



## **The Role of the State in Achieving Sustainable Development in Human Capital, Technology and Environmental Protection**

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### **1. Introduction**

The famous Burtland report of 1987 is considered to be the start of the sustainable development concept, but the concept itself was introduced much earlier in the nineteenth century by Hans Carl von Carlowitz, and related to forest management. Carlowitz formulated the postulate that forest management should be so conducted, that the same number of trees are planted as the number felled.

The concept of sustainable development was set up in response to the rapid degradation of the natural environment, the depletion of natural resources, and the growing inequalities between countries, and also the different groups within countries. Before the development of the sustainable development concept, individual areas of human activity were treated separately. Consequently, naturalists often reported the need for environmental protection at the expense of quality of human life, whilst proponents of social justice advocated economic development at the expense of the environment.

The concept of sustainable development seeks to integrate all areas of human activity by trying to strike a balance between the different activity areas. According to studies conducted by Pawłowski [31, 33–35] and Venkatesh [50], sustainable development has many dimensions. Undoubtedly, the so understood concept of sustainable development is the most holistic approach to the workings of civilisation.

The eminent sustainable development theorist Redclift [42] expressed the view that in the period 1987–2005, the development of the theory of sustainable development was simply a qualitative maturation expression of our civilization. Pawłowski [29, 30, 36] expressed the view that sustainable development paradigms differ to such an extent from the civilisation behavioural concept in previous epochs that he suggests the current period be included as a new revolution in the history of human civilization, namely the sustainable development revolution.

The problem is that the practical realisation of sustainable development faces a number of limitations inherent in the roots of the modern dominant socio-economic system of neoliberal capitalism which, by favouring the development of production at all cost, leads to the overexploitation of the earth's finite resources, excessive environmental degradation, and in recent decades, rapid growth of inequality, both between countries and between people within countries [16, 28, 49, 51].

These risks, as noted by Ikerd [14] and Rydzewski [45] are caused primarily by modern capitalism detaching itself from ethics and morality. Some researchers advocate that social sciences exhibit a greater interest in sustainable development issues [33–35, paying attention to the need to redefine the paradigms of the workings of societies towards the restoration of ethical and moral primacy in human relationships [14, 18, 19, 49]. The adoption of the GPB as an appropriate measure of a country's development is also questioned [7, 12, 49].

It is widely believed that the modern world is developing in an unsustainable way. Modern civilisation's ability to transform the world is virtually unbounded, to the extent that it can even lead to its own destruction [29]. All the more, the social sciences have not kept up with the almost exponential development of technology and techniques. Consequently, there is no universally accepted system of values, which leads to the fact that an enormous development of production effort, instead of eliminating poverty and inequality, creates increasingly larger exclusion groups [1, 3, 13]. The fact that raw material resources are increasingly being depleted intensifies the dangers even more [20, 30].

In recent years, much has been written about the greenhouse effect, but much less about the fact that non-renewable natural resources, especially fossil fuels, are rapidly running out, which is a far greater threat to the development of human civilisation than the greenhouse effect [21].

In their monograph S. Gawłowski, R. Listowska-Gawłowska, and T. Piecuch [5] also analyse the issue of the greenhouse effect, associated with the analysis of the depletion of energy reserves in relation to Polish energy security, where they discuss, not only the genesis of the greenhouse effect but also the quoted views of the European Union's experts and Polish scientists; members of three Polish Academy of Sciences Committees namely: the Mining and Geology Committee, the Geophysics Committee and the Environmental Engineering Committee.

The European Union experts are of the opinion that the main cause of global warming is industrialisation, in particular generally speaking, the raw materials, energy and chemical industries, as these industries release into the atmosphere the main greenhouse gases, which then create a barrier in the stratosphere, blocking and greatly obstructing the reflected solar radiation from the earth, from returning into space, which in effect raises the temperature on Earth, causing harmful consequences.

Therefore, the European Union ordered its affiliated countries to reduce greenhouse gas emissions, particularly and above all Poland, as energy in Poland is based mainly on fossil fuel, primarily coal, whilst simultaneously requiring Poland to build a further 11 new incinerators by 2015 which S. Gawłowski [5] amongst others, writes about.

