Chapter III

Conceptualization of the quantification of economic development

Katarzyna Nawrot

The identification of a new division of the world in the second half of the 20th century, often equated with the publication of A. Sauvy's work, gave rise to considerations on the differentiation of the development of individual regions of our globe and its causes. This led to attempts to define measures of this process, which in turn was to facilitate the classification of individual countries into developed and developing countries. Initially, the disproportions in development were quantified only in terms of quantity, mainly using size and dynamics of gross domestic product growth. However, research conducted in recent decades has shown that this approach is insufficient. Development cannot be reduced only to economic transformations, as it includes both quantitative and qualitative variables, and nowadays, in the case of both developed and developing countries, qualitative variables are gaining importance.

Therefore, in the analysis of development processes, their quantification is indispensable and comes down to the selection of economic, political, social or other features that would allow the comparison of individual countries and their classification according to the adopted typology. So far, it has not been possible to create a single indicator that would allow to

determine the level of development of countries in a satisfactory, versatile and generally accepted way. The fact is that there are justifiable difficulties in creating the optimal measure, but there is also a dilemma of the search itself. Despite research difficulties, the quantification of economic development is high on the agenda in the considerations of development economics. Identification and evaluation of the existing measures of development is of great cognitive and application significance both in the conducted empirical research and in the process of creating economic policy. This chapter conceptualizes, reviews, systematizes and assesses the existing measures and indicators with which attempts are made to quantify economic development. First, quantitative measures were analyzed, and then qualitative indicators, which, apart from economic factors, also include other aspects of life. Only a multidimensional analysis, taking into account economic factors as well as demographic, social, political, ecological and even cultural elements, enables a comprehensive assessment of the level of economic development, and more fully illustrates the existing disproportions between individual countries.

3.1. Quantitative approach to quantification

The most common measure of assessing the functioning of the economy is Gross Domestic Product (GDP) and its derivatives. The rate of economic growth shows the ratio of the change in the amount of real GDP in a given year to the level of real GDP in the base year. Gross domestic product is the amount of production provided by production factors located within the territory of a given country, regardless of who owns them. In international studies, the definition of GDP is often formulated as the sum of the added value generated by producers in the country in a given year, increased by taxes not included in the product valuation (Begg, Fischer, Dornbusch, 1999, pp. 25–26; WDR, 2002, p. 21). By complementing the GDP with the net income of factors of production located abroad, one obtains a measure of the total income achieved by the citizens of a given country, regardless of the place where the services are provided by the factors of production, called the Gross National Product (GNP). On the other hand, by reducing the gross national product in

the prices of production factors by the value of the consumption of fixed capital called depreciation, we obtain the net national product (NNP), i.e. national income. National income informs about the amount of money that the economy has at its disposal for spending on goods and services, after setting aside an appropriate part of it, sufficient to finance depreciation and maintain the existing capital stock at the current level. Both GDP and GNP make it possible to assess the size of the economy of individual countries, and are also a measure of global production.

In compiling the national income account, four types of expenditure making up the gross national product are distinguished. These are: consumer spending, capital expenditure, government purchases, and net exports (current account balance). The purpose of this division of national income is to help identify the causes of recessions or periods of revival by understanding the changes that main categories of spending were subjected to. Thus, the account of national income is a kind of classification of transactions contributing to the creation of national income depending on the type of input that causes their creation (Krugman, Obsfeld, 2002, p. 18). When analyzing the size of economies, it should be noted that they relate to different sizes of societies. Omitting this fact makes it difficult to assess the actual level of economic development, substantially distorting the results of the comparison between different countries. Only the amounts of GDP and GNP divided by the number of inhabitants – GDP and GNP *per capita* – allow a more precise comparison of the level of development of the economies of individual countries and regions. However, it should be emphasized that in a society where there are large disparities in the distribution of income, the GDP / GNP *per capita* indicators significantly distort the picture of the actual situation. Despite the undoubted weaknesses, it is precisely the income criterion that is a basis for specialists from the World Bank to classify individual economies into high-income, middle-income and low-income countries.[1]

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[1] According to the adopted classification of the World Bank, in 2020, on the basis of the value of the national income *per capita*, the economies with the gross national product *per capita* exceeding the value of USD 12,535 (GNP *per capita* > USD 12,535) were classified as high-income countries. In this group, an additional division was made into OECD countries and non-members of the organization. Among middle-income

When comparing *per capita* income in individual countries, it is worth taking into account the purchasing power of money parity. The prices of similar or even the same goods are at different levels. The simplest measure of purchasing power is a market basket made up of a single commodity.[2] When analyzing the gross national product in dynamic terms, the nominal value of GNP expressed in current prices should be corrected by the impact of changes in the general level of prices resulting from inflation. The value obtained this way is defined as real GNP, which measures the volume of production at constant prices, i.e. prices existing in a certain period, known as the base year. The general price level index used to implement the inflation adjustment is known as the GNP deflator and takes the following form:

$$\text{GNP deflator} = \frac{\text{nominal GNP}}{\text{real GNP}} \qquad (1)$$

W. Nordhaus and J. Tobin, in their opinion-forming article Is growth obsolete? published in 1972 by Columbia University Press (Nordhaus & Tobin, 1972), presented the concept of the Net Economic Welfare (NEW) index as a measure that corrects GNP by side effects of growth, the value of non-market goods and services and the value of leisure time:

NEW = GNP + value of non-market and unregistered activity
    + value of leisure time − value of side effects of growth   (2)

countries an additional division was introduced into upper middle-income countries (USD 4,046 ≤ GNP *per capita* ≤ USD 12,535) and lower middle-income countries (USD 1,036 ≤ GNP *per capita* ≤ USD 4,045). When the gross national product is below USD 1,036 (GNP *per capita* ≤ USD 1,036), we are dealing with low-income countries. Developing countries include middle-income and low-income countries. Attention should be paid to the changing boundaries between GNP *per capita* ranges in individual groups, dictated by the need to constantly adapt to transformations in the global economy (see World Bank, 2021).

