	129	220	242
721	1 058	165	302	35·9	42·1	17·1	122	147	183
649	1 565	52	241	112·2	132·8	27·4	162	241	464
1 353	2 716	197	586	34·4	38·4	11 0	135	201	298
523	730	36	109	81·2	69·0	12·4	192	226	297
226	544	30	103	55·7	56·8	13·0	161	241	343
91	194	24	49	11 5	38·1	9·3	111	213	204
74	192	18	73	24·7	27·4	12·8	127	260	406
366	575	44	115	29·6	27·1	9·2	134	157	261
71	90	13	24	—43·7	11·9	6·9	71	127	185
202	391	32	113	17·4	24·5	10·5	116	194	353
1 066	1 838	153	414	17·4	17·3	5·9	123	172	271
83	121	15	32	—9·3	12·7	5·7	91	146	213
692	1 019	84	190	16·8	16·2	5·3	121	147	226
186	343	31	109	9·2	14·4	7·2	109	184	352
55	149	8	36	28·8	22·9	6·8	161	271	450
50	206	15	47	38·4	24·4	5·0	257	412	313
1 912	3 402	128	487	7·3	7·4	1·8	114	178	381
203	610	17	87	31·3	21 1	3·6	234	300	512
211	365	17	67	4·4	9·6	3·1	105	173	394
267	340	22	56	1 8	5·0	2·3	102	127	255
108	189	7	29	5·7	9·9	2·7	106	175	414
118	181	12	34	7·1	4·9	1·7	112	153	283
168	328	8	43	6·4	6·9	1·5	116	200	538
250	438	15	53	4·7	6·6	1·3	113	175	353
140	368	9	45	20·7	9·7	1·5	189	263	500
67	88	4	14	—5·4	2·6	1·3	94	131	350
90	111	3	14	—2·9	2·4	1·3	96	123	466
44	63	3	12	—0·1	2·5	1·2	100	143	400
131	161	6	16	—0·4	2·0	0·7	99	123	267
115	160	5	17	—4·4	2·9	0·8	93	139	340
7 459	14 112	1 235	3 083	18·6	21·4	5·9	124	189	250

7*

Fig. 1. The regional structure of Poland's industry 1960 (according to A. Kuklinski
and M. Najgrakowski)

1 — unindustrialized areas, 2 — industrialized areas, 3 — industrial areas, 4 — industrial districts.

been described as unindustrialized areas. The words "according to our
classification" have been used deliberately because of the correlation
between the size and the number of the basic spatial units and the scale
of contrasts in non–industrialization. This correlation is, in most cases,
merely a statement saying that the increasing size of basic spatial units
corresponds to the decreasing scale of contrasts in the process of industria-
lization. In other words, in examining the main proportions of the regional
structure we obtain a more differentiated picture if we properly aggregate
the 300 county units than it would be the case with regard to 17 voivodship
units.

This relative methodical reference is not an attempt to deny that

TABLE 2. REGIONAL STRUCTURE OF INDUSTRY IN POLAND

1	Typological units of groups				
	A	B	C	D	Poland
	2	3	4	5	6
Area	9·9	11·4	14·3	64·4	100
Population	29·1	15·8	14·2	40·9	100
Urban population	43·6	19·3	13·0	24·1	100
Employment in industry	51·7	19·0	13·4	15·9	100

Source: A. Kukliński, M. Najgrakowski [4].

the regional differentiation of industrialization level is an objective fact —
it is merely a statement saying that there exist different patterns of
statistical data depicting this fact.

2. Dynamic pattern relating to 1946-60

The statement that in 1960 Poland should still be included in the group
of countries characteristic for essential disproportions in regional struc-
ture of industry offers the possibility of a more important dynamic
analysis which should define the trend of changes in this field.

The publications on that subject show that there are different opinions
as to how the changes in the regional structure of industry should be
measured [8]. It was particularly reasonable that attention has been drawn
to onesidedness of using relative indexes which exaggerate the develop-
ment of given phenomenon in underdeveloped regions as compared
with highly industrialized ones [4]. We are, therefore, of the opinion that
not only indices of the rate of changes should be used (column 18, Table 1)
but that indices of the scale of changes should also be used (column 15,
Table 1).

The statistical and cartographical analysis presented in Fig. 2. shows
that these two indices are not correlated but form a different spatial
pattern. This discrepancy of results of the analysis has become the
stimulus for further research for a method to include jointly the effects
of the "tempo" and the "scale" in the process of the transformation of
the regional structure of industry [6].

In order to solve this problem we have adopted the following approach.
During the period of 1946–60 the differences between the levels of
industrialization for the established typological units have become smaller
(see data in Table 3). Let us assume that in the future the processes of in-
dustrialization of the country will develop as they did during the period
1946–60. After how many years would the indices featuring the typolo-
gical units: A, B, C and D be brought to an equal level ?

It should be strongly emphasized that this is only an approach which
is a method of evaluation of the processes of reducing disproportions in
the regional structure of industry in Poland in the past. This approach does
not suggest that in the future one should really aim at bringing to
equality the levels of industrialization of all the established regions. On
the contrary, one can state that attempts of follow that way of thinking
are only possible when the principle of equal distribution of industry is
not accepted as one of the principles of the economic policy.

Performing the respective calculations we obtain the results given in
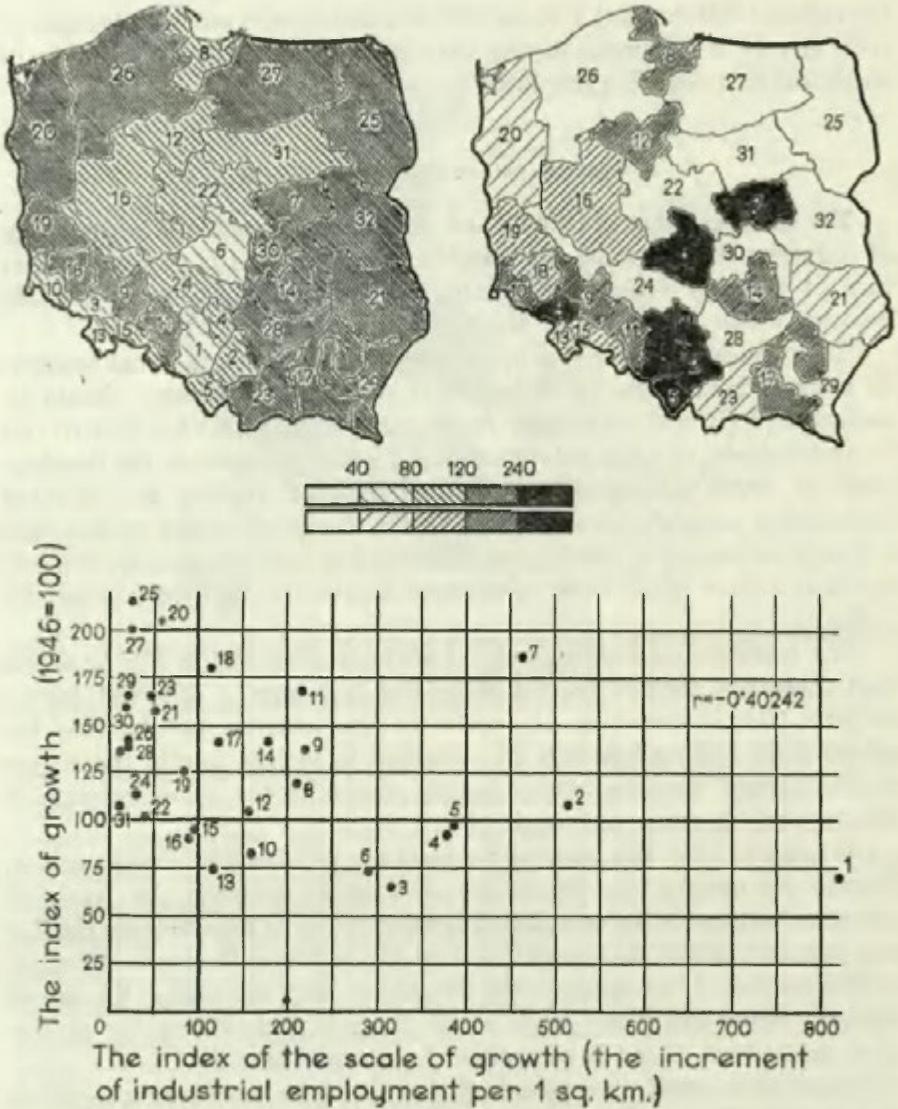Table 4. The number 47 in this table means that the areas of the group B

Fig. 2. The rate and the scale of industrial growth in Poland 1946-1960. The numeration of districts as in Table 1

will be equal (from the point of view of the employment index in industry per 1 sq. km) with the areas of the group A after 47 years, from the year 1960. The remaining numbers given in this table should be read in the same way. In the third column of this table there is a negative figure — 85. This figure means that the areas in group C will never equal the areas in

TABLE 3. REGIONAL STRUCTURE OF INDUSTRY IN POLAND IN 1946–1960

Typological units of groups	Employment in industry in thousands of inhabitants		Employment in industry per:			
			1 sq.km		100 inhabitants	
	1946	1960	1946	1960	1946	1960
A	757	1596	24·7	52 0	12·1	18·7
B	197	586	5·5	16 5	5·7	12·6
C	153	414	3·4	9·3	4·5	9·9
D	128	487	0 6	2·4	1·2	4 1
Poland	1235	3083	4 0	9 9	5·2	10·4

TABLE 4. EQUALIZATION PERIODS OF EMPLOYMENT INDEX
IN INDUSTRY – PER 1 SQ. KM

Typological units of groups	Equalling with typological units of groups		
	A	B	C
1	2	3	4
B	47	x	x
C	96	−85	x
D	73	110	56

TABLE 5. EQUALIZATION PERIODS OF EMPLOYMENT INDEX
IN INDUSTRY PER 100 INHABITANTS

Typological units of groups	Equalling with typological units of groups		
	A	B	C
1	2	3	4
B	15	x	x
C	24	639	x
D	27	36	29

group B with regard to the examined index if the tempo of industrializa-
tion of both groups continues as it was in the years 1946–60.

Periods required for the equalization of indices of employment in in-
dustry per 100 inhabitants have been calculated in the same way. The
comparison of the data given in Tables 4 and 5 shows that levelling of
industrialization from the point of view of the employment index in
industry per 100 inhabitants is quicker. This results from the index of
increase of population in 1946–60 being higher for typological units of
a higher level of industrialization.

In this context it is worth while to compare the data in Table 6 with
Fig. 3 where using the results of the research of L. Kosiński [2] we present
a synthetic pattern of the regional structure of migration in Poland in
the years 1951–60.

These materials allow us to state that during the years 1946–1960 in
Poland the process of concentration of population occurred [5] which is

TABLE 6. REAL AND HYPOTHETICAL INCREASE OF POPULATION IN THE ESTAB-
LISHED TYPOLOGICAL UNITS IN 1946–1960

Typological units of groups	Real increase of population in 1946–1960		Hypothetical increase of population in 1946–1960	
	in thousands	1946 = 100	in thousands	1946 = 100
A	2272	136	1522	124
B	1220	135	833	124
C	776	123	822	124
D	1467	114	2558	124
Poland	5801*	124	5801*	124

* 66 thousand inhabitants were not taken into consideration.
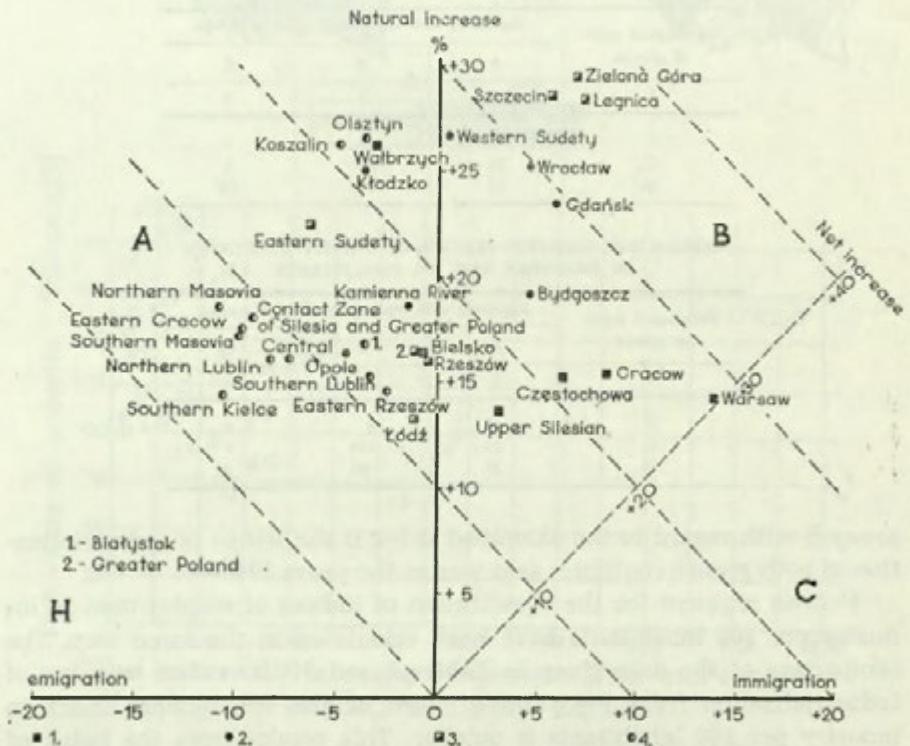
Fig. 3. Types of population changes in Poland 1951–1960 (according to L. Kosiński and A. Piotrowski)

1 — industrial districts, 2 — industrial areas, 3 — industrialized areas, 4 — unindustrialized areas.

one of the general regularities in the countries characteristic for the high rate of industrialization and urbanization. These materials allow the formulation of another essential general statement saying that in 1946–60 in the process of industrialization of Poland there was a tendency towards

TABLE 7. DEVELOPMENT OF ESTABLISHED TYPOLOGICAL UNITS IN 1946–1960

Index	Industrial district of Upper Silesia	Un–industrialized area of Białystok	Industrial area of Cracow
Population			
Increase in thousand	636	148	324
Increase per 1 sq. km	122·3	6·4	85·3
Increase index (1946 = 100)	135	116	140
Urban population			
Increase in thousand	1104	160	320
Increase per 1 sq. km	212·3	6·9	84·2
Increase index (1946 = 100)	217	200	183
Employment in industry			
Increase in thousand	252	35	116
Increase per 1 sq. km	48·5	1·5	30·5
Increase index (1946 = 100)	176	538	271

a gradual reduction of regional disproportions of this sector of the national economy. One can also distinguish, in a general way, three basic types of process of industrialization within Poland (Table 7):

(a) the process of further development of industry typical for the large scale and relatively slow rate of increase (e.g. Upper Silesia),

(b) process of industrialization typical for the relatively small scale and relatively high rate of increase (e.g. the area of Białystok),

(c) process of industrialization typical for both the large scale and high rate of increase (e.g. the area of Kraków).

