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Changes in higher education during the period of transformation in Poland – regional differences

1. Introduction

Since 1989, higher education in Poland, that is, universities and other schools training their students at an academic level and engaged in research, has been undergoing serious changes, both quantitative and qualitative. The changes are an element of the transformation and modernisation of Poland's entire socio-economic system that has been taking place since that year.

Without going into the details of the systemic transformation, the following of its aspects are worth noting:

(1) After Poland regained state sovereignty and introduced a democratic political system, the main element of change in its socio-economic system has been the transformation of the economic subsystem consisting in the liquidation of a socialist command economy and the development of a capitalist market one.

(2) The systemic economic transformation embraces the reconstruction of economic mechanisms and institutions, especially the decision-making and regulatory power of the state in this domain. The results are changes in the real structure of the economy, i.e., the emergence of new economic entities, the fall of others, changes in the character and size of production, exports and imports, employment and unemployment, the level of income, the rate of economic development, etc.

(3) The economic transformation is interpreted as a manifestation of modernisation. Modernisation is a process of civilisation changes that embrace economic changes; technological changes, especially in infrastructure and transport; social changes, including those occurring in social awareness and communication; cultural changes, primarily in the level and universality of education, etc. It is believed that the main modernisation processes are industrialisation and urbanisation. In the field of economy, modernisation means industrialisation, economic growth, and the formation of an industrial society which replaces traditional society. Currently put forward is a new notion of post-modernisation to define changes that take place in society and economy, involve such properties as flexible organisation, information revolution and others, and lead to the formation of a post-industrial society.

Even this brief characterisation of modernisation indicates that it is the core of transformation processes, and that it provides a context in which they should be considered.

(4) Taking into consideration the role of modernisation in changes and transformation of socio-economic systems, it can be assumed that those going on in Poland now have started and been shaping a new modernisation cycle that will not only lead to a market economy and substantial economic growth, but also to a higher civilisational level and better standards of living of the population.

(5) Thus, economic transformation has no value of itself and depends on broadly understood social effectiveness. This quality is not homogeneous; it has both positive and negative aspects. Attempts at defining the global effectiveness of transformation lead to the conclusion that one of its principal measures is economic growth as given by the increase in national income. At the same time, changes occurring through modernisation in the entire socio-economic system are not straightforwardly connected with economic transformation. Some are the result of and response to the changes taking place and the operation of market mechanisms, such as for example the formation of a labour market and unemployment. Others accompany those changes (e.g., technological advances), still others are involved in the processes of modernisation. The last include the development of higher education, which is a special subject of inquiry in the present study. This development, on the one hand, is a response to the increase in the demand for highly qualified personnel that has appeared in the market in the course of the transformation, in particular to higher wages and lower unemployment among highly qualified workers, and on the other hand, it is a factor controlling modernisation processes through an increase in innovation, technological progress, and improvement in organisation and efficiency of decision-making.

Thus, the aim of the present paper is to define the nature of change and relationships that have occurred in higher education during the period of transformation of Poland's socio-economic system, as well as regional differences in them. In particular, we intend to focus on:

(1) changes that have taken place in the character and operation of higher education,
(2) regional differences in higher education and how they have changed, and
(3) relations between the development of higher education and economic development in a regional approach.

It seems that the examination of these relationships will contribute to a better understanding of the place and role of higher education in the changes currently taking place in Poland.

The subsequent analysis of the state of and regional differences in higher education, changes occurring in this domain and relations holding there, is mainly based on the statistical materials of the Central Statistical Office published in the 1990–1998 yearbooks and pocket yearbooks as well as in special publications: *Higher schools* (1994/95, 1995/96, 1996/97, 1997/98) and *Poland under the new territorial division* (1998). Spatial analysis and the establishment of relations have been limited by incomplete statistical data in a regional approach.

2. Changes in higher education

After 1989, fundamental changes took place in Poland in the nature and operation of higher education. They embrace:

(1) the establishment of many non-state higher schools,
(2) a substantial increase in the number of students,
(3) changes in the directions of studies,
(4) deterioration in the personnel situation, and
(5) the weakening of the higher education – science relation.

Re 1.

In the years 1990–1998 the number of non-state higher schools grew from 6 to 159, while the number of state schools remained almost the same (100)[1]. There appeared private higher-educational institutions set up by international foundations, associations and private persons, as well as new higher schools of denominational organisations. The period of the most dynamic growth in the number of non-state schools was 1993–1997, when 70% of schools of this type were established, with an average of 26 new schools per year (Table 1). Non-state higher schools differ in size; most, however, are small professional schools that provide three-year study courses. Their completion leads to a licentiate's degree, i.e., a diploma of the lowest-level academic studies. Only 20% of non-state schools are chartered to award master's degrees. Private schools depend on tuition charges levied on students, unlike state-funded schools (where part-payments are only made by extramural students). This fact notwithstanding, most private schools offer a lower level of education than state universities.