[2] An example of a measure of the purchasing power of money is the Big Mac index published by the British weekly "The Economist". It shows the prices of the Big Mac sandwich sold in the McDonald's chain in different countries, converted into dollars at the current rate. The Big Mac Index shows whether a country's currency is overvalued or undervalued against the dollar.

Many researchers nowadays point to the shortcomings of GDP (Korten, 2002; Nawrot, 2008a; Anan, Segal, & Stiglitz, 2010; Jacob & Šlaus, 2010; Sandel, 2012; Fioramonti, 2013). It is worth quoting here the Report by the Commission on the Measurement of Economic Performance and Social Progress *Mismeasuring our lives. Why GDP Doesn't Add Up* by J.E. Stiglitz, A. Sen and J.-P. Fitoussi. In the preface to the Polish edition entitled *Błąd pomiaru. Dlaczego PKB nie wystarcza* E. Mączyńska emphasizes that despite its essence, GDP is an insufficient measure to assess the level of national wealth and social welfare, and thus to rely solely on quantitative indicators, without a deepened holistic analysis, including qualitative analysis, may lead to unauthorized conclusions resulting in costly errors in the socio-economic policy (Mączyńska 2013: VIII). Mączyńska refers to the apt Einstein's maxim that "Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted" (ibidem).

Quantitative indicators, regardless of the existing controversy related to determining their level, remain a valuable instrument for evaluating and facilitating the typology of countries. Despite their undoubted weaknesses, they have not yet been eliminated from international rankings as tools for quantifying the level of economic development. It should also be noted that qualitative indicators often take into account the values of GDP and its derivatives, which will be shown later in the chapter. Selected quantitative indicators are compiled in Table 1.

Table 1. Calculation of selected quantitative indicators

Quantitative indicators	
Gross Domestic Product (GDP)	GDP at factor prices = GDP at market prices – Indirect taxes + subsidies = Σ of factor income
Gross National Product (GNP)	GNP in factor prices = GDP in factor prices + net abroad property income
Net national product / national income (NNP / NI)	NNP in factor prices = GNP in factor prices – depreciation
Net Economic Welfare (NEW)	NEW = GNP + value of non-market and unregistered activity + value of leisure time – value of side effects of growth

Source: own study.

3.2. Qualitative approach to quantification

Since the 1970s, scientists from various backgrounds have attempted to propose an index that would cover other aspects of life, besides the economy, adequately evaluating individual countries.[3] Among the existing qualitative indicators, one can distinguish those of a homogeneous nature, as well as aggregated indicators. They have significant cognitive and application values, and their comprehensive implementation allows for a multidimensional assessment of the state of the economy. Depending on the adopted research perspective, the measures of economic development include (cf. Fig. 1):

- social indicators,
- institutional indicators,
- ecological indicators,
- sustainable development indicators.

3.2.1. Social indicators

The most popular qualitative measure nowadays is the Human Development Index (HDI) proposed in 1990 by the UNDP as an alternative measure of development. In the next two decades of work of the United Nations, new measures were introduced and the methodology of quantifying the existing ones was modified. The HDI takes into account, apart from the economic aspect (the actual purchasing power of the obtained income *per capita*), also the knowledge and vitality aspects, and its value is determined on the basis of three data:

- human life expectancy index (I_{Life}),
- education index ($I_{Education}$),
- GNP index (I_{Income}).

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[3] One can point to the APQLI (Augmented Physical Quality of Life Index), calculated on the basis of life expectancy, the amount of caloric consumption *per capita* and the degree of literacy and scholarization, or the EDI (Economic Diversification Index) based on the share of industry in generating GDP, the number of employees in industry, electricity consumption *per capita*, dependence of the economy on exports (see Deszczyński, 2001c, pp. 21–22).