II. EVOLUTION OF THE IDEAS DEFINING THE RATE AND TARGETS OF CHANGES IN THE REGIONAL STRUCTURE OF INDUSTRY IN PEOPLE'S POLAND

Having first established basic facts describing the trends of changes in the regional structure of industry in People's Poland it is worth while to make a brief analysis of the evolution of ideas and conceptions on the transformation of these phenomena.

The starting point for this discussion is undoubtedly the following quotation from the 6–Year Plan Bill voted by the Polish Parliament in 1950 [11]: "... during the planned period a long–term process will be commenced leading to a more even distribution of the productive forces and also of social and cultural facilities over the whole country. Disproportions in the development of the economic and cultural life resulting from the circumstances of the development of capitalist Poland will be reduced".

The aforesaid principles of the Bill have been eagerly introduced into the scientific and popular literature dealing with the principles of distribution of industry. One of these publications says: "The most important and predominant principle is the trend to a more equal distribution of industrial plants over the whole country [10].

In the middle fifties the assumptions for the localization policy of
the 6–Year Plan have been subject to a thorough analysis which produced
an evolution, which still continues, of the general concept of transforma-
tion of the regional structure of industry in Poland.

It seems worth while to present three quotations featuring the trend
of this evolution.

In 1956, K. Secomski stated his attitude towards the problem, as
follows [13]:

TABLE 8. NATIONAL ECONOMY OF PEOPLE'S POLAND IN 1946–1980

Index	Unit	1946	1960	1980	Increase index		
					1960 1946=100	1980 1960=100	1980 1946=100
Population	mln	23·9	29·7	37·3	124	126	156
Rural population	,,	16 1[1]	15·2[1]	14·3	94	94	89
Urban population	,,	7·5[1]	14·2[1]	23·0	189	162	306
Population in towns of over 100 thousand inhabitants	,,	2·4	6 1	9·7	254	159	404
Employment in industry	,,	1·24	3·08	} 5·65	248	} 171	} 387
Employment in handicraft	,,	0·22	0·22		100		
National income generated in:	mln zł 1961	79[2]	379·7	1200[2]	480	316	1500
industry	,,	26	178·4	765	684	430	2900
agriculture	,,	39	88·6	130	228	146	330

[1] The classification into towns and villages did not consider 304 thousand people in 1946 and 370 thousand people in 1960.

[2] According to B. Prandecka.

Sources: 1. K. Secomski. Polska w roku 1980 (Poland in 1980). XX lat Polski Ludowej. PWE, Warszawa 1964.
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"Undoubtedly, one should first of all refer to the most commonly
presented leading principle of the distribution of productive forces —
formulated in most cases as the principle of equal distribution of produc-
tive forces in the country. Instead, it should perhaps be more correct to
say "the principle of rational distribution" for, of course, the thesis of
equal distribution must, as a rule, be supplemented by a commentary.
This, however, is not a problem of a mechanically equal localization in
the whole country, but of the choice of alternatives of localization
enabling the full utilization of natural conditions of development of in-
dividual regions — bearing in mind the problem of equalizing the level
of development. It is, therefore, wiser to use the definition of rational
distribution of productive forces in the whole country".

In 1958, K. Dziewoński [1] stated that :

"In view of the experience in building the base of the socialist economy it seems that the above principle should be differently formulated or substituted by the principle of the equal possibilities and equal chances of social and economic development of the population in all parts of the country, of giving to their inhabitants similar living conditions — similar standards of living. This principle will continue to be the target principle which under the circumstances of continuous development of human society and its economy will never be achieved absolutely".

The experience and discussions held during the years that followed finnally led to the following formulation by K. Secomski [12]:

"As a rule, in each country the existing situation in the field of the distribution of the productive forces will always cause some reservations. Only perspective planning of the economic development allows the introduction of the required changes of regional proportions thus achieving some additional economic advantages. At the same time, it is true that the interregional differences as regards the level of industrialization, intensification of agriculture, uneven distribution of communication, deficiencies of settlement network, differences of the standard of living in the particular regions, etc. — may only be reduced step by step after implementation of several stages of economic policy.

...The aforesaid problem is really extremely complex. Individualization of the trends of development of the particular regions, the necessity of a proper distribution of tasks, considering the problems of individual rate of growth of each region in view of the premises of the overall–social interest — lead to the formulation of highly complex decisions in the long–term economic plans seeking an optimum for the whole country".

K. Secomski [12] continues in the quoted paper, stating that:

"... in the present stage of development of the socialist economy and due to the greater importance of specialization and distribution of tasks among the group of countries which are members of the Council of Mutual Economic Assistance, the thesis of the integration of international and national policy of distribution of productive forces should be firmly advanced".

With regard to the above mentioned formulations the evolution of ideas of interest to us could be described, as follows:

1. The main object of transforming the regional structure of the national economy is not the implementation of the principle of even distribution of the productive forces but the optimization of the rate of growth of national income, taking into consideration the complex problem of advantages arising from the international division of labour. In this

context, in a modified way, the postulate of reducing disproportions in the regional structure of the national economy is maintained, thus emphasizing that the implementation of this postulate is an extremely long-term and multi–stage process conditioned by the general needs of optimizing of the national economic growth.

2. The problem of regional structure of industry is the leading but not the sole problem with regard to transformation of the regional structure of the national economy. Industrialization is the most important but not the only method of increasing the intensity of economic growth of underdeveloped regions [14]. One could even emphasize that some areas of the country should perhaps be subject to a ban on building new industrial plants in order to meet the demands of a rapidly increasing tourist industry serving both national and international demand [3].

3. The process of finding an optimum of regional structure of industry in the socialist economy is not a conflict–free problem as had been asserted in the early fifties. One of the important elements of this process is to define properly, and to solve, the conflicting situations, occurring due to the mutual influence of the sectoral and regional pattern of planning and managing of the national economy [9].

One could thus state that the most general feature of the evolution of ideas under discussion is an evident tendency towards giving a more genuine picture of the real development of facts and a realistic evaluation of possibilities of transforming the regional structure of the national economy of the country.

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AREAS OF SPATIAL CONCENTRATION OF INDUSTRY IN POLAND

STANISŁAW HERMAN

1. METHOD AND SCOPE OF STUDY

Up to now, the investigations dealing with the spatial structure of industry in Poland were based — as to spatial units of reference — on voivodships (like papers by A. Kukliński [3, 4], and S. Leszczycki [7], or on poviats (see papers by K. Bromek [1], S. Leszczycki, A. Kukliński, M. Najgrakowski, J. Grzeszczak [5] and A. Wrzosek [9]). Voivodships differ in area within the range of 9506 to 29,369 sq. km, while for poviats the areas involved are from 335 to 2237 sq. km. In view of these dissimilarities there arose the necessity of supplementing the above studies by an analysis based on the smallest units of territorial administration, that is on rural communities, settlements and towns. As an index for the distribution of industry in 1956 the author chose for his analysis, employment in industry within the area of a given territorial unit, both in absolute figures and as indices per 100 sq. km and per 1000 inhabitants.

The author started his work with the preparation of a card index of the administrative units in which industrial plants are situated. For the total of 7227 territorial units of this kind, industrial plants existed in 5042 (approximately 70%). With this index as a basis a number of analytical maps were plotted.

Thus prepared, the statistical and cartographical material collected made it possible to define the areas of considerable concentrations of people employed in industry. Such areas the author calls 'a r e a s o f s p a t i a l c o n c e n t r a t i o n o f i n d u s t r y' (briefly: areas of concentration). Applying the method of elimination, there were selected from the previously mentioned 5042 territorial units 238 units representing 86 areas of spatial concentration of industry. Comparing these two figures one notes, that the areas of concentration are represented by two groups — one being areas based on single units, the other involving several administrative units each. In view of this, our criteria of elimination had to be differentiated for the two groups. Thus, for areas based on a single administrative unit, the limiting values adopted were as follows:

1. Within a given unit, the absolute number of persons employed in industry should not be smaller than 4000 workers, that is, eight times higher than the mean all–Poland figure for one industrialized territorial unit.

2. The index of persons employed in industry per 100 sq. km should not be smaller than the tenfold value of the all–Poland index.

In defining areas of concentration which developed from several territorial administrative units, the following criteria were adopted:

1. The individual units constituting the group should comply with at least one of the following conditions :

a. The absolute number of persons employed should not be smaller than 1000 industrial workers

b. The index of persons employed in industry per 100 sq. km should not be less than three times the value of the all–Poland index.

2. Continuity must be maintained in the territorial group (all units must adjoin each other)

3. The total number of industrially employed within the whole group should not be less than 4000 workers

4. The mean index of persons employed in industry per 100 sq. km for the area of the whole group should not be less than five times the value of the all–Poland index.

With the criteria thus established it was seen that along the margins of some of the areas of concentration, a number of administrative units failed to meet the conditions specified by the criteria adopted: even so, regarding the concentration of industrial workers, they stood out against the region they adjoined. This fact is significant, because it illustrates the theory of the evolution of areas of concentration by "budding". This is also why such units were taken into account as marginal zones, illustrating the probable trends of further spatial expansion of some of the areas of concentration.

The areas of spatial concentration of industry are characterized by considerable differences in their volume of employment, as well as in their indices of employment per 100 sq.km. This led to the necessity of classifying the different areas. As criteria for this classification there was adopted a combination of the following three determinants: the number of persons employed in industry, and the indices of employment both, per 100 sq.km and per 1000 inhabitants. Furthermore, attention was paid to the size of the areas occupied by different types of areas of concentration. Table 1 presents these types of areas of concentration, with the respective determinants added.

All areas of spatial concentration of industry resulting from the above scrutiny were given separate "certificates" containing the following data:

1. Size of area

2. Population, for 1946 and 1956

3. Increase in population during the 1946–1956 period

4. Number of industrial plants in 1956, the total figure and also split into 8 groups of branches of industry

5. Number of persons employed in industry in 1956, the total figure and also split into 8 groups of branches of industry

6. Index of persons employed per industrial plant in 1956, the total figure and also split into 8 groups of branches of industry

7. Index of persons employed per 100 sq.km

8. Index of persons employed per 1000 inhabitants

9. Increase in industrial employment in the 1946–1956 period

10. Index of increase in industrial employment, calculated to 1000 persons of increase in population, for the 1946–1956 period.

The above data enabled the author to analyze the spatial structure of Poland's industry in 1956, illustrating at the same time the principal trend of expansion during the 1946–1956 period. The result of this analysis is a picture of the degree of spatial concentration of industry in Poland, as well as in the individual voivodships.

TABLE 1. TYPES OF AREAS OF SPATIAL CONCENTRATION OF INDUSTRY

Type	Types of areas of spatial concentration of industry	Number of persons employed in industry	Determinant with reference to mean all-Poland determinants assumed to be 1		Approximate extent of given area in sq. km
			per 100 sq. km	per 1000 inhabitants	
1	2	3	4	5	6
A	Territorial industrial units (communities, urban settlements towns)	4000—9999	≥10	≥1·5	5—60
B	Industrial centres (communities, urban settlements towns)	10000—19999	≥20	≥1·5	25—70
C	Industrialized groups	4000—7999	≥5	≥1·5	30—90
D	Industrial groups	8000—19999	≥10	≥1·5	40—90
E	Industrial agglomerations	20000—49999	≥20	≥10	80—250
F	Large industrial agglomerations	50000—299999	≥25	≥10	200—500
G	Industrial conurbation	>300000	>50	>30	≥1000

Note: The differentiation in the employment indices per 100 sq. km between types A and C and between B and D, characterized by approximately identical numbers of workers employed, should be ascribed to differences in respective areas.