Table 1. Higher schools

Academic year	Total number of schools*	Number of non-state schools
1990/91	112	6
1991/92	117	11
1992/93	124	18
1993/94	140	36
1994/95	160	56
1995/96	179	80
1996/97	213	114
1997/98	246	146
1998/99	259	159

* Including military and police schools.

1 Two state universities were set up: the Opole University (1994) was created from the Higher Pedagogical School in Opole, and the Białystok University (1997) from a branch of the Warsaw University. The Medical Academy in Cracow was incorporated into the Jagiellonian University (1993).

Re 2.

In the years 1990–1997 the number of higher-school students soared from 404,000 to 1,092,000, that is, by 270%. Between 1992 and 1997 the annual rate of increase in the number of students was the highest and amounted to 116–118%. The increase was recorded mainly in state higher-educational institutions, which accounted for 67% of the total increase (Table 2).

Table 2. Students of higher schools

Academic year	Total	Intramural studies	Extramural studies	State schools	Non-state schools
1990/91	403,824	311,710	92,144	394,198	9,626
1991/92	428,159	326,554	101,605	417,674	10,485
1992/93	495,729	359,551	136,178	479,560	16,169
1993/94	584,009	394,775	189,234	555,072	28,937
1994/95	682,200	426,652	255,548	632,622	49,578
1995/96	794,642	454,724	339,918	705,243	89,399
1996/97	927,480	493,627	433,853	784,136	143,344
1997/98	1,091,841	539,728	552,113	865,046	226,795

The growth in the number of intramural students was caused by both, a population explosion and young people's higher educational aspirations. But the rate of increase in the number of extramural students grew even faster than of intramural ones: in the years 1992–1997 the respective figures were 133% and 109%. As a result, the proportion of intramural students dropped from 77% to 49%. The growing number of extramural students indicates that people are interested in improving their education and qualifications owing to the new situation on the labour market in Poland.

The increase in the popularity of studies in the years 1990–1997 is measured by the indices of net enrolment in higher education, which grew from 9.8 to 22.2, and gross student enrolment, which rose from 12.9 to 29.2[2]. Also the index of the number of students per 1,000 population grew from 10.6 to 28.2.

Despite the dynamic growth in the number of private schools, non-state institutions of higher learning play a secondary role in student education. In 1993 they constituted 26% of all higher-educational schools, but taught a mere 5% of all students, and in 1997, when their proportion increased to 59%, they still accounted for only 21% of students.

2 The index of net enrolment in higher education is the ratio of the number of students of the age consistent with this level of learning to the number of the population in this age group. The gross enrolment index is the ratio of the number of students, irrespective of age, to the number of the population of the age consistent with this level of learning.

Re 3.

In the years 1990–1997 there were also significant changes in the rate of development of particular directions of study (Tables 3 and 4). Those that strengthened their position included technical and pedagogical ones, business and management, and humanities, while social science improved its position. In 1990 those five types of study accounted for about 60% of the total number of students, and in 1997, 76%. The rate of increase in the popularity of these directions varied greatly, though. Among those with many students and high indices of dynamics were social science, business and management, and law. Medical studies recorded a decrease in the number of students.

A decided majority of private-school students enrolled in business and management courses; the next in popularity were pedagogical and theological courses. It is worth noting that in 1997 students of private economic schools made up 60% of all those learning in private institutions, and 52% of economics students in all types of schools.

Table 3. Number of higher schools by type

Types of school	1992/93		1997/98	
	total	non-state schools	total	non-state schools
universities	11	1	13	1
higher technical schools	32	1	30	5
agricultural academies	9	–	10	1
higher economic schools	14	8	93	88
higher pedagogical schools	11	1	19	10
medical academies	12	–	11	–
higher maritime schools	3	–	3	–
physical education academies	6	–	6	–
higher art schools	18	1	20	3
higher theological schools	8	6	16	14
other	–	–	25	24
Total	124	18	246	146

Re 4.

The personnel situation in higher education deteriorated considerably over the years 1990–1997 (Table 5). The index of increase in scientific-didactic staff (113%) was much smaller than the increase in the number of students (270%). The number of students per academic teacher grew from 6.3 to 14.9. This was accompanied by a significant turnover of junior staff, which is probably caused by their low salaries. The junior staff/professor index was 4.7 in 1990 and kept falling (to 4.1 in 1997). The development of the educational function and staff shortages put a didactic overload on university teachers.