Meanwhile, the view of the Polish scientists in the three Polish Academy of Sciences Committees is entirely different. They claim that the causes of the climate changes are primarily phenomena occurring in space, in particular solar activity and its derivatives, and finally plate tectonics, such as underwater earthquakes on the ocean floor, which cause the warm ocean water to mix with the seas from both the northern and southern hemispheres, which in turn causes glaciers to melt thus raising the sea level and climate changes.

Finally, the Polish scientists point out that the introduction of greenhouse gas emission restrictions does not make sense if this ban is to be confined only to European Union countries, and will not apply to other countries on other continents, especially to such countries where currently there is tremendous industrial growth like in China and India, or to economic giants such as the USA, Russia or Japan.

According to forecasts, at the current levels of consumption, there is enough oil for about 40–50 years, natural gas for about 60–70 years, and coal for about 140–150 years [30]. Equally alarming data is being

published on the availability of metals (Pawłowski 2011). According to these forecasts, there is enough copper for about 60–70 years, zinc for about 20–30 years, lead for about 50–60 years, mercury for about 40–50 years, and cadmium for about 30–40 years. Allowing for a large error in the above estimates, it can be assumed with a high probability, bordering on certainty that an acute raw materials crisis will occur within one generation of a human lifespan. It seems reasonable to state that the present generation is living at the expense of future generations [48].

These facts indicate that modern civilisation is developing in an unsustainable way, and achieving full sustainability is impossible. This does not mean that we should not take remedial action. The principle of minimalistic use of the Earth's non-renewable resources should be accepted. It is necessary to urgently implement the transformation into the ways societies function, both at global and local levels through recycling, reuse of waste, the search for new, less material-intensive technologies and minimising environmental pollution [28, 44, 51]. The open question remains how to do this?

In a world dominated by neoliberal capitalism, the dominant view is that the necessary regulations will be guaranteed by the free market with a minimum role played by the state. The observed rapid increase in the depletion of land resources and the degradation of social relations through the rapid growth of huge inequalities does not inspire optimism. It seems that it is again necessary to increase the state's role in controlling development [9, 11, 12, 17, 24, 27, 37].

From the above, it follows that the continuation of the current development model for our civilization faces barriers, primarily due to an increasing lack of natural resources and the progressive degradation of the environment. An increasingly common belief is that the leading paradigm of modern capitalism "grow or die" contributes to the growth in the supply of various goods, but at the same time it attracts a global crisis due to a lack of sufficient supplies of raw materials.

A transformation towards sustainable development appears to be a necessity if we, as humans, are to avoid disaster. In the modern world two concepts collide on how to carry out the necessary changes. Faith in the free market and competition dominate. According to proponents of this concept, there is sufficient innovative potential to enforce the necessary changes needed to prevent the lack of raw materials crisis.

However, we believe that it will be difficult to switch the way modern civilisation works to sustainable development without the state taking a leading role. The energy policies developed by selected countries (Brazil, France and the USA) after the energy crisis in 1973 will serve as evidence.

## **2. Transformation examples of energy provision**

In 1973, OPEC in response to the support provided by countries in the West, of Israel's war with Syria and Egypt (Yom Kippur War), placed an oil embargo on supplies to the United States, countries in the West, and Japan. In response to the shock caused by the embargo, a number of countries were forced to change their energy policy, placing a clear focus on increasing their energy independence.

### *Brazil*

Brazil decided to develop ethanol production as a substitute for petrol. Previous experiences probably had a deciding effect, since as far back as 1925 Brazil made use of ethanol, produced from sugar cane and maize, blended with petrol as a fuel for cars.

At the outbreak of the crisis, Brazil imported 80% of its crude oil. The decline in sugar price almost led to the bankruptcy of the developed sugar industry, based on sugar cane production.

It is worth mentioning that the so-called restructuring of the sugar industry in Poland also led to the collapse of sugar beet cultivation and sugar production, an important sector of the Polish economy, resulting in increased unemployment especially in small towns, and a significant rise in sugar prices.