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On the basis of the numerical data characterizing areas of spatial concentration of industry, the author evolved a method allowing a comparative evaluation of the degree of industrialization, the spatial concentration and the dispersion of industry, in the separate regions. As a criterion for these three features (after a number of verifying calculations) the index of localization suggested by Florence was used, assuming as reference value the size of the respective areas. The index of localization means the ratio of the per cent share in the all–Poland industrial employment in a given area to the per cent share of the same area in the total area of Poland. Depending on the type of features measured, this index has been used as the measure of: the degree of industrialization, the degree of spatial concentration of industry, and the degree of saturation with dispersed industry. By applying these measures to the analysis of any region's structure the following data of reference are obtained: the rate of industrialization of the whole region defines the measure of the degree of industrialization; the marked spatial concentration of industry observed within a given region evaluates the measure of the degree of spatial concentration of industry; and the rate of industrialization of the remaining part of the given region defines the measure of the degree of saturation with dispersed industry.

2. SPATIAL CONCENTRATION OF INDUSTRY IN POLAND IN 1956

The areas of concentration occupy an area of 7572 sq.km, i.e. $2 \cdot 4^0/_0$ of Poland's total area. In 1956, this area involved a concentration of 2,048,184 industrial workers, i.e. $75 \cdot 6^0/_0$ — and a population of 8,992,000 i.e. $32 \cdot 0^0/_0$, of the corresponding all–Poland figures. In 1946, employment in industry within the area discussed amounted to 963,149 workers equal to $77 \cdot 8^0/_0$ of the all–Poland industrial employment. Thus, in the 1946–1956 period the increase in employment was as much as 1,085,035 workers, that is, $75 \cdot 5^0/_0$ of the all–Poland increase. With 1946 = 100, the index of increase in employment is 113, slightly less than the all–Poland index which is 116. During the 1946–1956 period, the population increase in all areas of concentration was 3,652,000, i.e. $82^0/_0$ of the all–Poland increase.

The accumulation of the various groups of industrial branches in the areas of concentration is presented in Table 2. Here the groups of branches have been arranged in decreasing order of the index of spatial concentration of industry (in conformity with the per cent values of employment within the respective areas of concentration). For the index values given in Column 5 of Table 2, the all–Poland figures are taken as being 1.

TABLE 2. INDICES OF SPATIAL CONCENTRATION FOR INDIVIDUAL GROUPS OF INDUSTRY
IN POLAND, IN 1956

Group of branches of industry	Determinant of degree of spatial concentration	per cent of all-Poland employment	per cent of all-Poland number of plants	Average number of workers per plant—index referred to all–Poland index
1	2	3	4	5
Power Industry	40	95·5	29·3	> 3·2
Metallurgy and Metal Industry	37	88·2	77·9	> 1 1
Remaining Industries	35	83·7	51·2	> 1·6
Light Industry	34	82·4	58·3	> 1·4
Chemical Industry	34	81·6	77·4	> 1 0
Food Industry	21	50 1	22·4	> 2·2
Mineral Industry	19	45·2	34·3	> 1·3
Timber and Paper Industry	19	44·9	36·7	> 1·2
Total	32	76·6	37·3	> 2·2

In Table 3 these general figures have been supplemented by basic data characterizing the individual areas according to the types adopted for them. The prevailing groups of industrial branches given in Column 7 of this table, there have been established, assuming as lower limit 20% of the total number of workers employed in the industry of a given type of area.

The brief numerical picture of the degree of concentration of industry in the areas of concentration, enumerated above, provides a general characteristic of the spatial structure of the Polish industry in 1956:

1. Industry in its basic mass (76·6% of employment) was principally concentrated in large plants, situated in areas of concentration which occupied 2·4% of Poland's area.

2. The areas of concentration, formed by groups of units and by single administrative units, with more than 4000 workers each, constitute territories with — considering Polish conditions — a very high degree of spatial concentration of industry.

3. The basic branches of industry located in these areas of concentration are Power Industry, Metallurgy and Metal Industry, and Light Industry; all in all, these three groups comprise nearly three quarter of the workers employed in the industries located in the areas of concentration.

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4. In the areas under discussion there may be observed a correlation between the spatial concentration of industry and high index values of concentration of industrial production (where the average sizes of industrial plants are expressed by the number of workers employed). These correlations are in evidence both for industry as a whole (the index being 2·2), and for the individual groups of industrial branches and the types of areas of concentration. The numerical data illustrating these interrelations, clearly indicate one of the reasons of spatial concentration of industry: the concentration of industrial production.

5. The areas of concentration in the 1946–1956 period reveal a very rapid development of industry, which in turn led to a spontaneous increase in population. With this growth in mind, the remarkable fact observed in nine of these areas, is that the increase in industrial employment exceeded the growth of the population.

6. The parts of Poland (97·6%) remaining after deduction of the areas of spatial concentration of industry, reveal a very low degree of industrialization; this is expressed by the fact, that in 4804 administrative units there exist 18,687 industrial plants, that is 62·7% of the total number of plants in Poland, employing a total of 626,530 workers, equivalent to 23·4% of all–Poland's industrial employment. Here the greatest concentration of industrial workers per unit comprises from 1000 to 3999 workers: there are 158 concentrations of this type. As to industrial employment the branch structure is rather uniform, the foodstuff industry being the only predominant branch employing 26% of all workers active in the area discussed. Concentration of industrial production is on a very low level; this is illustrated both by the comparative indices (none of the branches of industry taken as a whole for this vast area reveal indices higher than the all–Poland level, while the index for industry as a whole shows a figure less than one half of the all–Poland index), and by the average number of workers per plant which in two groups only (the Metallurgy and Metal Industry and the Chemical Industry) exceeds 100 workers per plant.

7. The evaluation of the distribution of the areas of concentration leads to a number of detailed conclusions as to: where these areas are located (along railway lines, in areas containing raw materials and ready markets), the spatial evolution of the areas, the formation of groups of areas due to productive and territorial bonds, etc. An interesting example, of how a large river exerts its influence on the development of areas of concentration, may be seen along the valley of the Lower Vistula: here is located the only agglomeration of areas of concentration and industrialized administrative units in Northern Poland. From a dif-
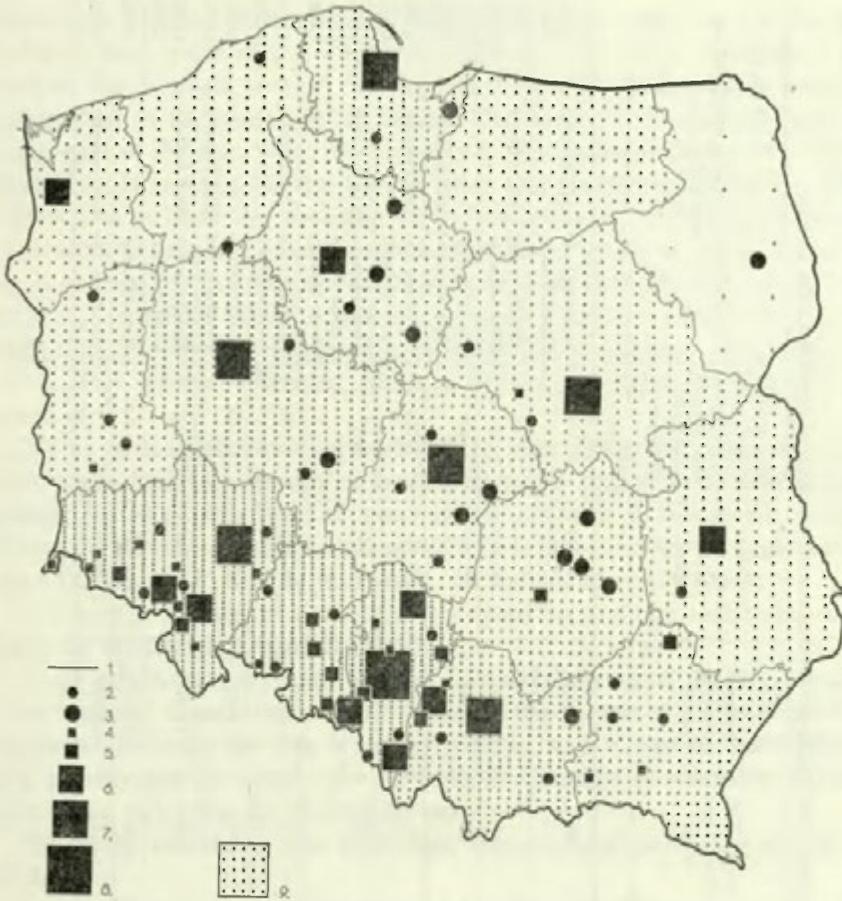
Fig. 1. Areas of spatial concentration of industry and the distribution of industry located outside these areas. According to the voivodship indexes of the degree of saturation with dispersed industry

1 — voivodship boundaries, 2 — territiorial industrial units, 3 — industrial centres, 4 — industrialized groups, 5 — industrial groups, 6 — industrial agglomerations, 7 — large industrial agglomerations, 8 — Upper Silesian Industrial Conurbation, 9 — degree of saturation with dispersed industry (dots, density proportional to the index value).

ferent point of view this problem has been expounded in a paper by Szczepkowski [8].

Furthermore, from the analysis of the distribution of the various types of areas of concentration and of the index of saturation with dispersed industry there evolves the thesis, that all Polish territory can be divided into two large spatial–industrial systems, differentiated according to the features characteristic for their spatial structures of

TABLE 3. GENERAL CHARACTERISTIC OF AREAS OF CONCENTRATION OF INDUSTRY IN POLAND, IN 1956

Types of areas of spatial concentration of industry	Number of areas of given type	Number of administrative units	Number of industrial plants	Number of workers employed in industry	Mean number of workers per 1 plant, index with reference to the all-Poland figure	Groups of branches of industry, predominant in given type	
1	2	3	4	5	6	7	
Territorial industrial units	30	30	1.284	190.055	> 1·8	Metallurgy and Metal Industry	(42%)
						Light Industry	(27%)
Industrial centres	13	13	1.043	183.434	> 2·1	Metallurgy and Metal Industry	(40%)
						Light Industry	(20%)
Industrialized groups	16	46	542	75.567	> 1·7	Light Industry	(30%)
						Metallurgy and Metal Industry	(28%)
Industrial groups	11	38	642	129.380	> 2·4	Metallurgy and Metal Industry	(30%)
						Power Industry	(20%)
Industrial agglomerations	9	40	1.618	311.036	2·3	Metallurgy and Metal Industry	(31%)
						Light Industry	(27%)
						Power Industry	(21%)
Large industrial agglomerations	6	31	4.356	650.042	> 1·8	Metallurgy and Metal Industry	(37%)
						Light Industry	(30%)
Upper Silesian Industrial Conurbation	1	40	1.621	508.670	> 3·8	Power Industry	(53%)
						Metallurgy and Metal Industry	(32%)
Areas of concentration, total	86	238	11.106	2.048.184	> 2·2	Metallurgy and Metal Industry	(35%)
						Light Industry	(21%)
Remaining part of Poland	x	4.804	18.687	626.530	> 0·5	Food Industry	(26%)
all-Poland	x	5.042	29.793	2.674.714	1·0	Metallurgy and Metal Industry	(30%)

industries. One of them, that of Silesia — Cracow takes in the highly industrialized parts of the Wrocław, Opole and Katowice voivodships as well as the western part of the Cracow voivodship which tends toward integration in its spatial development. The second comprises the remaining part of Poland. What are the causes that brought about this differentation? It seems plausible that in these two spatial–industrial systems differences in historical evolution of industrialization and of spatial concentration of industry must have had their effect while, at the same time, in the area of the Upper Silesian Industrial Conurbation, processes forming technical conurbation have been a factor accelerating this evolution. The characteristics of both systems discussed are as follows:

A. The Silesia — Cracow complex is characterized by the occurrence of:

— as predominants: 1. spatially developed forms of areas of concentration, based on groups of territorial units classed as industrialized groups (81%) of this type of areas in the country, 2. industrial groups (83%), 3. industrial agglomerations (67%), 4. large industrial agglomerations (33%) and 5. unique in Poland, an industrial conurbation;

— very few areas of concentration based on a single territorial unit (only 10 territorial industrial units);

— a relatively very high level of industrialization of the area, apart from areas of concentration (the indices of the degree of saturation with dispersed industry for the Wrocław, Opole and Katowice voivodships are the highest as compared with other voivodships, attaining values more than twice the all–Poland index).

B. In the remaining area of Poland there appear two other forms of evolution:

— the first with the marked spatial–industrial differences which, on the background of larger cities, lead to the formation of groups of territorial units with a considerable concentration of industrial employment, called in this paper industrial agglomeration (which exist at Bydgoszcz, Lublin and Szczecin) and large industrial agglomerations (which exist at Warszawa, Łódź, Gdańsk and Poznań) parallel to a very feeble industrialization of the areas outside these concentrations.