It is worth noting at this point that the permanent staff of professors at non-state schools is small (with the exception of the Catholic University of Lublin). In 1996 they

Table 4. Students of higher schools by course of study

Type of course	Students in thous.	
	1990/91	1997/98
pedagogy	57.4	151.1
arts	9.8	12.5
humanities	46.4	93.5
theology	9.3	17.7
social science	17.6	128.6
business and management	53.5	260.9
law	19.0	53.8
natural science	12.4	26.5
mathematics/information technology	9.7	20.5
medicine	40.7	33.9
technology	68.1	191.9
architecture	4.3	7.6
agriculture, forestry	28.9	35.3
household	0.8	9.5
transport/communications	2.8	11.2
mass media	4.1	6.2
services	1.5	10.2
other	17.5	21.1
Total	403.8	1,091.8

Table 5. Academic teachers

Academic year	Total	Professors	Junior staff	Professors and junior staff	
				State schools	Non-state schools
1990/91	64,454	11,363	53,091	63,814	640
1991/92	63,176	10,572	52,604	62,545	631
1992/93	63,076	10,830	52,246	62,061	1,015
1993/94	65,261	11,213	54,048	63,937	1,324
1994/95	67,066	11,771	55,295	65,199	1,867
1995/96	66,973	12,155	54,818	64,426	2,547
1996/97	70,372	13,185	57,187	66,670	3,702
1997/98	73,041	14,294	58,747	67,496	5,545

constituted 16% of all higher-school professors. The teaching staff of non-state schools usually derive from state-funded schools, which are still their primary workplaces. Given the deficiency of highly qualified personnel, this is actually a favourable development because it helps to maintain a suitable level of teaching in private schools. At the same time, having two (or even more) jobs helps poorly paid academic teachers to improve their financial situation. The disadvantage of combining didactic work at a private and a state school by professors and junior researchers is lack of time for scientific activity.

Re 5.

The co-occurrence of scientific and educational activity at higher schools accounts for the symbiosis of teaching and research that occurs at them. Students not only acquire and improve their knowledge, but are also made aware of how knowledge is generated, and they can take part in this process. The excessive teaching load that is characteristic of higher schools in Poland recently disturbs this symbiosis and restricts the possibilities of scientific activity.

Owing to their multi-disciplinary nature and a broad range of specialities, higher schools, especially universities, are particularly well-equipped to carry out research, both single- and interdisciplinary. Simultaneously, through the training of professional staff at an academic level, they are the main centres popularising scientific knowledge and making students aware of its role in technological progress and economic development.

With the proliferation of the various forms of higher education, especially the setting up of numerous private schools, and a very big increase in the number of students, scientific research in those institutions has moved to a second place.

The crisis in the relation between higher education and science should be seen in two aspects. On the one hand, the excessive teaching load causes scientific activity to slacken and slows down the scientific development of academic workers, which may lead to deterioration in the level of teaching. The number of doctoral theses shows poor growth: in 1997 it only amounted to 112% of the 1990 figure, while the number of post-doctoral degrees granted between 1990 and 1997 dropped by 30%[3]. There appeared a very distinct generation gap: more than a half of full professors are over 60. On the other hand, academic teaching helps workers to carry out their research, but only when their lecturing load is not too big and the studies are not mass enterprises making a direct contact between professor-researcher and student impossible.

While there has been a considerable increase in the number of published manuals, scientific creativity has been declining, though it is hard to document[4]. Another factor re-

3 In 1997 65% of research workers and 75% of professors were employed in higher education. About 90% of doctoral degrees were conferred by schools chartered to award them.

4 In the years 1990–1997 Poland fell from the 18th to the 20th position in respect of the number of scientific publications.

sponsible for the slackening research activity has been relatively lower outlays for science. The proportion of the state budget earmarked for science dropped from 2.5% in 1991 to 1.7% in 1997[5].

3. Regional differences in higher education and in its changes

The changes occurring in higher education are reflected in a regional approach which reveals considerable differences in them. Defining the regional differences in those changes helps to make them more concrete.

Differences in higher education in 1990, i.e., at the beginning of the transformation, were wide and greatly determined its further changes. Hence our starting point is the characterisation of the regional structure of higher education in Poland in 1990. For comparative reasons, it is given in terms of the present administrative division of the country into 16 voivodeships (in force since 1999)[6].

The characterisation is based on three indices of the state of higher education: the number of schools, the number of students, and the number of academic teachers (Table 6). They allow the voivodeships to be ordered by their level of development of higher education. The sum of the ranks achieved by the voivodeships on these three scales provides a basis for their classification (classification A). Four classes are distinguished: of a very high, high, average, and low level of development of higher education (Table 7).