The life expectancy index reflects a country's achievements in terms of the so-called average life expectancy and is based on the life expectancy indicator.
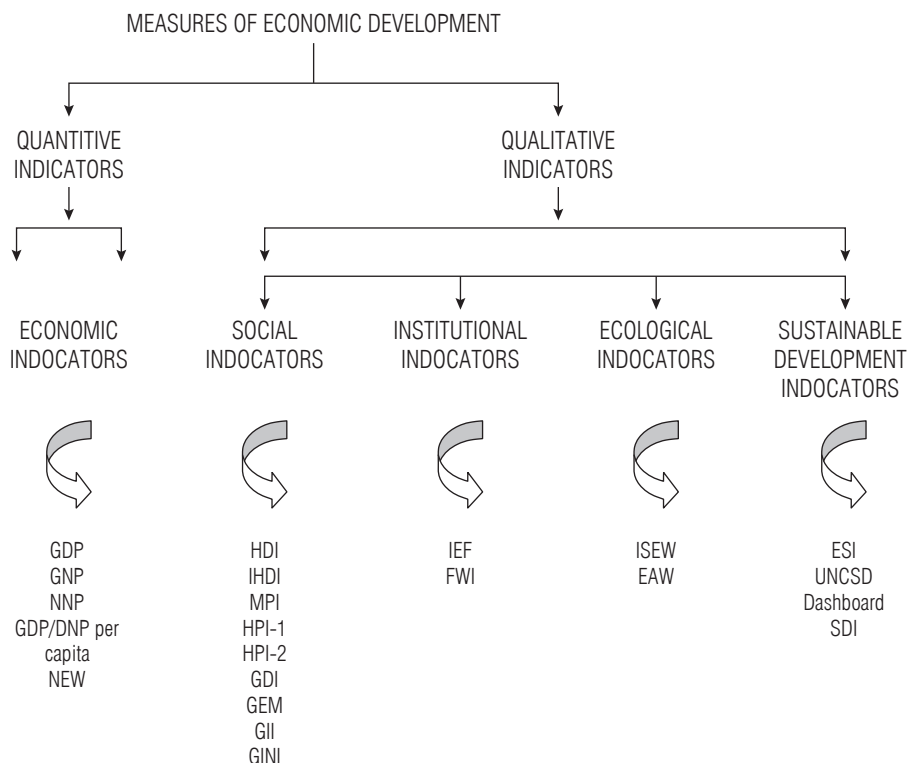
MEASURES OF ECONOMIC DEVELOPMENT

QUANTITIVE INDICATORS

QUALITATIVE INDICATORS

ECONOMIC INDOCATORS	SOCIAL INDOCATORS	INSTITUTIONAL INDOCATORS	ECOLOGICAL INDOCATORS	SUSTAINABLE DEVELOPMENT INDOCATORS
GDP	HDI	IEF	ISEW	ESI
GNP	IHDI	FWI	EAW	UNCSD
NNP	MPI			Dashboard
GDP/DNP per capita	HPI-1			SDI
NEW	HPI-2			
	GDI			
	GEM			
	GII			
	GINI			

Figure 1. Measures of economic development
Source: own study.

According to the Statistics Poland (GUS), life expectancy at birth, defined as the "average life expectancy", expresses the average number of years a person aged x years is expected to live, assuming a constant level of mortality from the period for which life expectancy tables were prepared (GUS, 2004, 190).

Comparing the standard of living in individual countries requires examining differences in national price levels. Consequently, the GNP index is calculated on the basis of the per capita GNP in purchasing power parity. The inclusion of income in the HDI is intended as a proxy for all dimensions of development not reflected in the level of knowledge

and life expectancy. Due to the fact that in order to achieve a decent level of social development, unlimited income is not necessary, the calculation of the GNP index uses logarithmic values for individual income values.

The education index is a product of the mean years of schooling, which is the average number of years of education received by a 25-year-old or older person, and the expected years of schooling, which is the expected number of years for a 5-year-old child to spend at school.

Nowadays, the HDI value is not calculated as the weighted average of the indices in each dimension, but is calculated according to the following formula:

$$\text{HDI} = \sqrt[3]{I_{Education} \cdot I_{Life} \cdot I_{Income}} \qquad (3)$$

HDI takes a value from 0 to 1, on the basis of which the classification is made into countries with:

- very high level of development (HDI ≥ 0,800),
- high level of development (0,799 ≥ HDI ≥ 0,700),
- medium level of development (0,699 ≥ HDI ≥ 0,550),
- low development (0,550 > HDI).

Each of the calculation dimensions is assigned a weight in the range from 0 to 1, determined on the basis of the formula:

$$\text{dimension index} = \frac{\text{present value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \qquad (4)$$

Table 2. Assumptions for the HDI calculation

Indicator	Maximum value	Minimum value
Life expectancy	85	20
Average schooling period	15,0	0
Expected schooling period	18,0	0
PNB *per capita* (2017, PPP USD)	75000	100

Source: UNDP (2020, p. 2)

A big advantage of the HDI is the greater number of criteria and, consequently, greater credibility of the assessment of the development level of a given country. However, it is still a subjective measure and does not take into account all important factors, such as infant mortality, the degree of malnutrition, the extent of economic freedom, and finally inequality in the distribution of income. The introduction of new measures of development by UNDP undoubtedly widened the possibilities of comparisons, but it did not eliminate quantitative measures from international comparisons. Attention should be paid to the ongoing research by both the UNDP and world research centers on the methodology of qualitative development measures. With regard to the HDI, in 2010 a new measure was introduced, correcting HDI by the degree of inequality – IHDI (Inequality-adjusted Human Development Index). In the case of IHDI, each of the dimensions of the HDI calculation is corrected by the degree of existing inequalities. To obtain indices that take into account inequalities in distribution, the sub-indices of the HDI are multiplied by $(1 - A)$, where A is the measure of inequality obtained as the result of $A = 1 - g/s$, with g being the geometric mean and s the arithmetic mean. The IHDI value represents the loss in development measured by HDI, resulting from the existing inequalities.