— the second form, an incipient form of industrialization and spatial concentration of industry, found its expression in the growth of minor and medium–sized concentrations of industries in separate towns and urban settlements which, in the present paper, have been called territorial industrial units and industrial centres. Here any possibilities of the formation of industrial groups are in an incipient stage. Except for these separate units, industrialization of these regions is rather negligible.

It is worthwhile to note, that for the predominantly large area of Poland the latter of the two forms discussed above under B, is more typical than the former.

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CONCENTRATION OF POPULATION IN EAST-CENTRAL EUROPE

Leszek Kosiński, Agnieszka Żurek

The present article is based on the concept of the concentration of spatial phenomena. This method was applied to population studies long ago. However, it is still useful nowadays as it helps to measure the distribution of phenomena in quantitative terms. The application of the method to demographic–geographical research was recently discussed by O. T. Duncan [1] and in Poland by R. Jedut [2]. Both emphasised that the results obtained depend on the basic reference unit. The method is especially useful in any comparative study. The comparison in time of the concentration of population on the present territory of Poland (1910—1931/33—1950—1960) was undertaken recently and the results published both in Polish and in a shorter form in English [3, 4].

Consequently, it seemed interesting to try and apply this method to the comparative study of different areas at the same time (comparison in space). In this article the concentration of population for 1960 in eight countries of East–Central Europe is analysed. The study includes: Albania, Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, Poland, Rumania and Yugoslavia.

Method and basic data

The study is based on the Lorenz curve. The curve is constructed within the Cartesian co–ordinate system by comparing two cumulative arrays — of population and that of the area occupied by the population. The curve limits an area OB between it and the diagonal OB and by comparing this area with the total area of a triangle OBC the concentration ratio η (etha) $= \dfrac{OB}{OBC}$ is computed.

A modified ratio k was computed according to the following formula

$$k = n \frac{a_1}{a_2}$$

where a_1, a_2 are upper and lower parts of the area limited by the diagonal and the curve.

TABLE 1. BASIC DATA FOR THE ANALYSIS OF THE CONCENTRATION OF POPULATION IN EAST–CENTRAL EUROPE

Country	Time	Kind of data	Name	Number		Area in sq. km			Population in thousands		
						Extreme values			Extreme values		
				Total	Modified*	Minimum	Maximum	Average	Minimum	Maximum	Average
Albania	2. October 1960	Estimate	*Rrethet*	27	26	472	2533	1038	17·3	194·9	62·6
Bulgaria	31. December 1960	Estimate	*Okrǎg*	30	28	1125	7556	3962	148·4	766·4	281·0
Czechoslovakia	1. March 1961	Census	*Okres*	109	105	120	2315	1220	42·5	1005·4	130·9
German Democratic Republic	1. December 1960	Estimate	*Kreis*	212	193	134	1574	561	19·2	1071·8	89·1
Hungary	1. January 1960	Census	*Jaras*	191	129	112	1943	720	22·5	1807·3	77·3
Poland	6. December 1960	Census	*Powiat*	396	324	333	2307	962	14·8	1682·1	91·8
Rumania	1. July 1959	Estimate	*Raionul*	224	189	400	5000	1251	24·6	1291·4	96·6
Yugoslavia	31. March 1961	Census	*Opština*	577	545	28	2043	469	1·4	843·2	34·0

* Since Cities were included into surrounding administrative units modified number of units is smaller than actual. Capitals of the countries (with the exception of Albania) were considered separately.

The basic data employed were either census data or official estimates for 1960 derived from the official publications[1]. For Rumania the data were obtained from the Institute of Geography, Rumanian Academy of Sciences, to whom the authors are greatly indebted. The population data for Rumania pertain to 1959 and for area to 1956 but Rumanian colleagues have assured us that any changes were insignificant.

It was more difficult to assure the comparability of basic reference units. In principle the study is based on the analysis of administrative units of the second order. The cities were included with surrounding counties. This was unnecessary in Yugoslavia where administrative units include cities as well as rural areas. However, in Albania the relatively small units of the first order were taken into account. In Federal Yugoslavia the structure of administrative division is different from that of the remaining countries. The average size of the *srez* was too big, the size of lower *opstina* was unfortunately rather small. The authors appreciate the assistance of Professor S. Ilesic, who supplied them with the administrative map of Yugoslavia. It was impossible to obtain the data relating to the area of *obstinas* in Bulgaria, therefore the much bigger units of first order had to be introduced into the study.

The average area of basic reference units ranged from 443 to 3,962 sq.km or 1 : 9 and excluding Bulgaria from 443 (Yugoslavia) to 1251 (Rumania) or 1 : 2·8. The average population of the basic reference unit ranged from 32,100 to 281,000 or 1 : 8·8 and excluding Bulgaria from 32,100 (Yugoslavia) to 130,900 (Czechoslovakia) or 1 : 4·1. It should be emphasized, that the ranking of countries with respect to the size of area is different from that of population. In both cases the smallest units are Yugoslav, the largest Czechoslovak, Rumanian and obviously Bulgarian ones. Furthermore, ranks of other countries varied a great deal.

Discussion of the size of basic reference units is not unimportant, since their size can contribute to the results obtained. In principle the larger the units, the smaller the differences among them, and consequently, the smaller the ratios of concentration. From this point of view the size of units tends to lower the resulting ratios in Czechoslo-

[1] Albania — *Vjetari Statistikor Republikes Popullore te Shqiperise 1964, Tirane* 1964. Bulgaria — *Statističeski godisnik na Narodna Republika Balgarija 1961,* Sofia 1961. Czechoslovakia — *Statistická Ročenka ČSSR 1964,* Praha 1964. German Democratic Republic — *Statistisches Jahrbuch der Deutschen Demokratischen Republik 1960/1961,* Berlin 1961. Hungary — *Évi Nepszámlálás 1.,* Elözetes Adatok, Budapest 1960. Poland — *Rocznik Statystyczny 1961,* Warszawa 1961. Rumania — Institute of Geography, Rumanian Academy of Sciences. Yugoslavia — *Statistički godišnjak Federativne Narodne Republike Jugoslavije 1964,* Beograd 1964.

vakia, Rumania and obviously in Bulgaria, whereas in Yugoslavia the tendency is just the reverse. Unfortunately, reduction of all the patterns into a common denominator was absolutely impossible. There seemed to be no possibility of introducing correction ratios. Eventually the available data were used and the reader is simply warned against possible deviations caused by the nature of the basic data. It seems however, that the deviations cannot be too great. R. Jedut computed the concentration ratios for units of different size in Poland. The average size of the unit of first order (voivodship) was 18 times greater than that of the second order (*poviat*). In our case the difference between the largest and the smallest units was 1 : 9 and excluding Bulgaria 1 : 3. Assuming the same dependency of ratios on the size of basic units (a very inaccurate assumption) one could expect deviations not exceeding 25% and excluding Bulgaria not bigger than 9%. An authority in statistics S. Szulc who did similar work when comparing the concentration ratios for Europe (based on administrative units of first order) and for the United States (states) clearly stated that the picture obtained when comparing the units of different size is not precise, but in general it does not raise any doubt.

Having constructed curves for each country (Fig. 1) the ratios η (etha) and k were calculated. The latter made it possible to analyse the reasons for the phenomenon of concentration and particularly the role of uninhabited areas as well as of great agglomerations. The map (Fig. 2) shows the areas occupied by equal groups of population (20%).

THE RESULTS OF THE STUDY

As far as the value of the concentration ratio η is concerned the countries under discussion can be divided into three groups. The lowest ratio was obtained for Bulgaria (0·21), however, this is an atypical case due to the exceptional difference in the size of the basic unit. Second group includes Rumania, Czechoslovakia, Albania, Hungary and Yugoslavia with ratios ranging from 0·31 to 0·36. The largest concentration of population is characteristic for Poland and Eastern Germany, where the ratios exceed 0·40 as compared to the average for all the countries 0·38. When taking into account a modified ratio k, another ranking is obtained. In this case it is also possible to evaluate the role of great agglomerations. The difference between the two ratios is not very significant in Yugoslavia and Rumania, but it is very large and important in the case of Hungary. In the remaining countries the difference amounts to 18–28% (on an average for the region 24%). Small differences between η and k indicate that the disparities in the distribution

TABLE 2. RATIOS OF POPULATION CONCENTRATION IN EAST–CENTRAL EUROPE IN 1960

Country	Concentration ratio η	Modified concentration ratio k	Difference between modified concentration ratio k and concentration ratio $k-\eta$	Relative difference in percentage (k divided by concentration ratio)
	1	2	3	4
Albania	0·33	0·39	0 06	118
Bulgaria	0·21	0·27	0 06	129
Czechoslovakia	0·32	0·38	0 06	119
German Democratic Republic	0·45	0·57	0 12	127
Hungary	0·34	0·52	0 18	153
Poland	0·41	0·52	0 11	127
Rumania	0·31	0·33	0 02	106
Yugoslavia	0·36	0·38	0 02	106
Total for 8 countries	0·38	0·47	0 05	124

of population depend either equally on the existence of poorly inhabited territories and of the bigger agglomerations (Yugoslavia, Rumania, Albania) or on the lack of extremes (Czechoslovakia).

Big disparties emphasize the importance of big cities, clearly seen in the case of the German Democratic Republic, Poland and especially Hungary (Budapest).

The difference between the aggregate ratios η and k for all the countries involved is relatively large. In this case, however it depends not only on the differences between rural and urban areas but also on the differences among different countries.

During construction of the curves another measure of concentration was introduced which helps to show on the map the areas inhabited by equal numbers of population.

The area of the eight countries equals 1,273,000 sq.km and was inhabited by 117 million people with the resulting density of 92 persons per sq. km. However, the 20% living on the areas with the lowest density

TABLE 3. POPULATION AND AREA BY DIFFERENT DENSITY GROUPS IN EAST–CENTRAL EUROPE

| Population		Area		Density of population per sq. km		Reference units		
Percentage	Thousands	Percentage	Thousands of sq. km	Average	Bordering	Number	Average population Thousands	Average area Thousands sq. km
0—19·9	23.397	41	521	44·9	62·4	554	42	937
20—39·9	23.397	26	330	70·9	84·8	367	64	899
40—59·9	23.397	18	228	102·6	119·3	322	73	708
60—79·9	23.397	12	151	154·9	256·5	224	105	677
80—100	23.397	3	43	544·1		73	321	589
100	116.985	100	1273	91·9	x	1540	76	827
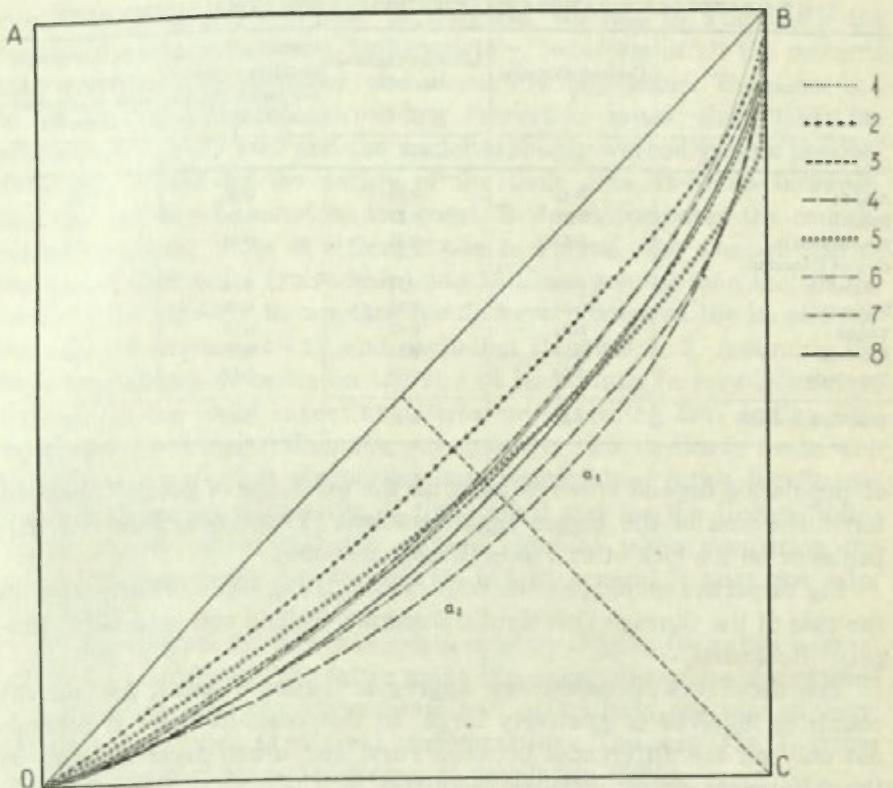
Fig. 1. Concentration curves of population in the countries of East–Central Europe — 1 Albania, — 2 Bulgaria, — 3 Czechoslovakia, — 4 German Democratic Republic, — 5 Hungary, — 6 Poland, — 7 Rumania, — 8 Yugoslavia

OA — Percentage of population (cumulative array), OC — Percentage of area (cumulative array), a_1, a_2 — upper and lower parts of the area limited by the diagonal OB and curve OB.