The voivodeship standing out for its very high level of development of higher education was that of Mazovia with its 15 schools, 73,000 students, and 11,000 academic teachers. It accounted for 16% of all higher schools, 19% of students, and 18% of academic teachers in Poland.

The high-level class was made up of five voivodeships: Małopolska, Lower Silesia, Silesia, Wielkopolska, and Pomerania. Each of them had 8–13 higher schools, 25–50 thous. students, and 6–9 thous. academic teachers. They accounted among them for almost 50% of higher schools, students and academic teachers in Poland.

The voivodeships of the average-level class: Łódź, Lublin, West Pomerania, and Kujawy-Pomerania, had 5–6 higher schools each, 17–31 thous. students, and 2–5 thous. academic teachers.

The voivodeships of the low-level class had an average of two schools educating 7 thous. students and employing 900 academic teachers.

The concentration of higher education in the ten voivodeships with a very high, high and average level of its development resulted, among other things, from the spatial di-

5 In 1995 the expenditure on R&D constituted 0.74% of the GDP. The share of higher schools in the expenditure was 25%, although they provided 55% of Poland's research staff (Wasilewski et al. 1997). In 1999 the outlays for science were a mere 0.5% of the GDP, as against 2–2.5% in West European states with their much higher national incomes. In Poland the share of public expenditure on higher education in the GDP dropped from 1.11% in 1990 to 0.85% in 1997.

6 In this paper the voivodeships are called regions, and the two terms are used interchangeably, because the voivodeships are the main structural units of Poland's territorial organisation (see Chojnicki 1996).

Table 6. Higher education by voivodeship*

Voivodeships	Number of schools				Students		Academic teachers	
	1990/91		1997/98					
	total	non-state schools	total	non-state schools	1990/91	1997/98	1990/91	1997/98
Kujawy-Pomerania	5		6	1	18,630	53,389	2,457	2,840
Lower Silesia	9	1	18	10	35,766	83,616	6,219	6,146
Lublin	5	1	8	4	31,199	57,365	3,965	4,625
Lubuska Land	2		3	1	5,166	24,248	623	1,121
Łódź	6		17	11	22,900	68,637	4,719	5,052
Małopolska	13	2	19	9	49,969	106,450	8,182	9,108
Mazovia	15	1	63	49	73,505	203,874	11,214	12,434
Opole	2		3	1	7,707	20,657	752	1,059
Podkarpacie	2		7	5	6,371	41,159	810	1,610
Podlasie	2		11	8	4,771	31,235	1,033	2,234
Pomerania	8		12	4	28,423	53,165	4,452	4,643
Silesia	8		25	17	38,602	121,376	6,084	6,898
Świętokrzyska Land	2		8	6	8,873	28,208	977	1,295
Warmia-Mazuria	2		6	4	10,408	25,134	1,277	1,582
West Pomerania	6		11	5	17,156	71,465	2,839	3,489
Wielkopolska	9	1	19	11	34,867	87,236	5,540	6,394
Total	96	6	236	146	394,313	1,077,214	61,143	70,530

* without military and police schools

Table 7. Classification of voivodeships by their level of higher education

Classes of higher education development	Voivodeships, 1990 (A)	Voivodeships, 1997 (B)
very high	Mazovia	Mazovia
high	Małopolska Lower Silesia Silesia Wielkopolska Pomerania	Silesia Małopolska Wielkopolska Lower Silesia Łódź
average	Łódź Lublin West Pomerania Kujawy-Pomerania	West Pomerania Pomerania Lublin
low	Warmia-Mazuria Świętokrzyska Land Podlasie Podkarpacie Opole Lubuska Land	Podlasie Kujawy-Pomerania Podkarpacie Świętokrzyska Land Warmia-Mazuria Lubuska Land Opole

stribution of established scientific centres in Poland[7]. In those voivodeships they are located in metropolitan areas or in the principal cities (capitals).

The study of regional changes that took place in higher education in the years 1990–1997 is based on two indices: (1) an increase in the number of schools, which practically meant an increase in non-state schools, and (2) an increase in the number of students (Table 6, Figs 1–4).

The main voivodeship of change in higher education was Mazovia. It was there that 48 new non-state higher schools were set up, that is, 34% of those established over the study period. The increase in the number of students in this voivodeship constituted 19% of the national figure. Silesia ranked second with 17 new private schools and an increase in the number of students amounting to 12% of the national figure. The next positions were occupied by Wielkopolska (10 new schools, the proportion of the increase in the number of students of 8%), Małopolska (7; 8%), Lower Silesia (9; 7%), and West Pomerania (5; 8%). These six voivodeships accounted for 68% of newly established schools and 62% of the national increase in the number of students, with the dynamics of the latter index ranging between 416% (West Pomerania) and 213% (Małopolska).