To better illustrate development trends, in 1995 UNDP introduced the Gender Development Index (GDI) and the Gender Empowerment Measure (GEM). In the proposed GDI, the calculations were made in the same dimensions, based on the same indicators as for the HDI, however, it allowed to capture the disproportions in development between women and men. The larger the recorded disproportions in a given country or region, the lower the GDI index was compared to the HDI index. With complete equality in the development of women and men, GDI and HDI would have the same values.

The GDI value was the average of the equal life expectancy index, the equal development of education index, and the equal income distribution index. The individual equally distributed indices were estimated on the basis of the size of the indices in individual dimensions, calculated separately for men and women in accordance with the methodology

adopted for the HDI. The value of equally distributed indices resulted from the formula:

equally distributed index = {[share of the female population (female index$^{1-\varepsilon}$)] + [share of the male population (male index$^{1-\varepsilon}$)]}$^{1/1-\varepsilon}$ (5)

The ε value determined the aversion to inequality in a given society, indicating the penalty for gender discrimination. The greater the value of ε, the greater the penalty for society as a result of the existing disproportions. A value of $\varepsilon = 0$ indicates that there is no gender development inequality penalty (in which case GDI and HDI are the same). A value of $\varepsilon = 2$ adopted in the GDI and GEM calculations determines, in turn, moderate losses due to inequalities in gender development. Therefore, the equation takes the form:

equally distributed index = {[share of the female population (female index^{-1})] + [share of the male population (male index^{-1})]}$^{-1}$ (6)

The GEM indicator was to show to what extent women are entitled to participate in economic and political life. The calculation of GEM focused on the opportunities available to women rather than on their actual predispositions. The GEM calculation takes into account the participation of women in political and economic life and the disproportions in the distribution of income between different representatives of sexes, thus reflecting economic independence. The GEM calculation was based on the calculation of the arithmetic mean of the EDEP (Equally Distributed Equivalent Percentage) indices. The EDEP index can be defined as an equally distributed index in relation to equality between women and men. Individual EDEP indices were estimated within each of the GEM dimensions in accordance with the formula adopted in the methodology for calculating the GDI index. For the indicator of the participation of women and men in political and economic life, the estimated values were additionally divided by 50. The rationality of such an approach is explained by the fact that in an ideal society where the empowerment of women and men would be

the same, the values of the GEM indicator variables would equal 50%, which means that the share of women and men would be the same for each variable.

Contrary to GDI, the GEM indicator shows the inequality of opportunities in selected areas of social life. This inequality is in no way related to the size of the national income, as evidenced by the analysis of the GEM indicator in highly developed and developing countries.

In response to criticism towards GDI and GEM, the methodology with regard to gender inequality in social development was modified and, in 2008, the GII (Gender Inequality Index) measure was proposed. GII estimates the inequality between the development of women and men in terms of health, empowerment and access to the labor market, illustrating the loss of social development resulting from gender. The value of GII ranges from 0 to 1. The value 0 means no gender inequality, while the value 1 means complete inequality. Calculation in the health dimension is based on the perinatal mortality rate and the birth rate of young mothers. In the case of validation, the number of women and men with secondary education for a given society and the number of seats in parliament held by women and men were taken into account. Labor market participation was estimated on the basis of female and male labor market participation rates.

The evolution of the methodology can also be observed in attempts to measure poverty, which, as a subjective category, reduces quantification to the selection of indicators showing the depravity of human life in the identified dimensions. Poverty means that basic living needs are not being adequately met. The most frequently used measure of poverty is the so-called poverty lines used by the World Bank to determine the percentage of the population living below the poverty threshold. There are one dollar a day poverty line[4], two dollars a day poverty line, and aurenational poverty line. When a society lives below the one dollar poverty line, it is called extreme poverty, meaning that the individual is unable to meet the basic needs of survival. Moderate poverty means that

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[4] The common name of the one dollar poverty line means that an individual has less than USD 1.25 of income a day.

an individual earns less than two dollars a day, but more than one dollar, and is able to cover basic needs.

In 1997, UNDP introduced the first Human Poverty Index (HPI) to measure the level of development or underdevelopment of countries. The HPI measured the same dimensions as the HDI, namely viability, knowledge, and standard of living. It turned out that countries with the same HDI value had significant differences in HPI values. This was due to the fact that, unlike the HDI, which measures the general level of social development, the HPI poverty index reflected its individual directions and indicated the existing areas of backwardness. Thus, the multidimensionality of the poverty index made it possible to identify the largest clusters of poverty within a given region or within individual countries. The poverty indicators were differentiated into HPI-1 for developing countries and HPI-2 for OECD countries.

HPI-1 index was calculated on the basis of:

- probability life expectancy below forty years,
- adult illiteracy rate,
- percentage of the population deprived of access to a safe source of water,
- percentage of underweight children for a given age group.

HPI-2 was measured in the same dimensions as HPI-1, but with slightly different indicators. The viability was determined by the probability of life expectancy below sixty years. The level of knowledge was measured according to the number of adults (aged 16–65) lacking functional writing skills. The standard of living, in turn, was expressed in the share of the population living below the poverty line. In addition, HPI-2 took into account the dimension of social exclusion, measured by the long-term unemployment rate (12 months or more).