(on an average 45) occupied over 40% of the territory whereas the top 20% occupied only 3% of the territory but with average density of 263 persons per sq.km. On the whole the higher the density the lower the share of the area and the smaller number of reference units becoming smaller but with larger populations. In the group of highest density, the large cities are represented (all over the region), in the second group it is mainly industrial areas (predominantly in the North), and in the third and fourth groups the relatively better developed agricultural areas, in the last — less inhabited mountainous areas especially in the South.

The map based on this division of units into five groups is in fact a certain modification of the density map where rather density structure is shown.
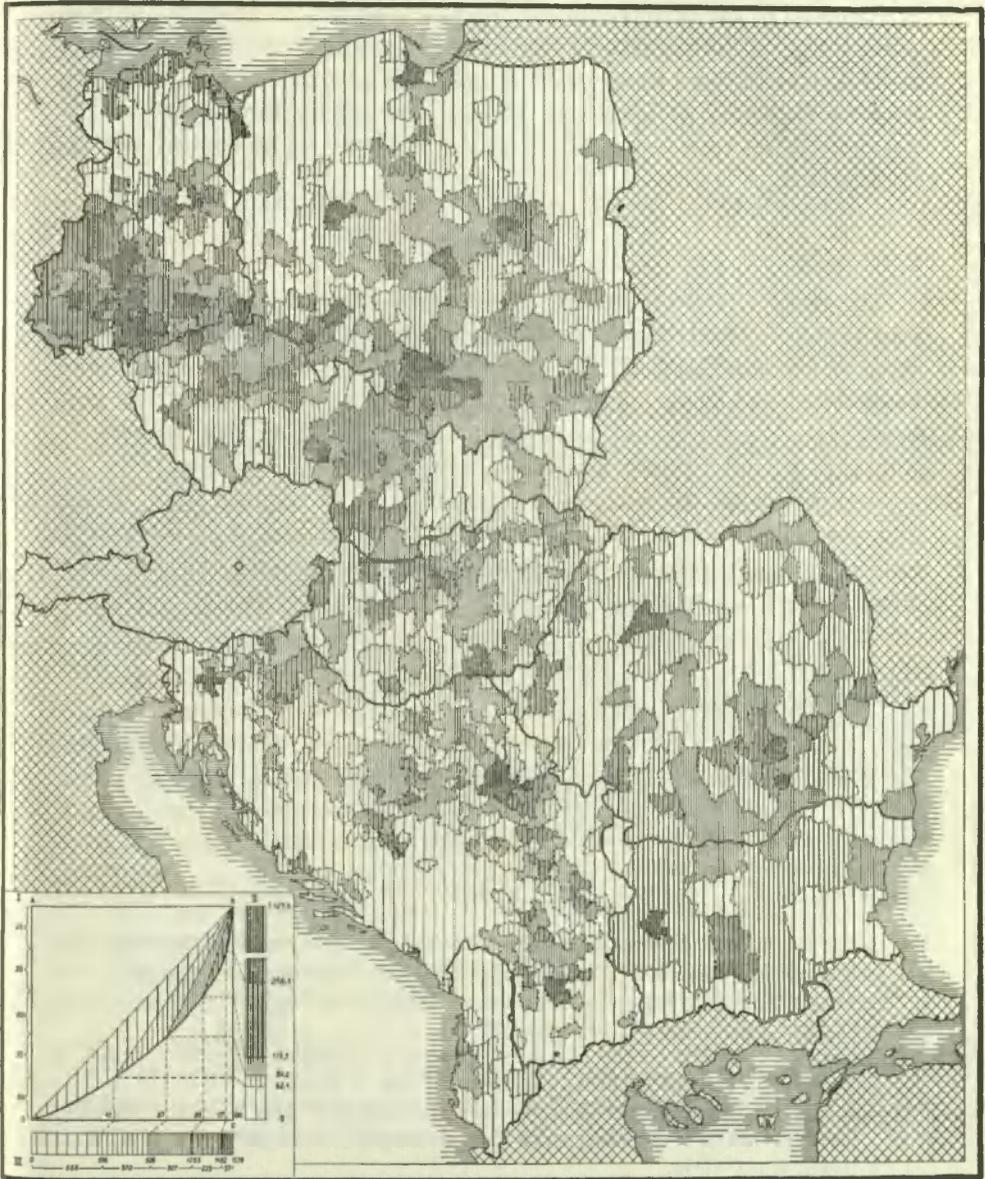
Fig. 2. Map of population concentration in East–Central Europe

I. Concentration curve of population in East-Central Europe. OA — Percentage of population (cumulative array). OC — Percentage of area (cumulatve array). II. Number of administrative units in each area inhabited by equal numbers of population. III. Density of population per sq.km in areas inhabited by equal groups of population (20%). Bordering and average densities.

It should be mentioned, that such a joint analysis is rather an abstract venture due to the persistent "demographic autarky" of the countries in East-Central Europe. However, it seems feasible that in connection with growing economic co–operation, greater mobility of labour can be envisaged. In that case such a joint regional analysis can be applied without reservations.

Conclusions

The results obtained confirm our general knowledge of the situation. The largest spatial disparity of population exists in most industrial countries in the North of the region, with the exception of Czechoslovakia which is known for its fairly balanced structure of the urban network. Hungary stands out as a special case with its specific problem of Budapest grown within a different spatial pattern of economy.

Application of the concentration method to the comparative studies in space helps to define quantitatively, with one indicator of a synthetic character, the differences between the countries, although the inevitable disparities of the size of basic reference units make the analysis more difficult.

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RESEARCH ON THE DYNAMICS OF THE INTER–REGIONAL COMMODITY FLOWS

Wojciech Morawski

1

From an analysis of allocation, intensity and structure of the commodity flows we shall attempt to define one of the essential aspects of the structure and the regional typology of the country or of the processes of differentiation and integration of the spatial pattern. This kind of research was undertaken by E. L. Ullman [1] from a quantitative point of view and then included by W. Isard [2] into the system of regional analysis. In Poland Z. Chojnicki [3, 4] achieved some interesting results.

It should be emphasized that when in applied research of the physical size of commodity flows for the regional analysis we encounter two drawbacks. Firstly the research of the physical volumes of commodity flows do not offer any chance of refering to series of economic categories e.g. the value of production or the national income. Secondly such research raise no doubts while the flow of goods of homogeneous commodities is considered; however, as soon as we try to transform much of the analytical information and turn it into a synthetic form, doubts and reservations arise.

Bearing in mind the aforesaid doubts and restrictions concerning the limited application of physical volumes of commodity flows in the regional analysis I should like to present, some results of studies on the dynamics of these flows. I shall therefore concentrate on the problem of influence of the structure and changes of commodity flows on the dynamics of the formation of regional balances of commodity flows.

2

This research includes the railroad commodity flows during the period 1958–1962, based on data obtained from official statistics on intervoivodship flows. The railroad transport in Poland plays a major role in the interregional exchange of goods. Roughly speaking its represen-

tative nature may be defined by the share the railway transported of the total carried by all means of transportation[1] which, during the examined period of time amounted to slightly more than 90%.

The situation that existed in 1958–1962 as regards the intensity of commodity flows on the railway and changes in the spatial and generic structure of these flows is connected with the general economic development of the country. The differences of dynamics of the development of industry (and its branches), agriculture, forestry and construction as well as changes in the allocation of production forces, progress in specialization and co–operation had a large influence upon the railroad transport. Table 1. shows changes in the generic structure and dynamics of the railroad commodity flows.

TABLE 1. CHANGES OF STRUCTURE AND DYNAMICS OF RAILROAD COMMODITY FLOWS WITHIN THE COUNTRY

Kind of commodity (group)	Share un total in %		Index of growth 1962–1958 in %
	1958	1962	
Bituminous coal	40·7	40·8	120·4
Brown coal and coke	5·2	4·6	106·9
Ores and pyrites	6 1	7 1	141·3
Stones	7·3	7 0	115·3
Stands and gravels	7·8	7·0	107·5
Crude and rafined petroleum	1·7	2·5	173·7
Metals and metal manufactures	6·9	7·2	125·2
Bricks	2·6	1·7	78·3
Cement	2·5	2·5	117·8
Artificial fertilizers	1·8	2 1	138·2
Chemical products	1·8	2·2	150·0
Grains	2·1	2·6	149·5
Potatoes	0·9	1 0	144·5
Sugar beets	2·6	2·4	113·6
Other crops and processed agricultural products	3·4	3·8	135·4
Timber and timber products	6·6	5·5	98·8
Total	100 0	100 0	120·3

Bituminous coal greatly influenced the level of the dynamics of transport. An above–average level of flow was reached by commodities related to agriculture (except for sugar beet) and by some industrial commodities, while the share of the flow of construction goods diminished[2]. Of course, the situation varied in different regions, as regards changes of the structure and of the dynamics.

[1] The total of transport includes not only public car–transport shown in the official statistics but also the estimated transport by cars owned by enterprises not licensed for transport services.

[2] This is related to changes of building technics (reduction of brick consumption) and in particular to the improvement in regional distribution of building materials. It also results from the wider use of road transport over shorter
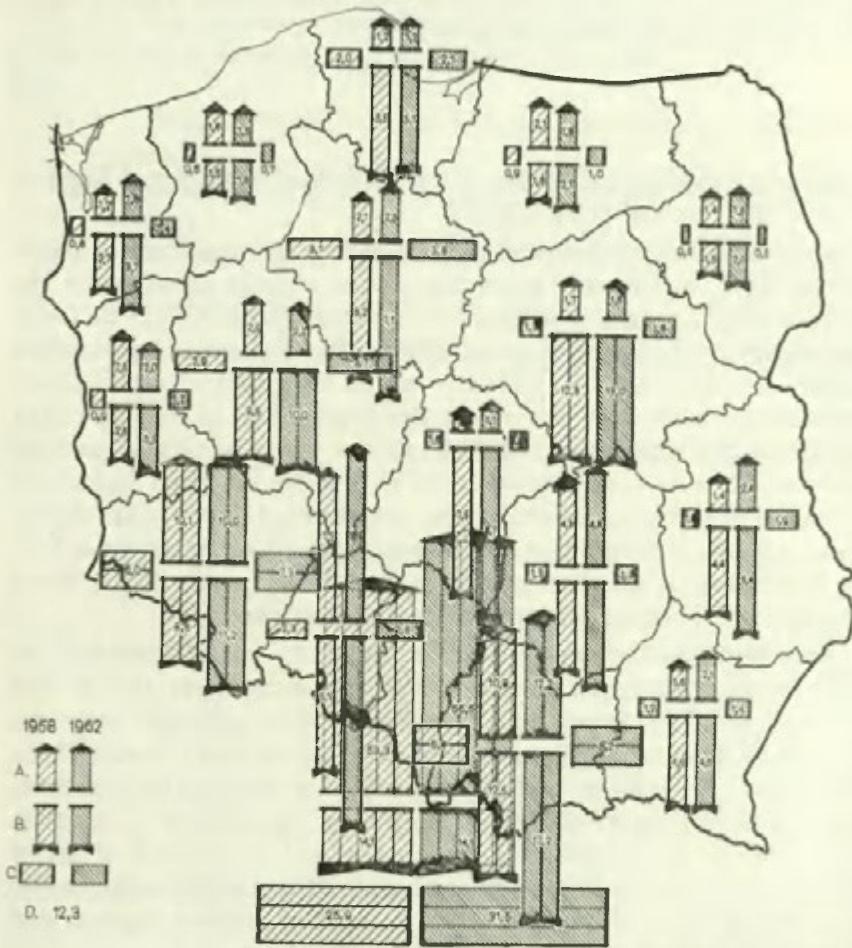
Fig. 1. Regional commodity flows (by railways) in 1958 and 1962.
A — inflows, B — outflows, C — infra-regional flows, D — flows in millions of tons.

Since our discussion concentrates on regional balances of flow of commodities, it seems reasonable to present, to begin with, the distribution of outflows, inflows and infra-regional flows and their dynamics. These are shown in Fig. 1, from which we perceive the importance of

distances; the annual value of building and construction production and services increased during the examined period by 37% and the total output for investment by 50%.

9*

different regions from the point of view of intensity of commodity flows, the character of regions in the light of flow balances and changes which took place during the examined period.

3

In order to define the regional differentiation of dynamics of balances we will adopt the following scheme:

If the transport volumes of a given region for the initial period (1958) are increased in the same proportion as the average increase for the whole country during 1958–1962 we shall obtain a hypothetical value for this region in the terminal period (1962). The difference between the hypothetical value and the effective one in the terminal period (1962) shows the deviation that occurred in the given region in relation to the average of the whole country. Calculations made according to such a scheme allow us to state whether the change for the given region and during the examined period was quicker or slower in relation to that of the whole country. If in addition we introduce groups of commodities into our calculations it will enable us to define the influence of the group structure and its dynamics upon the obtained results.

The above given approach has been applied, in regional research on dynamics of employment in the United States by H. S. Perloff and others [5] and E. S. Dunn, Jr. [6]. In Poland A.K. Kukliński drew our attention to these works [7]. In these studies, the method of research has been defined as "shift technique". Extending the meaning of this term, according to the nature of studies concerning the problem in question, we can follow A. K. Kukliński and say that it is "a method of inter– –regional and inter–branch shifts analysis". In our case, owing to the range of application it may be called "a method of inter–regional and inter–group shifts analysis".