In a crisis situation, the Brazilian government decided to focus on becoming independent of imported oil, improve the situation of the entire sugar industry and develop its own automotive industry. On 14<sup>th</sup> November 1975 the government launched the *National Alcohol Fuel Program*, consisting of three components:

- It was decreed that Petrobras, the state-owned enterprise should purchase a guaranteed amount of ethanol for biofuel production,
- Payments to the ethanol producing agricultural industry were introduced, by offering low-interest loans from Banco de Brasil,

- Through appropriate financial mechanisms, fuel prices were controlled in such a way as to ensure that ethanol prices did not exceed 59% of the price of petrol.

At the same time support was provided for the development of domestic car production, designed to burn ethanol, reducing registration fees for such cars, and guaranteeing preferential loans for their purchase. Consequently, the number of registered new cars increased from 1% in 1979 up to 96% in 1985. Although a sharp fall in oil prices in the late eighties, and a rise in sugar prices on the world markets caused a decline in interest in ethanol powered cars during the nineties, a renewed rise in the number of cars run on ethanol was perceived after 2002. Government intervention resulted in up to 96% of the cars being powered by an ethanol-petrol blend during the best period. Ultimately, this number stabilised at 56%.

In parallel with the development of the spirits and automobile industries, the government invested in research to improve the quality of the cultivated sugar cane. This resulted in an increase in ethanol production from 3900 litres/hectare in 1980 to 5600 litres/hectare in 2001. A wise state intervention not only led to a significant Brazilian independence from imported oil, but also to a whole new sector creating 700,000 new jobs. If we add to this a reduction in the consumption of non-renewable raw materials, such as crude oil along with the associated reduction in CO<sub>2</sub> emissions, it is easy to see that the transformation of the Brazilian fuel sector can be regarded as a good transformation example towards sustainable development. This was achieved with the state taking on a very active role.

### *France*

French energy in 1973 was based 70% on crude oil. Striving for energy independence, the French Government opted for the development of nuclear energy. Success would be impossible without the dominant role being played by the state. The state-owned *Electricite de France* played an important role as both the main generator and distributor of electricity.

Since nuclear power development encountered significant protests, legislation favouring nuclear power was introduced so as to prevent the blockade of nuclear reactor constructions, in effect preventing the stoppage of nuclear power station construction.

Since nuclear power, particularly in terms of investment, has been and is quite expensive, a team of scientists and engineers working for *Electricite de France*, with the financial support from the government developed a unified multi-reactor system, consisting of identical modules, which significantly reduced the costs. Consequently, 58 reactors were built during the period 1971-2001. Today, as much as 43% of the electricity generated in France is in nuclear power stations, increasing to a significant extent France's energy independence.

Central, government controlled planning, the unification of all the reactors and the integrated management of electricity production by a state-owned enterprise, led to such a significant reduction in costs, that the cost of producing electricity in France today is one of the lowest in the world, whilst the amount of energy generated, exceeds its own requirements to such an extent, that France is a major exporter of electricity (see Table 1).

**Table 1.** Electricity prices in selected countries for 2011

**Tabela 1.** Cena energii elektrycznej w wybranych krajach

Country	€/kWh	Country	€/kWh
Austria	€ 0.1213	Estonia	€ 0.0817
Belgium	€ 0.1182	Finland	€ 0.0784
Bulgaria	€ 0.0746	France	€ 0.0763
Cyprus	€ 0.1822	Germany	€ 0.1340
Czech Republic	€ 0.1195	Greece	€ 0.1188
Denmark	€ 0.1091	Hungary	€ 0.1194
Country	€/kWh	Country	€/kWh
Ireland	€ 0.1303	Portugal	€ 0.1064
Italy	€ 0.1565	Romania	€ 0.0925
Latvia	€ 0.1015	Slovakia	€ 0.1327
Lithuania	€ 0.1185	Slovenia	€ 0.1162
Luxembourg	€ 0.1180	Spain	€ 0.1271
Malta	€ 0.1927	Sweden	€ 0.0887
Netherlands	€ 0.1181	United Kingdom	€ 0.1149
Poland	€ 0.1142		

## *USA*

In the case of the United States, great importance was also placed on energy independence. The then president, Richard Nixon stated in 1973:

Let us set as our national goal, in the spirit of Apollo, with the determination of the Manhattan Project, that by the end of this decade we will have developed the potential to meet our own energy needs without depending on any foreign energy sources.