The values of the HPI-1 and HPI-2, unlike HDI, GDI or GEM, were not calculated on the basis of the indices of individual dimensions, but were the expression of the percentage of depravity in the areas of knowledge, viability and standard of living. HPI-1 and HPI-2 were calculated from the equations:

$$\text{HPI-1} = [1/3(P_1^{\alpha} + P_2^{\alpha} + P_3^{\alpha})]^{1/\alpha} \tag{7}$$

where:

P_1 – probability of probability life expectancy below forty years, measured at birth,

P_2 – adult illiteracy rate,

P_3 – arithmetic mean of the population deprived of access to a safe water source and underweight children for a given age group.

$$\text{HPI-2} = [1/4(P_1^{\alpha} + P_2^{\alpha} + P_3^{\alpha} + P_4^{\alpha})]^{1/\alpha} \tag{8}$$

where:

P_1 – probability of probability life expectancy below sixty years, measured at birth,

P_2 – the number of adults lacking functional writing skills,

P_3 – population below the poverty line,

P_4 – long-term unemployment rate.

The use of α value in the calculation of HPI-1 and HPI-2 was of significant importance for the final value of the indicators. For $\alpha = 1$, the HPI value would be equal to the arithmetic mean of indices for individual dimensions. As the value of α increases, a higher weight would be assigned to the dimensions with the highest depravity.

In 2010 UNDP introduced a new measure of poverty – the Multidimensional Poverty Index (MPI). Its purpose is to illustrate the scope of depravity in developing countries in the identified areas, which are to present the problem of poverty in an even more precise way. It is also worth noting that individual areas refer to the "Millennium Development Goals" implemented by the United Nations.

The MPI calculation is performed in three dimensions – analogous to those included in the HDI or HPI, but with the use of different indicators. Child mortality and nutrition were taken into account in the dimension of viability. The number of years of study and the enrollment rate became the basis for calculations in the education dimension. Standard of living is assessed on the basis of the availability of fuel for

cooking, toilet, water, electricity, floor, and household items. Each of the highlighted areas has the same weight within each dimension.

The value of the multidimensional poverty index MPI is the result of the product of the poverty index H (headcount ratio) and the poverty scale A (intensity of poverty), which can be written as:

$$\text{MPI} = H \cdot A \tag{9}$$

Poverty index H, denoting the share of the number of the poor in a given society, is calculated on the basis of the formula:

$$H = \frac{q}{n} \tag{10}$$

where q is the number of the poor and n is the number of people in a given population.

The poverty scale reflects the percentage of weighted partial indicators in which, on average, poor people are disadvantaged. With regard to households identified as poor, the estimated amount of depravity is summed up and divided by the total number of poor. The level of depravity is determined according to the formula:

$$A = \frac{\sum_{1}^{q} c}{q} \tag{11}$$

where c is the level of depravity.

Indicators showing disproportions in the distribution of income among the inhabitants of a given country are also of significant importance in determining the level of economic development. The Gini coefficient is a measure of the degree to which the income distribution differs from the equal distribution. The value of this coefficient is related to the Lorenz concentration curve illustrating the relationship between the total percentage of income shown on the ordinate axis and the total percentage of households in subsequent income groups presented on the abscissa (Fig. 2). The figure shows the degree of equality or inequality in the distribution of income. The greater deviation of the Lorenz curve L from the straight line inclined at 45° (running ideally along the marked diagonal

OA and called "the line of perfect equality") indicates greater inequality in the distribution of income.
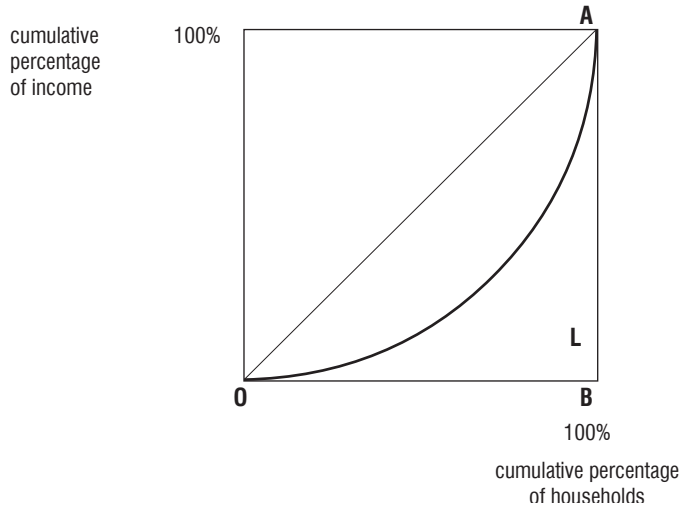

Figure 2. Lorenz curve
Source: own study.

The value of the Gini coefficient ranges from 0 to 1. A value of 0 implies perfect equality (each person from a given community receives the same amount for their work, regardless of its nature), while a value of 1 means perfect inequality in the distribution of income (one person from a given group receives all income). In other words, the greater the value of the coefficient, the greater the degree of concentration, and thus the greater the inequality. Both extremes, for both the egalitarian distribution and the extreme inequality, are only possible theoretically as they have never occurred for the observed income distributions.