Once we know how to apply this method in regional research on employment in the United States, were are then able to state its applicability to the interpretation of dynamics of the commodity flows in the inter–regional pattern.

The method of inter–regional and inter–group shifts analysis may be applied in many sections of research of the commodity flows in the regional pattern (voivodship) and also within a given group in order to establish the deviations recorded in regions. It was then decided to apply this method for examining the dynamics of balances of the commodity flows in different commodity groups and in general for each of the 17 voivodships.

4

Let us now present a mathematical formulation of the problem and of the method of inter-regional and inter-group shifts[3].
Let:

E_{ij} = balance of flows in group i in the voivodship j in the initial period

E^x_{ij} = balance of flows in group i in voivodship j in the terminal period

$E_{i.}$ = total transport in the whole country in group i in the initial period $- \sum_j E_{ij}$

$E^x_{i.}$ = total transport in the whole country in group i in the terminal period $= \sum_j E^x_{ij}$

$E_{.j}$ = balance of flows, total for voivodship j in the initial period $= \sum_i E_{ij}$

$E^x_{.j}$ = balance of flows, total for voivodship j in the terminal period $= \sum_i E^x_{ij}$

$E_{..}$ = total transport in the whole country in the initial period $= \sum_{i,j} E_{ij}$

$E^x_{..}$ = total transport in the whole country in the terminal period $= \sum_{i,j} E^x_{ij}$

Then:
The differential group shift in a voivodship is:

$$Sg = E^x_{ij} - (E^x_{i.}/E_{i.})E_{ij} \qquad (1)$$

The differential total shift in a voivodship is:

$$Sd = \sum_i [E^x_{ij} - (E_{i.}/E_{i.})E_{ij}] = \sum_j Sg_j \qquad (2)$$

The total shift in a voivodship is:

$$St = E^x_{.j} - (E^x_{..}/E_{..})E_{.j} \qquad (3)$$

The proportional shift in a voivodship is:

---

[3] Symbols and equations that will be applied are adopted from the methodical work of H.S. Perloff [5], p. 71, foot note 9 and E. S. Dunn, Jr. [6] p. 112.

$$Sp = \left[E^x_{.j} - (E^x_{..}/E_{..})E_{.j}\right] - \sum_i \left[E^x_{ij} - (E^x_{i.}/E_{i.})E_{ij}\right] =$$

$$= \sum_i (F^{.}_{i.}/E_{i.})E_{ij} - (E^x_{..}/E_{..}) \sum_i E_{ij} =$$

$$= \sum_i \left[(E^x_{i.}/E_{i.}) - (E^x_{..}/E_{..})\right]E_{ij} \tag{4}$$

This means that the differential group shift — Sg (1) — is the difference between the effective balance of commodity flows in group i in the voivodship j in the terminal period, and the balance of commodity flows, which could be recorded if the dynamics of commodity flows in group i in the voivodship j was on an average level of the dynamics of group i in the whole country.

TABLE 2. DIFFERENTIAL, PROPORTIONAL AND TOTAL SHIFTS OF

Kind of shift	Warsaw	Bydgoszcz	Poznań	Łódź	Kielce	Lublin	Białystok
1	2	3	4	5	6	7	8
Sg the differential group shifts							
Bituminous coal	−272	− 80	+ 3	− 25	− 6	−420	− 85
Brown coal and coke	−108	− 42	+ 94a	− 32	− 21	− 4	− 68
Ores and pyrites	+ 88	+ 10	−219b	+129	−229	−234	− 38b
Stones	+165	+ 75	+49	+129	− 44	+212	+ 7a
Sands and gravels	− 8	+ 332a	−175	+ 4	−218	+ 82	+ 35
Crude and rafined petroleum	+ 15	+ 59	− 1	+ 94	+ 18	+178	+ 17
Metals and metal manufactures	− 71	+ 15	−50	+ 22	− 29	+ 1	− 37
Bricks	+546	− 22b	−143b	+ 22	+ 72	− 74	− 74
Cement	+105	− 40	− 84	− 21	+ 16	+464	− 1
Artificial fertilizers	− 44	+ 81	− 66	− 60	+ 77	+ 5	− 25
Chemical products	− 9	− 81	−28	+ 3	− 8	+ 1	+ 3
Grains	− 32	+ 11	+ 2	+ 33	− 32b	− 41	− 11
Potatoes	− 98	+ 8	+138	− 62	− 68	− 97	+ 43
Sugar beets	+ 52	− 95	+226	− 36	+ 12	+177	+105
Other crops and processed agricultural products	+250	− 69	−203	+ 74	+ 34	− 12	− 12
Timber and timber manufactures	+161	+ 21a	+ 89	+121	− 27	+ 62	− 98
Sd The differential total shifts	+740	+183	−368	+395	−453	+300	−239
Sp The proportional shifts	+512	+142	− 82	+148	+ 70	+211	− 83
St The total shifts	+1,252	+325	−450	+543	−383	+511	−322

Notes: 1. The differential group shift is the difference between the real balance of commodity flows in a given group, a given group in a given region reached the average level of a given group in the whole country.
2. The differential total shift is the sum of differential group shifts of a given region;
3. The proportional shift is the difference between the total shift and the differential total shift;
4. The total shift is the difference between the real balance of the commodity flows of a given region, and the whole country.
5. *a* means that the differential group shift with positive sign took place with simultaneous transformation
6. *b* means that the differential group shift with negative sign or the total shift with negative sign took place

The differential total shift — Sd (2) — is the sum of differential group shifts in the voivodship i.

The total shift — St (3) — is the difference between the effective balance of total flows in the voivodship j in the terminal period and the balance of flows which could be recorded if the dynamics of the commodity flows in the voivodship j was on an average level of the total transport dynamics in the whole country.

The proportional shift — Sp (4) — is the difference between the total shift in the voivodship j and a differential total shift in the voivodship j. The proportional shift shows the deviation from the total shift which results from a definite group structure of the commodity flows in the voivodship j.

The results obtained from calculations made according to the

BALANCES OF THE COMMODITY FLOWS IN VOIVODSHIPS 1958–1962

in thousand tons

Olsztyn	Gdańsk	Koszalin	Szczecin	Zielona Góra	Wrocław	Opole	Katowice	Cracow	Rzeszów
9	10	11	12	13	14	15	16	17	18
+ 51	+ 722	+ 16	—163	+ 3	+ 136	— 1,355	+3,133	— 1,966	+ 292
— 20	+ 110	+ 4	— 17	— 255b	+ 133	+ 24	+ 273	— 85	+ 14
+ 28a	+ 143	+ 4	— 63	+ 10	— 275b	+ 34	+1,234	—1,107b	+ 274a
+ 9	— 24	—29	+ 68	— 69	— 482	+ 547	— 11	— 989b	+ 365
—293	+ 76	— 25	+ 52a	— 59	+ 68	+ 282	+ 252	— 362	— 47
— 9	+ 82	+ 6	+ 84a	+ 16	+ 31	— 172	+ 130	— 385	— 173
— 14	+ 166	— 15	— 9	— 38	— 140	+ 32	— 344	+ 617	+ 120
+ 17	+ 42	+ 85	—163	— 39	— 300	— 16	+ 180a	— 92	— 41
— 73	+ 17	— 20	+ 43	— 32	— 92b	— 397	— 456	+ 542a	— 4
— 39	— 28	— 29	—129	— 47	— 72	+ 137	— 77	+ 108	+ 66
— 4	+ 26	— 4	+ 25	0	+ 49	+ 40a	— 84	+ 29	+ 64
— 42	— 17	— 37	— 61	— 10b	+ 195a	+ 43	+ 87	+ 35	— 37b
— 56	— 12	+ 37	+ 48	— 5	+ 37	+ 23a	+ 156	— 44	— 38
— 71b	+ 13	— 34	— 60	+ 17	— 47	— 140	+ 444	+ 9	— 55
— 67	+ 90a	— 25	— 14	— 39b	— 252	+ 9	+ 114	+ 68	+ 41
+ 29	— 69	— 97	— 93	— 283	— 13b	— 112b	+ 145	+ 82	+ 210
—554	+1,337	—163	—452	— 830	—1,024	—1,021	+5,176	— 3,540	+1,051
—219	— 31	—249	—148	— 459	— 698	— 365	+ 710	+ 336	+ 137
—773b	+1,306	—409b	—600	—1,289b	—1,722b	—1,386b	+5,886	+ 3,204	+1,188

and in a given region and the balance of commodity flows which would take place if the dynamics of development of

balance which would take place if the dynamics of flows balance of a given region reached the average level of the

of the negative balance into a positive one during the examined period.
with simultaneous transformation of the positive balance into a negative one during the examined period.

presented method of research are given in Table 2. According to the
established principles, the proportional shifts for different regions
(voivodships) have been calculated in Table 2. as differences between the
total shift and the differential total shift.

5

In the present paper the method of shifts has been applied with
regard to relative numbers i.e. to the balance which may be either
positive or negative (may have "+" or "−" sign), and this requires
further explanation.

In our case the balance is the difference between the outflow from
a region and the inflow to a region. These balances are calculated from
the initial materials (railroad commodity flows statistics) which are:

— divided into 16 groups, each of them being an aggregate con-
sisting of heterogeneous products (wherein the only exceptions with
certain provisous are the groups of: bricks, cement, artificial fetilizers,
grains, potatoes and sugar beets).

— measured in physical units (tons):

Both of these features of the initial material obviously limit the
range of the economic balance analysis. The first complicates the image
of different groups, while the second limits the inter–group analysis
and analysis concerning the sum of group balances to the physical aspect
(tons) only of the problem of flows. Due to the varying economic im-
portance of different products and therefore of certain groups of com-
modities containing these products, the physical volume of balances is
of limited importance to the regional analysis. The correct analysis
should be based on the value of commodity flows. Polish statistics of
the commodity flows (railroad) offer no such data. However, studies on
the creation of the value — monetary formula have already been
undertaken [8], [9].

In spite of the reservations concerning groups and units of measure
it was decided to develop, first of all, the methodical approach to the
problem. The analytic sense of these studies and the conclusions drawn
(typology of regions) should be treated as methodical suggestions, not as
an exhaustive economic interpretation of dynamics of inter-regional flows.

Considering the aforesaid restrictions, we assume, that the positive
balance expresses the "superfluity" (surplus) of the region, while the
negative balance shows the "insufficiency" (deficite) of the region.

In elaborating Table 2, effective balances were applied from the initial
period (1958) and the effective and hypothetical balances from the terminal
period (1962). With regard to the terminal balance it should be noted,
that the effective balance may have an absolute value smaller, equal or
larger than the hypothetical balance. Also, it should be noted that there

may be four combinations of signes ("+", "−") of the effective and hypothetical balances, namely:

(a) effective balance with "+", and simultaneously a hypothetical balance with "−";

(b) effective balance with "−", and simultaneously a hypothetical balance with "+";

(c) effective balance with "+", and simultaneously a hypothetical balance with "+";

(d) effective balance with "−", and simultaneously a hypothetical balance with "−".

The formation of an absolute value of the effective and hypothetical balances and the different combinations of signs ("+", "−") have a definite influence upon the sign and the absolute value of the differential proportional and total shifts which may be proved easily from the theoretical example in Table 3.

TABLE 3. DIFFERENTIAL GROUP SHIFTS AND THE TOTAL SHIFTS

	Balance of the terminal period		Differential group shift (Sg), total shift (St)	
	Effective E_{ij}^{-} or $E_{i.}^{x}$	Hypothetical $(E_{i.}^{x}/E_{i.})E_{ij}$ or $(E_{..}^{x}/E_{..})E_{.j}$	Relative value	Absolute value
(a)	(+100)	−(−120)	= +220	220
	(+100)	−(−100)	= +200	200
	(+100) .	−(−80)	= +180	180
(b)	(−100)	−(+120)	= −220	220
	(−100)	−(+100)	= −200	200
	(−100)	−(+ 80)	= −180	180
(c)	(+100)	−(+120)	= − 20	20
(c..)	(+100)	−(+100)	= 0	0
(c...)	(+100)	−(+80)	= + 20	20
(d.)	(−100)	−(−120)	= + 20	20
(d..)	(−100)	−(−100)	= 0	0
(d...)	(−100)	−(− 80)	= − 20	20

Using the example presented in Table 3. let us now consider the meaning of "+" and "−" signs of the differential group shift and the total shift[4] depending on the combination of "+" and "−" signs of both effective and hypothetical balances.

(a) The "+" sign of the shift means that during the examined period the negative effective balance of the initial period (1958) was transformed into a positive effective balance for the terminal period (1962).

[4] We omit here the problem of the differential total shift, which is the sum of differential group shifts and also the problem of the proportional shift which is the difference between the total shift and the differential total shift.

The absolute value of the shift means the range (from "−" to "+") within which the shift took place.

(b) The "−" sign of the shift means that during the examined period the positive effective balance of the initial period (1958) was transformed into a negative effective balance for the terminal period (1962).