It identified three areas of action:

- Increasing its own fuels production by:
  - The development of renewable fuels,
  - Increasing fuel efficiency and energy savings,
  - The development of alternative technologies, including new technologies for fossil fuels.

It is true that the Federal Energy Administration was created, but the principal mechanism for achieving the goals above was market-based [23]. Consequently, large groups tried to compete, with their interests not always consistent with the overall objective. For example, a lobby by the maize producers led to the production of ethanol from maize, the least utilised raw material. Despite these actions, oil imports in the eighties, rose from 34.8% to 43.1% [4].

In fact, during this period, the production of self-sourced energy increased only from coal which was controversial, by barely 5%, nuclear energy and to a lesser extent from renewable sources, primarily geothermal.

In 2007, the United States government formulated a new program dependent on introducing a new generation of biofuels based on cellulosic ethanol production, assuming that in 2022 ethanol production from this source will reach 78 billion litres. Even if this program is successful, ethanol can replace at the most 13% of petrol consumption in the United States in 2022.

### **3. Ecological education and sustainable development**

As mentioned previously, environmental protection is one of the four fundamental parameters which determine sustainable development.

The current introduction of environmental protection issues into the curriculum at all levels is not only fashionable but is becoming really



needed by the hour, as written about in many works, including those by A. Hłobił (2011), and I. Piecuch and T. Piecuch [38-40].

With the introduction of environmental protection activities into schools at the lowest possible level (different from the ones currently run in accordance with the nature syllabus), the teaching of this subject cannot be separated from promoting the principles of sustainable development.

Within the activity framework of the new subject on environmental protection, introduced systematically as early as possible into schools within the framework of the so called ecological education, the teaching of sustainable development should be skilfully woven into the curriculum, which is inextricably linked with environmental protection.

From an early age, a child and then an adult has to realise that, apart from the fact that on the one hand the environment needs to be permanently and very effectively protected, but on the other it should not be so excessively protected that sustainable development is completely blocked, including for example technological development, i.e. economic development, thus introducing a specific uneven development of society and more widely, civilisation. This depends on good, modern education of a future adult citizen who will be accustomed to protecting the environment in which he lives, with a simultaneous lifelong memory that the protection of the environment must be integrated into sustainable development.

The unusual importance of the issue raised here was highlighted at the scientific conference entitled “The Perspectives and Tasks of Ecological Education in the 21st Century” at the University of Częstochowa in June 2002, organised by its Scientific-Educational Centre and the Institute of Environmental Engineering.

The works of Gumnitsky [8], Puchała [41] and Szaniawska [47] into this issue are particularly noteworthy as attention is drawn to the integrated education of sustainable development.

In this article the authors’ opinion on the correlated problem of environmental protection and sustainable development of societies, is that in order for it to achieve the desirable results it should be disseminated in widely understood schooling, if possible in all the countries of our globe, starting with the highly industrialised countries, amongst which China deserves special attention.

It is the opinion of many specialists and various world ecological organisations that it is the dynamically developing Chinese economy which does not fulfil, in a specific way, the conditions of dynamic development and it is in this aspect that the technological development parameter dominates over the environmental protection parameter, despite the fact that in the most recent period there has been a minimal, albeit perceptible improvement in this regard.

That is why the Chinese Prime Minister's visit, with a large delegation of representatives from Chinese industry, to the Polish Prime Minister on 26<sup>th</sup>–27<sup>th</sup> April 2012 in Warsaw deserves special attention, as the issue treated in this article, was also raised during the bilateral talks.

#### **4. Summary**

Change analysts in the energy sector [10, 25, 46] believe that the United States has not yet achieved its objectives in the transition to energy independence. By analysing the above three examples, which prove that without state intervention it is impossible to achieve a profound transformation since new innovative global solutions demand in the initial period state support, ranging from financial support initially (for research, development of new industries) and ending in specific support through regulation.