The Gini coefficient in an arithmetic form can be presented as follows (Aronson & Lambert, 1994):

$$G = \frac{1}{2\mu n^2} \sum_{i=1}^{n} \sum_{j=1}^{n} | x_{i} - x_{j} | \tag{12}$$

where:
    G – Gini coefficient,
    μ – average income,

n – number of all households,

x_i – a given person's income.

Doubled value of the Gini coefficient informs about the average absolute difference between the pairs of income and is an expression of the average income. This means that if we randomly select two people from a set of people and express the difference between their incomes as a share in the average income in this set, this share (on average) will be twice as large as the Gini coefficient: a coefficient of 0.3 means that the difference between the incomes of two people randomly selected from this group is 60% (2 × 0.3) of the average income. If the coefficient is 0.5, the difference will be equal to the average income (ibidem).

The geometric interpretation of the Gini coefficient[5] comes down to determining the area constituting the difference between the perfect equality line *OA* and the Lorenz curve *L*, i.e. *OAB-OLAB* divided by the area of the triangle *OAB* (determined on the basis of the perfect equality line). With a perfectly even distribution of income among households, the Lorenz curve *L* would follow the perfect equality line *OA*, and the Gini coefficient would be 0. At total concentration, the Lorenz concentration curve would follow the *OBA* line. Thus, the weaker the concentration, the closer the concentration curve is to the line of even distribution.

In research practice, inequalities relate primarily to inequalities in the distribution of income. In the context of the quantification of development processes, however, it is important to emphasize that inequalities refer to both wealth inequality and inequality of opportunities. As part of wealth inequalities, the most frequently analyzed are income inequalities, which relate to both income from work and income from capital. With regard to wealth inequalities, one should also distinguish inequalities due to property, in particular real estate, metals or luxury goods. The

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[5] In the literature on the subject one can find numerous proposals for calculating the Gini coefficient, coming down to determining the area defined by the Lorenz curve both under the curve and between the curve and the perfect equality line of 45°, see e.g. Aronson & Lambert (1994), Kot (2000, p. 114), Rynarzewski, Zielińska-Głębocka (2006, p. 192), Nawrot (2014, pp. 66-67), Parteka (2015, p. 64).

second very important area of socio-economic inequalities are inequalities of opportunities, within which one can indicate (Nawrot, 2017, p. 55): inequalities in the dimension of knowledge and education and access to it, inequalities in the dimension of health and access to healthcare, inequalities in access to financial services, inequalities in access to broadly understood public goods, inequalities in access to new technologies and innovations, inequalities of production possibilities resulting from the provision of production factors, inequalities in the choice of the form of living. Thus, socio-economic inequalities and development disproportions do not only refer to differences in the distribution of income, but also to access to education, health care, work, consumption opportunities, access to information, freedom, respect for human rights, approaches to urban and rural areas and to development in relation to gender. Differences in access to social opportunities, minimum wage or environmental conditions are also significant (Nawrot 2014: 104).

3.2.2. Institutional indicators

The UNDP reports on development emphasize the importance of the broadly understood factor of freedom, which has not been included in the current indicators quantifying the level of development due to methodological difficulties. The issue of freedom was only included in the Alternative Human Development Report on Arab countries, where a new methodology was proposed that took into account the scope of freedom in individual countries. The authors of the report explain this with the significant link between freedom and development, which is especially visible in countries where freedom is restricted and where wealth measured by *per capita* income does not always reflect the level of social and economic development.

The attempt to include the freedom aspect in the aggregated index was made by scientists from the Heritage Foundation (HF) and by a team of researchers from the Fraser Institute and Cato Institute with the support of Nobel Prize winners Milton Friedman, Garry Becker and Douglass North. The result of the research, and at the same time a functional expression of the quantification of economic freedom, were two alternative

indices, namely the index of economic freedom (IEF) formulated in 1995 by scientists from the Heritage Foundation (Heritage Foudation 2004; 2007) and the economic freedom of the world index – FWI (Gwartney & Lawson, 1997; 2002; 2003).

Freedom indices are also referred to in the literature on the subject as measures of the level of globalization, or as institutional measures of sustainable development (Kowalczewski, 2000, pp. 51–73; Piontek, 2002, pp. 97–105), since individual factors and variables are an expression of the development of a given country precisely at the institutional level. The undeniable importance of institutional development in the social and economic development of the state justifies the need to analyze this level and include it in the quantification of the level of economic development. Moreover, some factors and variables of the index of economic freedom are identical with factors of both endogenous and exogenous nature implying economic development. Indices of economic freedom, being a quantitative expression of the scope of economic freedom of a given country, may therefore constitute a measure contributing to the quantification of economic development, as well as serve to study the relationship between economic freedom and economic growth and development. Due to the analogy of indices, the Heritage Foundation index of economic freedom is presented later in this chapter.

The level of economic freedom measured by the HF index of economic freedom is determined on the basis of the analysis of independent economic variables that can be classified into the following categories, also known as economic freedoms:

- entrepreneurial freedom,
- trade freedom,
- monetary freedom,
- freedom from government,
- fiscal freedom,
- property rights,
- investment freedom,
- financial freedom,

- freedom from corruption,
- labor freedom.