The absolute value of the shift means the range (from "+" to "−") within which the shift took place.

(c.) The "−" sign of the shift means that during the examined period the effective balance of the terminal period (1962) deviated downward as compared with the average dynamics for the whole country in 1958–1962 period.

(c. .) The particular case — conformity of the dynamics of the effective balance and the average dynamics for the whole country during the examined period.

(c . . .) The "+" sign of the shift means that during the examined period the effective balance of the terminal period (1962) deviated upwards as compared with the average dynamics for the whole country in the 1958–1962 period.

(d.) The "+" sign of the shift means that during the examined period the effective balance of the terminal period (1962) deviated upwards as compared with the dynamics for the whole country in the 1958–1962 period due to the recorded reduction of the "insufficiency" (deficite).

(d. .) The particular case as (c. .)

(d . . .) The "−" sign of the shift means that during the examined period the effective balance of the terminal period (1962) deviated downward as compared with the average for the whole country in the 1958–1962 period due to the recorded increase of "insufficiency" (deficite).

Following systematically our approach we may state that:

(c.) and (d . . .) The "−" sign of the shift means in both cases a less favourable formation of the balance for the terminal period as compared with the average dynamics for the whole country in the period 1958–1962, which means that either, the increase of the positive balance was slower than average or the drop of the negative balance was slower than average.

(c . . .) and (d.) The "+" sign of the shift means in both cases a more favourable effective formation of the balance for the terminal period as compared with the average dynamics for the whole country in the period 1958–1962, which means that there was a faster than average increase of the positive balance or there was a faster than average drop of the negative balance.

(c. .) and (d . .) Particular cases which did not occur in the example (Table 2).

Comparing the meaning of positive signs in the case (*a*) and cases (*c*...), (*d*.), it is easy to state that the positive signs of the differential group shift and the total shift express a more favourable formation of the effective balance in the terminal than in the initial period. Nevertheless in order to emphasize the evaluation of the sign of the balance, the case (*a*) has been marked in Table 2.

Comparing the meaning of the negative sign in the case (*b*) and cases (*c*.), (*d*...), it is easy to state that the negative signs of the differential
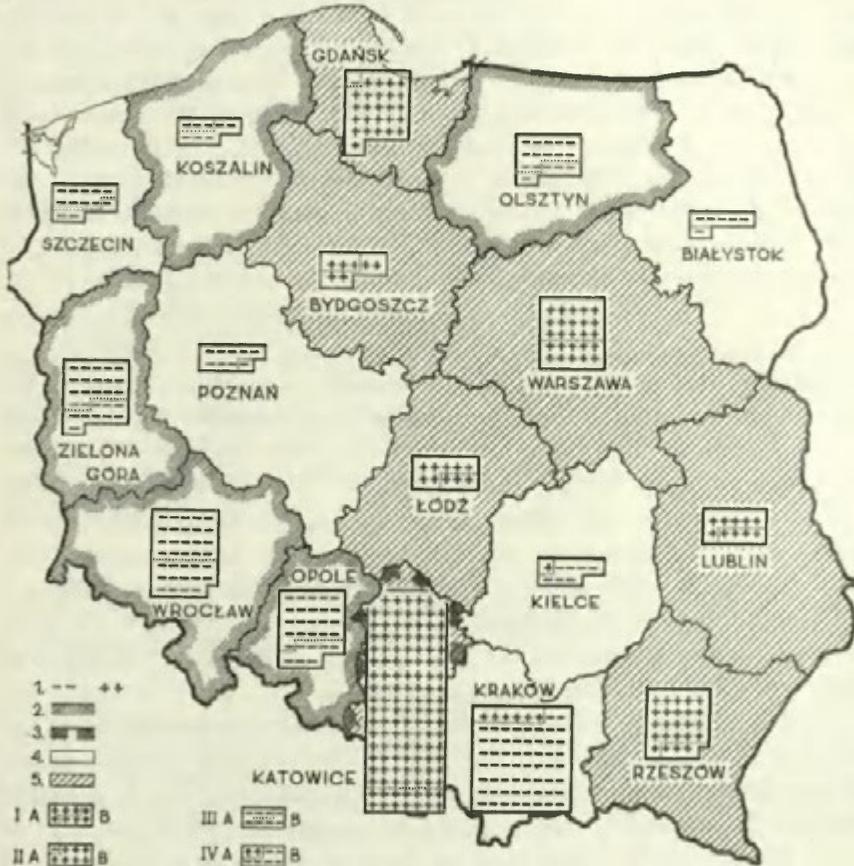
Fig. 2. Voivodship typology based on the balances of commodity flows (by railway) in 1958 and 1962 as well as the differential group shifts and the total shifts in the 1958–1962 period

1 — 1 million tons, 2 — effective balance positive in 1958 only, 3 — effective balance positive both in 1958 and 1962, 4 — less favourable formation of the effective balance in 1962 than in 1958, 5 — more favourable formation of the effective balance in 1962 than in 1958. I — Positive total shift: A — differential, B — proportional; II — Positive differential shift: A — proportional, B — total; III — Negative total shift: A — differential, B — proportional; IV — Negative differential shift. A — proportional, B — total.

group shift and the total shift express a less favourable formation of the effective balance in the terminal than in the initial period. Nevertheless in order to emphasize the revaluation of the sign, the case (b) has been marked in Table 2.

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The results of Table 2. have been shown in Fig. 2. It should be stressed that the numbers in Table 2 and in Fig. 2. are the deviation values of the dynamics of balances of different groups of commodities and regions from the average dynamics, which characterized all the examined phenomena (country and transport). The absolute values of balances can be read from Fig. 1. while Fig. 2. shows the character of the dynamics of regional balances as compared with the dynamics for the whole country. The analysis of the results obtained, namely the differential, proportional and total shifts of balances of the commodity flows enables us to identify four types of voivodships from the point of view of the total and the proportional shifts formation:

T y p e I., in which occurred a more favourable formation of the effective balance in 1962 than in 1958 because the increase of the positive balance was faster than everage for the whole country, or because the drop of the negative balance was faster than average for the whole country, whereas the group structure (proportional shift) exercised a positive influence because it increased the total shift positively. This was observed in the voivodships of: Katowice, Warsaw, Rzeszów, Łódź, Lublin, and Bydgoszcz.

T y p e II., in which, under circumstances analogous to those in Type I, the group structure (proportional shifts) exercised a negative influence because it partly neutralized the positive total shifts. This was observed in the voivodship of Gdańsk.

T y p e III., in which occurred a less favourable formation of the effective balance in 1962 than in 1958, due to a slower increase of the positive balance than average for the whole country or due to a slower drop of the negative balance than average for the whole country, or even, due to the transformation of the positive balance in the initial period to a negative one in the terminal period (with the sign b). The group structure (proportional shift) exercised a negative influence because it made the total shift more negative. This was observed in the voivodships of: Wrocław (b), Opole (b), Zielona Góra (b), Olsztyn (b), Szczecin, Poznań, Koszalin (b) and Białystok.

T y p e IV., in which under circumstances analogous to those in Type III the group structure (proportional shifts) exercised a positive

influence because it partly neutralized the total negative shift. This was observed in the voivodships of Cracow and Kielce.

The differential group shifts in Table 2 illustrate the development of the economic situation of regions (voivodships) in different groups of commodities in the 1958–1962 period against the background of the general economic development of the whole country, which, in this case may be measured by the increase or drop of flows in different groups of commodities. The proportional shifts indicate the scale of the influence of the group structure upon the total shift.

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PROBLEMS OF LESS DEVELOPED POLISH REGIONS AND THEIR ACTIVATION

Bolesław Winiarski

Introduction

The present article gives a general outline of the problems facing the less developed regions of Poland and their activation. The author also draws attention to certain very important questions connected with these problems. The article gives prominence to economic matters and emphasizes the theoretical aspects of applied research and its results.

The survey of the less developed regions and of the prospects for their activation has aroused the general interest of Polish research centres and public opinion. These problems are also taken into consideration by the State in its economic policy. It is thought that they may also interest foreign readers.

I. The typology of less developed regions

The first problem that must be solved when starting the survey of less developed regions is the choice of a correct term to define the subject of the survey. The term "less developed regions" (or areas) is in general use in this country and to it has been lent a dynamic character, bringing into prominence the attitude taken towards it as a result of general social motives. The lesser development of certain regions is regarded as a complex of phenomena that should be changed; this, in turn, calls for a dynamic attitude towards development problems examined from this point of view. Research on the insufficient development is undertaken not simply for cognitive reasons, but also in order to establish the scientific foundations of an economic policy to be directed by the State.

Research into problems concerning the difference in the level and rate of development of various regions was started in Poland almost immediately after the Second World War. The first serious work dealing with problems of economic underdevelopment of certain regions of the

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country and the methods necessary for their solution was by B. Malisz and J. Kostrowicki [4]. The book not only effects a detailed analysis delimiting the economically weak regions, but also explains the theoretical and practical aspects of the activation policy.

The results of this research primarily demonstrated the correlation between retardation in the process of the economic growth of many regions and the historical and political reasons (i.e.; the fact that the Polish lands were dominated by the three partitioning powers: Prussia, Russia and Austria during the whole of the 19th and the beginning of the 20 th century). The development of each of the above regions was carried out in a different way, and at the same time all of them conducted a policy of restraining economic growth of Polish lands. The partition of Poland between the three powers left lasting traces on the social and economic structure of the three parts of the country. The removal of the boundaries between those parts on the political map was insufficient to equalize the differences and the inequalities increased for many decades. The efforts that were made in the inter–war period to bring about the economic integration of the three parts and reduce the obvious differences were in no proportion o the existing needs; and the differences caused by the disaster and the wasteful economy under occupation during the Second World War made the situation even worse.

The defining of the inequalities in the level of economic development of various regions of the country had to be based on detailed investigation of the level of economic activity of all regions. In this connection the earliest works on this subject laid the main emphasis analysing the shaping of various economic indices in various regions: population, the level of industrialization, extent of transport development, the communal economy, the housing situation, the level of agricultural development and the social and cultural institutions. By comparing the indices established separately for each region general conclusions were drawn. Regions in which the indices were relatively the lowest (the worst) were noted as economically underdeveloped.

In the mid fifties, investigation of backward regions was considerably expanded. Apart from central research and administrative centres, regional centres also initiated research in this field. The Cracow and Poznań centres have to be mentioned first of all; several studies were carried out in these centres dealing with the differences in the level and rate of development within the voivodship boundaries.

Finally, in the late fifties, the problem of underdevelopment and activation of regions was made one of the principal subjects dealt with by the Committee for the Space Economy of the Country created at the Praesidium of the Polish Academy of Sciences [1].

In the same period some other comprehensive, theoretical works were published discussing problems of underdevelopment and the activation of backward regions, while particular case studies extended the knowledge of the problems facing various regions of the country.

Worth noticing is the fact that in the research mentioned, emphasis was laid on two basic features which qualified certain regions as backward. They were:

(a) failure to take full advantage of economic conditions and resources of the region, or incomplete utilization of resources (b) a lower standard of living of the population as compared with the national average.

The importance given to the above features was dictated by practical considerations. The ascertainment of inadequate utilization of the existing economic resources or regional conditions is tantamount to manifesting the potential possibilities of accelerating the development of the whole national economy. The demonstration that in certain regions of the country people are living in relatively worse conditions than the national average standard of living means that conclusions must be drawn aimed at eliminating or at least reducing the existing discrepancies. This is a pragmatic approach, but it seems to be methodologically fruitful, because it facilitates the transition from typological research to concrete study in planning the development of the given regions.

The present interpretation of the concept of underdevelopment of certain regions results from the evolution of thought on the distribution of productive forces in a socialist economy. In the early fifties the so-called principle of equal distribution was quite generally recognized in Poland. If a lower index was revealed in a certain field of productive activity, this was sufficient to imply that the region was underdeveloped. But the development of the theory of distribution of productive forces has proved the fallacy of that principle and has resulted in establishement of the principle of rational distribution, attaining the most effective utilization of the specific regional conditions and economic resources [5]. Recognizing the fact that natural resources are not evenly distributed, it is rational to distribute economic activity in proportion the regional conditions and possibilities. However one essential reservation should be made: the spatial distribution of economic activity should not result in maintaining and certainly not in deepening the discrepancies in the living standards of the population in the various regions. Social considerations demand that this reservation should be strongly emphasized.

From the economic point of view, the population factor plays a double role. Firstly, the population of each region is a part of the consumers of the final social product. The satisfaction of the needs of the population

is the aim of socialized production. On the other hand, the population of each region represents a certain amount of manpower, that is, a part of the social productive forces. In the conditions of socialist economy, the division of the social product according to one's labour is the basic form of division; if this principle is to be consistently implemented, then the lower level of consumption of the population of a region reflects a lower degree of engaging the regional manpower in the social economic process. It is essential that no important differences should arise between regions in the general level of engaging regional manpower in work generating income, so that the local population may participate in the division of social product. Taking this as a basis, one can state that if the level of utilization of the available manpower of the region is lower than the national average, this proves deficient utilization of a part of the national productive forces and is coincident with the reason for the lower incomes of the population of the region.