In recent years, a U.S. success was the discovery and mastery of shale gas, whose resources are so large that they satisfy 20% of U.S. needs today, and in future could satisfy U.S. needs up to 40%. However, the actual discovery and exploitation of shale gas was not caused by a government program.

The above examples seem to indicate that the transfer of sustainable development to society cannot be carried out without state involvement on many levels. Such a society requires a change in people's mentality, which requires appropriate education supported by legislation. In parallel, it is necessary to develop new technologies, targeted not only at profits, but also to achieve social and pro-environmental objectives. It is impossible to achieve these goals in a social system, in which the only recognised development criterion is profit at any cost and absolute competition of everyone against everyone.

It is worth referring to the situation in Poland. The changes observed in recent years do not inspire optimism. Poland has a huge amount of good quality coal. One would expect the government to create a re-

search program aimed at a more ecological use of this fuel. Meanwhile, instead of establishing a long-term strategy for the use of coal, an unthought through restriction on mining activities ensued, leading to many job losses, which in turn resulted in Poland becoming an importer of coal. The changes observed in the energy sector point to the lack of a national, long-term state co-ordinated energy security strategy in Poland. Instead of such a strategy, free market and competition was encouraged, dividing energy companies in an unthought of way, which according to the doctrinal foundation, should within the competition framework, lead to a stable energy supply. Lessons were not learnt from the experiences of France, Brazil and the USA. Full use is not made of Poland's scientific potential and renowned institutes throughout the world, namely: Główny Instytut Górnictwa (The Central Mining Institute), Instytut Gospodarki Surowcami Mineralnymi i Energią (Mineral and Energy Economy Research Institute) and Instytut Mechaniki Górotworu (The Strata Mechanics Research Institute). The discovery of huge deposits of shale gas in Poland could significantly improve the energy supply in Poland. The problem is that the energy security of every country requires complex solutions, harmonising the energy supply with the sourcing of primary energy, and ending with the generation of electricity [22, 26].

Leaving this matter, key to the running of each country, to be regulated by the markets' invisible hand is highly risky, because the markets for which profit is the dominant factor, may lead to a situation where the most profitable areas of activity are removed, like raisins from a cake, leaving the whole energy market like a cake with the raisins missing and holes in many places.

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## **Rola państwa w osiągnięciu zrównoważonego rozwoju w kapitale ludzkim, technologii i ochronie środowiska**

### **Streszczenie**

W artykule przedstawiono podstawowe paradygmaty zrównoważonego rozwoju, zwracając szczególną uwagę na wyczerpywanie zasobów nieodnawialnych, w tym nośników energii. Na zakończenie tej części artykułu, stwierdzono, że konieczne są głębokie zmiany w rozwoju cywilizacji w kierunku równowagi. Analizując politykę energetyczną Brazylii, Francji i USA, po kryzysie energetycznym z roku 1973, zauważono, że skoordynowana polityka krajowa w przypadku Brazylii i Francji, doprowadziła do osiągnięcia wyznaczonych celów. Natomiast Stanom Zjednoczonym nie udało się osiągnąć swoich celów, opierając się wyłącznie na mechanizmach rynkowych. Powodem tego było to, że poważne zmiany wymagają znacznych nakładów w fazie początkowej zarówno na badania i przynajmniej w pierwszej fazie na komercjalizację. Ponadto, jak pokazuje przykład Francji, utworzenie przedsiębiorstwa państwowego doprowadziło do ujednoczenia budowy reaktorów jądrowych, co znacznie ograniczyło koszty kapitałowe. W rezultacie we Francji wytwarzana jest najtańsza energia elektryczna.

Przestawienie cywilizacji w kierunku zrównoważonego rozwoju jest jeszcze bardziej złożonym przedsięwzięciem, ponieważ obejmuje również aspekty społeczne, które nie mogą być wewnętrznie regulowane przez mechanizmy rynkowe. Dlatego, według autorów, nie jest możliwe, wprowadzanie zrównoważonego rozwoju bez wiodącej roli państwa.