Standing out among the remaining voivodeships for their high dynamics of the number of students, much above the national average, are Podlasie (in which a new state university has been founded beside private schools), Podkarpacie and Lubuska Land. However, owing to their poor initial position in the process of changes, their proportion in the national increase in the number of students is relatively low.

As follows from the above analysis, changes in higher education improving its level concentrated mainly in those voivodeships that already had a well-developed system of higher learning, and they did not modify regional differences in it in any significant way. The 1997 classification of voivodeships by their level of development of higher education (classification B) is clearly similar to the 1990 one (classification A) (Table 7). Their comparison leads to the following conclusions:

(1) Mazovia has asserted its supremacy,
(2) while the size of the high-development-level class keeps constant, its composition has changed: Pomerania has left this class and switched places with Łódź, promoted from the average-level class,
(3) Kujawy-Pomerania has fallen from the average-level class to the low-level one, and
(4) within the particular classes the order of voivodeships has changed on the scale of development of higher education. In the high-level class, Silesia has overtaken Małopolska, and Lower Silesia has clearly weakened its position.

The spatial concentration of higher education and different sizes of voivodeships as measured by their population figures give different indices of the number of students

7 By a scientific centre we mean a spatial cluster of scientific entities within a single or several cities. The components of a centre are entities representing each of the organisational sectors of science, viz. higher schools, institutions of the Polish Academy of Sciences, and research and development units, with an obligatory presence of a university (Chojnicki, Czyż 1997).