In Poland the deficient usage of productive forces in the economic process coincides, as regards geographical boundaries, with the areas with a low per capita agricultural output. In such regions there is a surplus of rural population which cannot find work in the locality in which they live. Thus the existing available manpower is the basic potential factor of growth. However the utilization of redundant manpower calls for the modernization of agriculture, because shifting part of the population to other jobs without prior replacement of human labour by mechanization could have an adverse effect on the total agricultural production. Not all the retarded regions have other potential factors and conditions, apart from manpower, necessary for the intensification of the economy. This, in turn, involves the necessity of discussing the alternative of utilization of manpower: whether to create employment possibilities on the spot by means of developing the economy of the region, or to transfer the surplus of manpower to other regions.

In conducting research on the problems of less advanced regions, it is most essential to have statistical data at one's disposal and to avail oneself of data pertaining to small territorial units. For several years work has been going on in Poland aimed at gradually establishing a system of regional statistics which would supply data for each district (poviat) separately. In 1965, work was started on the initiative of the Geographical Institute of the Polish Academy of Sciences, with the aim of presenting a picture of the economic growth of the poviats in the years 1950–1965. This will provide detailed information about the rate of growth of small territorial units in Poland and at the same time will provide material for research into the problems of less advanced regions.

II. Theoretical conceptions of shaping the growth of less advanced regions

In the first period of the planned economy in Poland, views concerning the means of promoting the growth of less advanced regions were based on the optimistic conviction that industrial investments in these regions would suffice easily to overcome their general backwardness and to start a process of economic activation. The 1950–1955 6–Year economic plan contained respective provisions of the policy of locating new investments. In this connection part of the investment projects were actually located in poorly developed eastern and southern voivodships.

But the experience gained during that period proved that in many instances the location dictated by the postulate of activation was more than once a premature decision. The areas where new industrial plants were to be built, were insufficiently prepared to receive them. The exploitation of these plants called for constant subjugation of various difficulties as regards transport facilities, supplies and organizational measures. It should be added that perhaps too great a generalization of the experience gained in this way resulted in the reluctance of many economic administrative bodies to make large investments in poorly developed areas. In this situation two trends were evolved: on the one hand, branch administration pointed to the immediate economic advantages obtained if the new investment projects were located in highly developed areas; on the other hand, local and regional governments postulated for the activation of their regions.

The author of the present article extensively discussed this problem in his previous work [6] in which the concept of activation based on gradual elimination of the causes of underdevelopment was advanced. The essence of the problem could be reduced to the lack of places of work and of durable non–productive consumption (capital). This makes it impossible to utilize effectively (in line with the general technical level) the available natural and manpower resources. In solving the problem of how to remove these shortcomings, the existing conditions of the regions must be taken into consideration from the point of view of the whole national economy, particularly the character of the resources that could be utilized as a result of activation. For instance, if natural resources of valuable raw materials are discovered in the underdeveloped regions, their exploitation may bring about an acceleration in the rate of economic growth of the country, thus it is sensible to commence activation with investments destined for the exploitation of these raw materials. The same may be said of the activation of regions with particularly propitious natural conditions for the location of investment projects envisaged in the long–range plan for the economic development of the country. On the other hand, if

it is possible that the process of economic growth may be held up by the barrier of a shortage of manpower, then the location in underdeveloped areas of such investment schemes that essentially need human labour, may prove most effective. In almost all instances the location of investments producing collective consumption goods in poorly developed areas is justified in the first stage of their activation. Such investments can become a substitute for the lack of sufficient possibilities of increasing the individual incomes of the population. Bringing an improvement in the general development of the area, they also bring certain "external advantages" in the later stage when industrial investments are started.

One should not overlook the constructive role played by small–scale industrial production, handicrafts and services, and above all, the intensification of agriculture. If there is no other possibility of activation, then labour–absorbing intensification of agricultural production becomes an important mean of greater use of manpower in the less advanced regions, at least as a transitional solution.

Every activation initiative should be analysed separately from two points of view: that of the region concerned, and that of the whole national economy. The essence of the difficulties inherent in the problem of activation can be reduced to the insufficient effectiveness of investments made in a given time and a given area in the less advanced regions. Economic policy is then faced with the alternative: either to gain better results in the total growth of the national income, or to sacrifice part of this growth for the sake of a more rapid equalization of the development level throughout the country. This problem is particularly acute concerning the decisions for relatively short periods of time. As regards more distant prospects, the conditions necessary for the elimination of contradictions between the local interests of the less advanced regions and those of the national economy as a whole are gradually disappearing.

The tendency towards a gradual disappearance of the above mentioned contradictions is the result of:

1. the appearance of an increasing number of barriers limiting the further economic expansion of economically more advanced regions. These barriers are: increasing shortage of manpower, deterioration of the water conditions, the ground economy, the increasing cost of the functioning of inflated aglomerations, etc.

2. The gradual introduction of infrastructural facilities all over the country; increasing the standard of education and of public health service, and the rise in the cultural level of the population.

The opinions outlined here are based on certain assumptions of the theory of economic growth supplemented by the spatial factor. In Poland, the so–called "Kalecki model" played an important role in drawing up

the long–range development plan. The said model takes into account not only investments but also the existing reserves in fixed assets and the progressive exhaustion of these assets, as well as the barriers (ceilings) limiting economic growth: shortage of manpower, the restriction on increasing import of necessary raw materials (problems of foreign trade), organizational and technical difficulties in the execution of investment plans, etc.

The latent reserves of existing assets and each of the barriers that should be taken into accout are factors placed in a certain area. In the first stage of industrialization the factor of reserves of already existing assets is an argument in favour of investments in presently well developed areas. This assures the minimalization of capital coefficient. Production growth can be attained by more efficient utilization of the existing assets increasing the share of the labour factor. In case of need, manpower can be transferred from other regions. But in later stages the reserves of manpower are exhausted, and aglomerations need workers that have to be brought from more and more distant regions. This, in turn, brings about an increase in the public costs and shortage in infrastructural facilities that can be developed only at an increasing cost. This is the right moment to start activation of less advanced regions by means of changing the location policy and directing new investment projects to new areas. To establish the right moment for such a manoeuvre it is necessary to watch carefully the course of the development of the national economy in spatial terms and to conduct a survey of the local conditions and of the development prospects of various regions.

As the most important investments are, as a rule, located in towns, analysis of the possibilities of an increase of urban centres assumes particular significance.

In recent years a new conception of investigation of the economics of the settlement structures has been invented in Poland by B. Malisz [3]. He demonstrated that the process of development of towns is accompanied by the existence of several "thresholds" hampering further development; the surpassing of each of them opens up new prospects for expansion. When the town reaches a certain size it becomes necessary to make a choice: either to make large outlays to cross the "threshold" or to stop the further development of the town and start expansion in other centres where there are still reserves of urban areas and communal facilities etc. The local planning authorities in Poland have conducted detailed studies to determine the size at which the determined "thresholds" of development occur in each separate case; the result of these studies are of prime importance in regional and national plannig, and also in the formation of programmes for the activation of less advanced regions.

As regards the very system of activation, two basic solutions have been adopted recently. They have been defined, using military terms, as "attack on a narrow or a wide front" [7].

The first solution can be applied, above all, in regions where natural resources valuable to the entire national economy have been discovered. The commencement of their exploitation generally calls for big investments, concentrated in time and space. Basic production investments have prominence in this case, usually preceding the full infrastructural development of the area. Higher investment costs resulting from the inadequate preparation of the area, are covered with a surplus by the profits derived from the rapid commencement of exploitation of the resources, particularly important for economy in case they help to overcome or to push back the "raw materials barrier". In Poland practical solutions of this kind have been applied in the development decisions of the mining and power centres at Konin and Turoszow, the sulphur district at Tarnobrzeg and the copper district of Legnica–Głogów, and also in the foundation of the petrochemical industry with a centre in Płock. The activation of the region in all these cases was most often a "secondary product", resulting from initiatives undertaken with the whole national economy in mind, and dictated by the needs of rational shaping of the growth rate and basic proportions of the development of the whole national economy.

The second solution is based on the gradual saturation of the less advanced regions with the lacking infrastructural elements and acting in the direction of gradual improvement of the population living standards as well as its social and cultural conditions. This solution is taken into consideration in the case of regions poor in valuable raw materials and other natural resources; for which in a given development stage of the whole national economy the basic functions have not yet been determined in detail, so that their full activation must be postponed to later years.

III. The less advanced regions activation policy

Problems of developing less advanced regions were put forward in Poland first and foremost within the framework of the concrete economic policy conducted by the State.

After the Second Word War the first aim of the activation policy was that of a rapid reconstruction of the regained Western and Northern Territories of Poland. The problem consisted of: resettlement of the area, reconstruction of the devastated towns, industry and agriculture. Basic reserves existed in the infrastructure: transportation system, the underground urban equipment (however, considerably damaged) and in the

remaining fixed assets, mainly buildings, since most of the machines had been removed by the occupation powers. The economic reconstruction of the Western and Northern Territories is one of the most important successes of the Polish economy. It has resulted in the full economic and socio–cultural integration of the Regained Territories with the rest of the country and in the rational utilization of their resources for Poland's national economy, their general activity being much higher than in the pre–war years.

Fig. 1. Less developed regions in Poland (according to B. Winiarski [6] 1 — counties of the relatively lowest economic development

In the years of the 6–Year Plan (1950–1955) the activation initiatives were mostly directed to the southern and southeastern regions of the country. In that period, the activation process encompassed the Cracow, Rzeszów, Lublin, Kielce and Białystok voivodships. At the same time further reconstruction and development of the Western and Northern Territories continued.

The manifestations of excessive investment tension in the national economy and of excessive dispersal of investments resulted in the narrowing of intitiatives connected with the activation of the less advanced regions in the years 1956–1960. The activation policy was only considered in the national plan to the extent of its connection with the implementation of other lines of the economic policy, e.g. the development of the raw material base. Apart from industrial investments, a new set of additional factors could be noticed: the shift of substantial means in national economic plans for agriculture and for branches producing means of consumption allowed the starting of development processes in numerous economically weaker territorial units where intensification of agricultural production was begun, small–scale industry was developed, and social and cultural facilities were expanded.

At present problems of activation are dealt with in spatial planning, connected with long–range economic planning. The foundations of regional plans covering the years 1961–1980 have already been prepared for all the regions.

Detailed regional plans are now being prepared covering areas in which an important concentration of investment effort has been envisaged. Such plans have already been prepared for the Płock region, the new mining and industrial district Konin–Łęczyca–Inowrocław, the sulphur district and many other districts.

The system of investment location is of basic importance in the policy of planned regional development. In Poland this system is based on the obligation of every investor to obtain the permission of the respective authorities to conduct investments, including construction work, in the place he has chosen. Big investments are located by the central planning organization the Planning Commission of the Council of Ministers, in accordance with the motions and opinions of the regional authorities and ministries supervising the particular line of economic activity.

The location of investments of a limited scope is the prerogative of voivodship planning organizations viz., the Voivodship Commissions of Economic Planning at the Praesidia of the Voivodship People's Councils.

The activities of regional authorities deserves mention. The local government, i.e. the people's councils, regard the development of their respective voivodships or districts as their most important task. They prepare so–called locad development plans (long–term and annual plans), co-ordinated with the national economic plan. People's councils in Poland also co-ordinate the whole of the economic activity in the area under their control, so it is their right and duty to confer on any initiatives undertaken by big and middle–sized industry and by transportation enterprises. The people's councils also bear responsibility for spatial planning on a

local and regional scale. The activity of the people's councils as co-ordinators of the local economy allows them to negotiate in other factors which influence the development of their regions, apart from investments. These factors include: employment policy, utilization of the production and servicing possibilities of the region, improving the work of the transportation system, and supplies, taking advantage of the tourist and recreational attractions of the region.

As it is known, all economic activity in Poland comes under State control. This allows a purposeful co-ordination of all activities, taking into consideration the needs of less advanced regions. But it should be stated that there are still many forms and instruments of planning that ought to be improved.

The means of integrating the decisions taken in drafting regional plans with the system of making economic decisions at various levels, beginning with the enterprise and terminating at the ministry, is a matter of primary importance. This is the reason that the problem of spatial planning methods has been given prominence in the research conducted by the Committee for Space Economy and Regional Planning set up at the Polish Academy of Sciences (KPZK PAN).

Additional motives have recently appeared stimulating and accelerating research on the theory of spatial economy and planning. First of all, they are dictated by the requirements of international co-operation and the development of international division of labour. As regards the problems facing the less advanced regions, they may concern the development of, e.g. frontier regions and the undertaking of joint investments which can even influence the growth of regions situated in the centre of the country. Here Płock, the development of which is due to the petrochemical works built there and the processing of oil supplied by the pipeline running from the U.S.S.R. to the G.D.R., serves as the best example. On the other hand, the economic situation within the country also inclines to accelerate the solution of local problems. The fact that numerous young people born since the war have reached working age, resulted in the need to prepare jobs for them in many regions of the country. This is accompanied by an acute shortage of manpower in some other regions of Poland. In this connection, the overspill policy has been started, which will open up new prospects of accelerating the development of less advanced regions, to which many factories are to be transferred from the inflated centres.

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