Each of the ten freedoms can be assigned a weighting from 0 to 100. The number 100 indicates the state policy most favorable to economic freedom, and 0 – the policy least stimulating the development of economic freedom. Moreover, it is determined whether there has been an improvement/deterioration of individual freedoms. Based on the average of the weights of all the freedoms, the general level of economic freedom of countries is assessed (Heritage Foundation, 2004, pp. 49–70; 2007, pp. 37–53).

Five categories of economic freedom have been distinguished, classifying countries as:

- free,
- mostly free,
- moderately free,
- mostly unfree,
- repressed.

An index value in the range of 80–100 means that the country is economically free; 70–79.9 – mostly free; 60–69.9 – moderately free; 50–59.9 – mostly unfree; 49.9 and below – repressed.

Individual categories of freedom, being the basis for the calculation and assessment of the level of economic freedom of a given country, are of equal importance. Particular categories of freedom, being the basis for the calculation and assessment of the level of economic freedom of a given country, are of equal importance. The authors of the index are aware that the analyzed spheres of economic activity may have a varying impact on the scope of the exercised freedoms, however, they argue on the basis of the conducted research that assigning different weights to individual dimensions of the index would not have a significant impact on the measurement of the scope of economic freedom, and the chosen methodology allows for an adequate quantification (Heritage Foundation, 2004, pp. 39–42). Apart from the discussion on this subject, it should

be stated that there is no doubt that the country's long-term growth and development are conditioned by its proper functioning in all identified dimensions.

3.2.2. Ecological indicators

Initially, the side effects of economic development were not included in the account of the national income. Attention was paid to them together with an attempt to quantify their size and the development of the above-mentioned measure of net economic welfare (NEW). The increase in ecological awareness and the associated exposure of global threats resulting from environmental devastation, resulted in the more and more widespread use of ecological measures in assessing the development of economies.

One of the measures of welfare that corrects economic effects by the amount of environmental devastation is the Daly and Cobb ecological natural resources index, also known as the Index of Sustainable Economic Welfare (ISEW). It takes into account both the management of mineral resources and the so-called intergenerational social justice. The basis for the ISEW calculation is individual consumption weighted by the social inequality ratio. When calculating the ISEW, the following are taken into account:

- value of services from household work,
- value of services from consumer durable goods,
- value of services from roads and highways,
- consumption related to education and healthcare,
- increase in net capital,
- balance of investments abroad and foreign investments in the country,

reduced by:

- costs related to environmental pollution,
- consumption of non-renewable resources,

- expenditure related to health care and education,
- advertising expenditure,
- travel expenditure,
- urbanization costs,
- costs of road accidents,
- expenditure on durable consumer goods,
- costs related to the loss of natural resources and agricultural areas,
- losses related to long-term changes in the environment (greenhouse effect, ozone layer depletion).

When comparing GNP and ISEW, it was noticed that these indicators run in parallel in the early and peak stages of industrialization. In a later phase, the equality is distorted, the reasons for which are believed to be:

- contamination of the natural environment,
- unfair distribution of income,
- living in conditions of competition and full mobility.

Among the environmental indicators of development, it is also worth mentioning the EAW (Index of the Economic Aspects of Welfare), the OECD short-term indicators of environmental protection and the United Nations environmental indicators of sustainable development.

3.2.4. Sustainable development indicators

Nowadays, one of the most comprehensive indicators of development is the SDI (Sustainable Development Index), created by experts from The United Nations University. This measure covers the largest range of variables, both quantitative and qualitative, using and including databases from UNDP, the World Bank and The Freedom House. One can risk a statement that SDI is a synthetic expression of the most important dimensions of economic development and the cumulative value of the existing indicators (see Fig. 1).

The index calculation is based on a comprehensive analysis in seven dimensions:

- human rights, freedom and equality,
- demography and life expectancy,
- health and healthcare,
- education, technology and information,
- economic development and foreign debt,
- consumption of raw materials,
- the environment.

Within each of the dimensions, two factors were identified and assigned to the appropriate variables. Their number was determined by the nature of individual factors, and a total of fifty-eight variables were distinguished (see Table 3). From three to six variables were assigned to each factor. The aggregated value of the SDI index is calculated as the arithmetic mean of the indices of the selected variables. Their weights are the same. The authors of the index are aware that this is the main methodological problem that needs to be resolved. In addition, the indices are quantified for each dimension, which allows for comparability both between countries and within individual areas.

Table 3. Calculation of the Sustainable Development Index

1. Human rights, freedom and equality	
A. Political and human rights	B. Equality
A_1 – political rights index	B_1 – income distribution – Gini index
A_2 – civil rights index	B_2 – GDI
A_3 – refugees – country of origin	B_3 – number of working children
A_4 – military expenditure	
A_5 – armed forces	
A_6 – government commitments	
2. Demography and life expectancy	
C. Demographic issues	D. Life expectancy
C_1 – population growth	D_1 – infant mortality rate
C_2 – population decline	D_2 – mortality rate for children under five
C_3 – aging of the society	D_3 – maternal mortality rate
	D_4 – life expectancy

3. Health and healthcare

E. Healthcare	F. Diseases and food
E_1 – health care expenditure measured as a share of GDP E_2 – health care expenditure *per capita* E_3 – immunizing children E_4 – doctors E_5 – childbirth provided by qualified medical personnel	F_1 – tuberculosis F_2 – the presence of HIV F_3 – child malnutrition F_4 – insufficient daily caloric intake F_5 – excessive daily caloric intake F_6 – access to a safe source of water