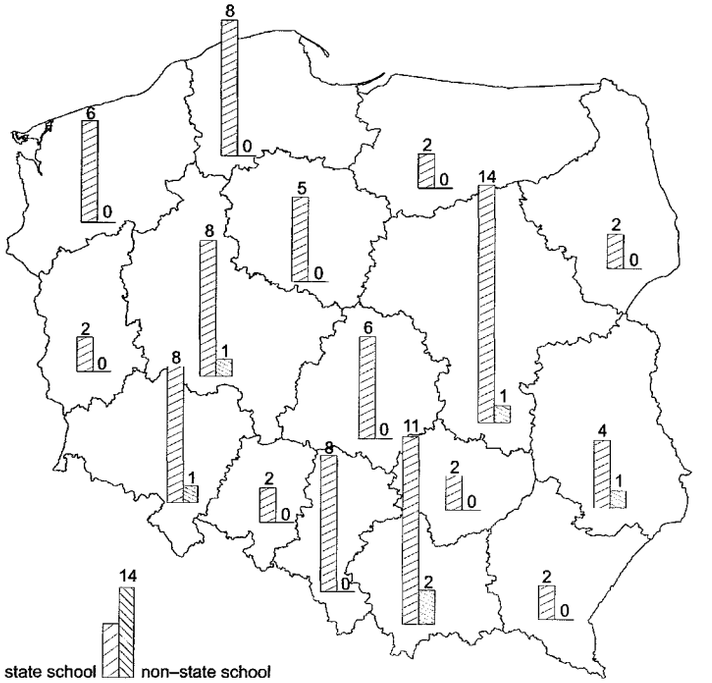

Fig. 1. Higher schools in the academic year 1990/91

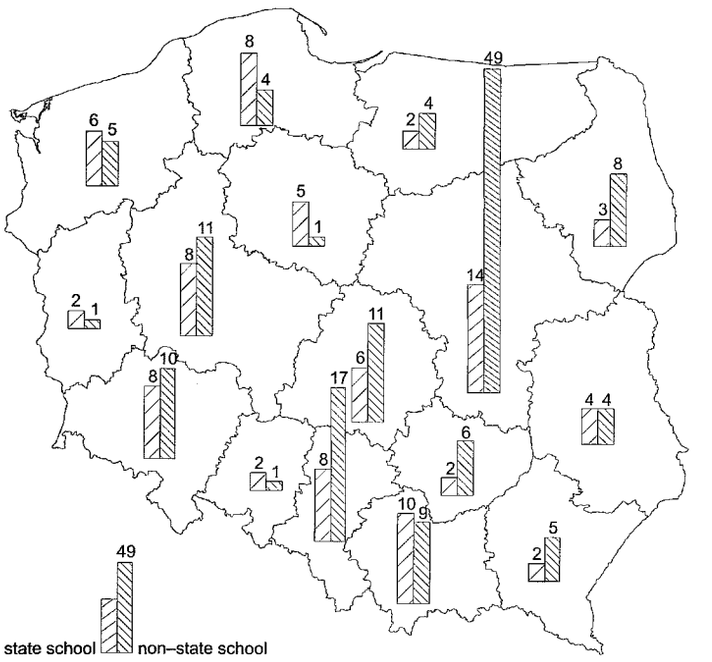

Fig. 2. Higher schools in the academic year 1997/98

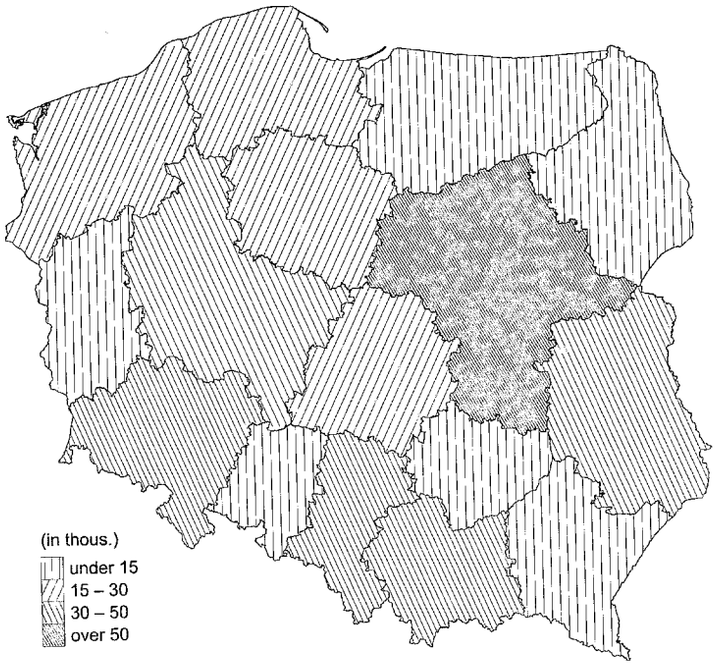

Fig. 3. Higher schools in the academic year 1990/91

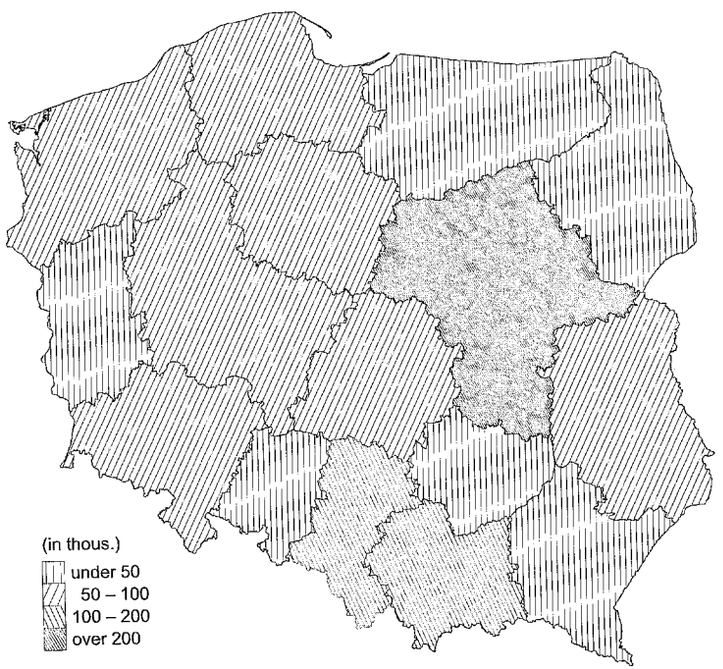

Fig. 4. Higher schools in the academic year 1997/98

per 1,000 population in the pattern of the 16 voivodeships. However, the calculation of this index is based on the simplifying assumption that the educational activity of schools of higher learning has only a regional (voivodeship) range. In 1997 the national mean was 28 students per 1,000 population. The highest indices were recorded in West Pomerania (41) and Mazovia (40), while Małopolska and Lower Silesia attained high figures (above the national average). The lowest number of students in relation to the number of their populations were observed in Warmia-Mazuria, Opole, and Podkarpacie.

4. Relationship between the development of higher education and economic development in the regional approach

The relationship between the development of higher education and economic development is an interesting link in the formation of the processes of modernisation in the course of the transformation. Its examination provides an insight into the co-variability of two significant components of the modernisation process. A regional approach to it not only makes it more concrete, but also improves our understanding of the processes of Poland's regional development.