4. Education, technology and information

G. Education	H. Technologies and access to information
G_1 – adult literacy rate G_2 – total enrollment index G_3 – public expenditure on education	H_1 – telephone lines

5. Economic development and foreign debt

I. Economics	K. Debt
I_1 – GNB *per capita* I_2 – PPP GNP *per capita* I_3 – annual GDP growth I_4 – net domestic savings	K_1 – total external debt K_2 – present value of the debt K_3 – total debt service

6. Consumption of raw materials

L. Economy – core savings	M. Economy – consumption of raw materials
L_1 – energy consumption L_2 – minerals consumption L_3 – net forest consumption L_4 – CO_2 damage/costs	M_1 – energy consumption per GDP unit M_2 – paper consumption M_3 – commercial energy consumption M_4 – electricity consumption

7. Natural environment

N. Natural environment – natural resources, land consumption	O. Natural environment – problems of rural and urban areas
N_1 – state protected areas N_2 – drinking water resources N_3 – forest area N_4 – areas for agricultural use	O_1 – population in agglomerations O_2 – population density in rural areas O_3 – growth of an agglomeration above 1 million O_4 – average annual deforestation

Source: own study based on (Nováček & Mederly, 2002, pp. 50–56).

The choice of seven dimensions for the calculation of the SDI index was dictated by the belief that the four dimensions of development identified so far, namely economic, social, institutional and environmental, are insufficient.

The SDI value is between 0 and 1, with a higher value representing better progress towards sustainable development. Human rights, freedom and equality were recognized as one of the most important dimensions of development, according to the argument that development would not be achievable either in the case of totalitarianism or a significant polarization in the distribution of income.

The disadvantage of the SDI is the lack of access to the most representative set of data in each of the surveyed countries and thus the optimal use of the achievable. Despite the existing weaknesses, SDI is a valuable basis for further research on a comprehensive measure of economic development.

The basis for the calculation of the SDI is presented in Table 3, and selected qualitative indicators are compiled in Table 4.

In research on the quantification of development, qualitative aspects are becoming more and more significant. It is important to illustrate the disproportions within a given country, between countries, and in terms of the entire society of the contemporary world economy. In the substantive dimension, this applies in particular to the differences in the distribution of income, but also in the access to education, health care, work, consumption opportunities, access to information, freedom, respecting human rights, in approach to urban and rural areas and in development in relation to gender. Differences in access to social opportunities, minimum wages, and environmental conditions are also important.

There are also differences in consciousness in different parts of the world, and as a consequence, consent to the existing social conditions, relations within a household or society, unconditional consent to treatment and acceptance of the existing opportunities for human development, or rather the lack of them. On the other hand, along with the development of information technologies, network society and a kind of information revolution, the awareness of differences among the poorest

Table 4. Calculation of selected qualitative indicators

Qualitative indicators	
Human Development Index (HDI)	HDI = life expectancy index$^{1/3}$ education index$^{1/3}$ GNP index$^{1/3}$
Gender Development Index (GDI)	GDI = equally distributed life expectancy index + equally distributed education index + equally distributed income index
Gender Empowerment Measure (GEM)	GEM = equally distributed index for parliamentary representation + equally distributed index for economic participation + equally distributed index for income
Gender Inequality Index (GII)	GII = 1 – equally distributed gender index
Human Poverty Index for developing countries (HPI-1)	HPI-1 = probability of life expectancy below 40 years + adult illiteracy rate + percentage of the population deprived of access to a safe source of water + percentage of underweight children for a given age group
Human Poverty Index for selected OECD countries (HPI-2)	HPI-2 = probability of life expectancy below 60 years + percentage of adults lacking functional literacy skills + percentage of population living below the poverty line + long-term unemployment rate
Multidimensional Poverty Index (MPI)	MPI = the product of the poor index and the poverty scale
Gini coefficient	$G = \dfrac{1}{2\mu n^2} \sum\limits_{i=1}^{n} \sum\limits_{j=1}^{n} \left\| x_i - x_j \right\|$
Index of Economic Freedom (IEF)	IEF = entrepreneurial freedom + trade freedom + monetary freedom + freedom from government + fiscal freedom + property rights + investment freedom + financial freedom + freedom from corruption + labor freedom
Sustainable Development Index (SDI)	SDI = human rights, freedom and equality + demography and life expectancy + health and healthcare + education, technology and information + economic development and foreign debt + consumption of raw materials + the environment

Source: own study.

classes is growing, which may cause social unrest and antagonism, and, consequently, lead to a social crisis on a global scale.

Important questions arise about the relationship between poverty, inequality and economic development and growth. A dilemma arises as to whether development comes down to reducing poverty, or if it should lead to reducing inequalities, and then whether the consequence of reducing poverty will be leveling development disproportions, as well as to what extent development differentiation becomes an obstacle to development and finally – how economic advancement affects development inequality.

Regardless of the emerging challenges, the diverse nature of developing countries indicates the need to undertake interdisciplinary and multidimensional research, taking into account, in addition to significant economic factors, also aspects of complex political, social and cultural ties, and even those bordering on anthropology or psychology. The diagnosis of the situation in developing countries cannot be limited to only one perspective, or only to the quantitative dimension.