The starting point in the study of the relationship between the development of higher education and economic development in the regional approach is the classification of voivodeships by the GDP per person. The 1997 values of this index in the 16 voivodeships are treated as the effect of regional economic changes that have occurred in the process of transformation (Orłowski et al. 1998). The use of income as a synthetic measure of the level of economic development is justified by significant correlations of this index with partial indices of economic development. The set of such partial indices included: small-scale private enterprise, commercial companies with foreign capital, the magnitude of investment outlays, technological progress in industry, and the level of urbanisation.

A characteristic feature of the 16-voivodeship system is wide differences in the level of economic development as manifested in the value of per capita income: from 70% to 150% of the national average. Even more striking contrasts are in the economic power of the voivodeships: their contribution to the GDP varies between 2% and 20%. Using the index of per capita income (GDP), the voivodeships can be divided into three classes: strong (3 voivodeships), average (5) and weak (8) (classification C) (Table 8). The strong and average voivodeships are those with urban-industrial areas, while weak voivodeships are predominantly agricultural, have a low level of urbanisation, and are situated mainly in eastern Poland.

Within their classes, however, voivodeships differ in the growth rate of their GDP. In the class of strong voivodeships, Silesia displays low growth dynamics and maintains its position owing to the economic potential worked out in the past. The voivodeship that stands out for its high development rate in the average class is Małopolska, and in the weak class, Warmia-Mazuria.

Table 8. Contingency table of voivodeships

Level of economic development, 1997 (C)	Level of higher education development, 1997 (B)		
	very high and high	average	low
strong voivodeships	Mazovia Silesia Wielkopolska		
average voivodeships	Małopolska Lower Silesia Łódź	Pomerania West Pomerania	
weak voivodeships		Kujawy-Pomerania Lublin	Lubuska Land Opole Podkarpacie Świętokrzyska Land Podlasie Warmia-Mazuria

The relations between the development of higher education and economic development in the regional approach are examined in two aspects.

The first concerns the classification of the voivodeships: (a) by the criterion of the level of development of higher education (classification B), and (b) by the criterion of the level of economic development (classification C). An analysis of the degree of overlap between these two classifications leads to the conclusion that there is a clear relation between a voivodeship's level of economic development and its level of development of higher education (Table 8). Exceptions are voivodeships characterised by a high level of development of higher education while displaying an average level of economic development (Małopolska, Lower Silesia and Łódź), and those which have an average level of development of higher education and a low level of economic development (Kujawy-Pomerania and Lublin). Thus, in 11, or the majority of, voivodeships we can observe the following tendency: the higher the level of economic development, the higher the level of development of higher education. In the remaining five voivodeships the development of higher education is a class higher than economic development.

The other aspect concerns the statistical dependence between the growth in the number of students in a voivodeship in the years 1990–1997 and its level of economic development (as in 1997). This relation was examined with the help of regression analysis[8].

The most adequate statistical description of the relation between the increase in a voivodeship's number of students and the level of its economic development is thought to be a simple regression model in the following version: "the proportion of a regional increase in the number of students in the national increase in the years 1990–1997" depends on "regional income per person", and in the form of the following equation:

$z_1 = -11.43 + 1.67\, x_1 \quad R^2 = 80.0\%$

at the $\alpha = 0.05$ significance level.

However, residuals from regression calculated on the basis of this equation reveal regional deviations from this relation. Significant negative residuals correspond to the voivodeships of Pomerania, Opole, Lubuska Land, and Wielkopolska, which show a slower increase in the number of students than in the level of regional income per person. In turn, significant positive residuals are found in Małopolska, Podkarpacie, Mazovia, Podlasie, Lublin, and Silesia, and indicate faster growth in the number of students than might be expected from its connection with regional income per person.

The voivodeships showing positive and negative deviations (identified on the basis of residuals from regression) from the relation "increase in the number of students – regional income", display a specific pattern of development in the period of transformation. The 'greater' increase in the number of students in Mazovia, Małopolska and Silesia can be explained by the fast growth, attractiveness and high rank of their centres of higher learning as well as by the well-developed labour market in higher-order market services in their home metropolitan areas. In turn, the 'greater' increase in the number of students in the weak agricultural voivodeships of eastern Poland: Lublin, Podkarpacie and Podlasie, is connected with their young people's educational aspirations (Lublin voivodeship has the highest proportion of pupils in comprehensive schools in the country). The aspirations are reinforced by the crisis and hidden unemployment in the agriculture of those voivodeships. The 'weaker' growth in the number

8 Into a regression model with the equation $z = f(x)$ three indices of increase in the number of students were substituted successively as dependent variables:
z_1 = proportion of the regional increase in the number of students in the national increase in the years 1990–1997,
z_2 = regional increase in the number of students in the years 1990–1997 per 1,000 population, and
z_3 = number of students per 1,000 voivodeship population in 1997.
The independent variable (x_1) was per capita regional income as a measure of the level of economic development. The following equations were obtained as a result of parameter estimation:
$z_1 = -11.43^* + 1.67^* x_1 \quad R^2 = 80.0\%$
$z_2 = -16.05 + 0.83^* x_1 \quad R^2 = 32.6\%$
$z_3 = -26.57 + 1.32^* x_1 \quad R^2 = 53.6\%$
* significant at $\alpha = 0.05$ level

In these regression equations the variables defining the regional increase in and the numbers of students (z_1, z_2 and z_3) are significantly dependent on the 'regional per capita income' variable (x_1). However, the strongest connection is that between the regional increase in the number of students relativised to the national increase (z_1) and the per capita income (x_1).

The substitution into this regression equation of other explanatory variables in the form of the percentage of regional income generated in market services as a measure of a voivodeship's modern economic structure (x_2), and the index of enrolment in comprehensive secondary education as a measure of the voivodeship's cultural level (x_3) did not bring about a marked increase in the value of the coefficient of determination R^2 (see the equations below):
$z_1 = -11.91 + 1.66^* x_1 + 0.93\, x_2 \quad R^2 = 80.0\%$
$z_1 = -13.44^* + 1.67^* x_1 + 0.08\, x_3 \quad R^2 = 80.7\%$
$z_1 = -13.60^* + 0.63\, x_2 - 0.24\, x_3 \quad R^2 = 21.8\%$
$z_1 = -11.80 + 1.73^* x_1 - 0.08\, x_2 + 0.12\, x_3 \quad R^2 = 80.9\%$
* significant at $\alpha = 0.05$ level

of students in the economically advanced voivodeships of Wielkopolska and Pomerania is hard to explain and requires further studies.

5. Conclusion

Higher education in Poland has undergone fundamental changes during the period of transformation. While its nature and activity have changed, its spatial distribution has basically remained the same, though. The regional structure of higher education has shown a high degree of inertia.

The intensive development of higher education only started in 1992, which was a turning point in the economic transformation dividing a recession phase (1990–1992) from that of slow economic growth. The changes in higher education are unequivocally connected with the results of the economic transformation. Its efficiency is expressed in economic development as measured by the increase in national income, which amounted to an annual average of 5% over the years 1992–1998.

Also regional differences in changes that took place in higher education are connected with the results of the economic transformation at a regional scale. Those changes are closely connected with a high level of income per region's resident. On the one hand, it determines a higher level of living of the population and as a result raises its educational aspirations, and on the other, it is an indicator of beneficial changes in the structure of the economy whose outcome is greater demand for labour.

The results obtained do not allow any conclusions as to how far the changes in higher education in Poland and its regions are involved in modernisation processes. That is to say, it is impossible to establish whether they are a response to beneficial changes occurring in the structure of the labour market in the course of transformation, and whether they play any part in determining innovation processes and improving organisational structures in the economy.

The influence of education through its higher forms on the development of civilisation is not a simple causal relation, and finding a regularity in this field for a short period of change is not an easy task. On the basis of our results it is only possible to indicate certain symptoms of civilisational progress. At the national scale, a manifestation of the progress is the growth in the role of economic and social studies in the structure of academic education, which is of crucial significance for the course of modernisation processes. In those voivodeships where the increase in the number of students was higher or lower than that expected from its relation with regional income, one might interpret it as a symptom of lagging or poor progress in modernisation processes.

References

Chojnicki Z., 1996. Region w ujęciu geograficzno-systemowym (The region in a systems-geographical approach). In: Czyż T. (ed.), *Podstawy regionalizacji geograficznej*. Poznań: Bogucki Wydawnictwo Naukowe, 7–43.

Chojnicki Z., Czyż T., 1997. *Struktura przestrzenna nauki w Polsce* (The spatial structure of science in Poland). Poznań: Bogucki Wydawnictwo Naukowe.

Orłowski W.M., Saganowska E., Zienkowski L., 1998. *Szacunek Produktu Krajowego Brutto według 16 województw za 1996 i 1997 rok* (Estimate of the 1996 and 1997 Gross Domestic Product by 16 voivodeships). Warszawa: Zakład Badań Statystyczno-Ekonomicznych GUS i PAN, 262.

Wasilewski L., Kwiatkowski S., Kozłowski J., 1997. *Nauka i technika dla rozwoju* (Science and technology for development). Warszawa.