



Historical perspectives of material use in Czechoslovakia in 1855–2007

Jan Kovanda*, Tomas Hak

Charles University Environment Center, J. Martiho 2/407, 162 00 Prague 6, Czech Republic

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ABSTRACT

The article deals with the historical development of material use in the Bohemia and Moravia-Silesia/Czechoslovakia in 1855–2007. We calculate domestic material consumption (DMC), an indicator based on the concept of socio-economic metabolism and economy-wide material flow analysis, and relate it to various socio-economic factors such as changes in political regimes, industrialization and consequent growth in GDP and population. DMC is good at reflecting the gradual industrialization which took place up to the First World War, then the strong focus on the development of heavy industry under communist rule, and finally the swing to a more consumer industry and service-oriented economy after the fall of the communist regime and the subsequent transition from a centrally planned to a market economy. The comparable DMC figures per capita for Czechoslovakia and the United Kingdom prove that we arrived at feasible values of material consumption.

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1. Introduction

Material flow analysis presents a well-established approach to study interactions between societies and their natural environment. It is based on the theory of socio-economic, societal or industrial metabolism (Ayres, 1989, 2004; Baccini and Brunner, 1991; Fischer-Kowalski and Haberl, 1993; Ayres and Simonis, 1994), which assumes a socio-economic system is interconnected with the environment through material and energy flows. It is said that these flows are behind the majority of environmental problems people have to face today, such as structural landscape changes related to mining of fossil fuels and extraction of other raw materials, biodiversity loss related to production of biomass in large-scale agro-ecosystems, global climate change and acidification related to consumption of fossil fuels, and eutrophication related to use of mineral fertilizers (Schmidt-Bleek, 1994; Giljum et al., 2005; Van der Voet et al., 2009). It is important to monitor these material and energy flows and strive to reduce them, as this reduction should lead to a decrease in pressures exerted on the environment by human society. It is further useful to analyze these flows in relation to economic and social development in an historical perspective, as it supports the understanding of current patterns and dynamics of material flows and related environmental problems (Martinez-

Alier and Schandl, 2002; Hornborg et al., 2007; Costanza et al., 2007; Moore et al., 2010). Insights from this analysis can be applied in scenarios and models aimed at future trends in resource use and providing ex-ante assessments of the environmental and economic effects of different resource policies. This issue was addressed by Giljum et al. (2008), for instance.

Even though there is a growing body of literature on current patterns, structure and the dynamics of the socioeconomic use of materials and energy (for instance Adriaanse et al., 1997; Mündl et al., 1999; Matthews et al., 2000; Mäenpää and Juutinen, 2001; Pedersen, 2002; Barbiero et al., 2003; Bringezu et al., 2004; Giljum, 2004; Weisz et al., 2006, 2007a; Xu and Zhang, 2008), the historical aspect of this phenomenon covering the 19th century and the first half of the 20th century has so far been addressed only rarely (Schandl and Schulz, 2002; Krausmann and Haberl, 2002; Gales et al., 2007; Cusso et al., 2006; Kuskova et al., 2008; Krausmann et al., 2009). The author's other recent articles were focused on the period 1990 onwards (Kovanda et al., 2008, 2010). The primary goal of this paper is to provide an historical perspective of material consumption in Bohemia and Moravia-Silesia/Czechoslovakia and to relate it to the main socio-economic changes in society which have taken place in history in 1855–2007. The rest of the article is structured as follows: Section 2 provides information on methods and data used for the analysis, Section 3 presents and discusses the main findings and Section 4 suggests in conclusion some topics for further work in the field of historical analyses of socio-economic metabolism.

* Corresponding author. Tel.: +420 220 199 476; fax: +420 220 199 462.
E-mail address: jan.kovanda@czp.cuni.cz (J. Kovanda).

Table 1
Summary of data sources used for the analysis including an estimate of the level of reliability.

Material category	Particular material flows
Biomass APT	Cereals, roots and tubers, fodder plants, other agricultural biomass, by-products from harvesting, grazing from meadows and pastures, wood, products from biomass (including fishery products)
Fossil fuels APT	Brown coal, hard coal, crude oil, natural gas and products from fossil fuels
Metal ores APT	Iron ore, non-ferrous ores, pig iron, steel and other products from metals
Construction non-metallic minerals APT	Limestone for cement production, sand and gravel for concrete and asphalt production, other non-metallic construction minerals
Industrial non-metallic minerals APT	Limestone for industrial processes, magnesite, dolomite, industrial sands, kaolin, feldspar, fluorspar, gypsum and anhydrite, salt, natural and artificial fertilizers, glass, pottery

2. Methods and data

Material flows in Czechoslovakia have been approached from an economy-wide perspective. We carried out the economy-wide material flow analysis (EW-MFA), which was first standardized in the Eurostat methodological guide (Eurostat, 2001) and further elaborated in the Eurostat compilation guide (Weisz et al., 2007b) and within the OECD work program on material flows (OECD, 2008). The aim of the EW-MFA is to quantify the physical exchange between a national economy, the environment and foreign economies on the basis of the total material mass flowing across the boundaries of the national economy. The ultimate goal of the analysis is to get a material balance, i.e., the state when material inputs into the economy equal material outputs summed with additions to the physical stock of the economy (e.g., traffic infrastructure, buildings and durable goods). The analysis focuses on solid materials and typically excludes water and air (Eurostat, 2001; Schandl et al., 1999).

For the period 1855–2007, we compiled selected material flow indicators as defined in the above methodological standards. First, we calculated domestic extraction used (DE), which includes all domestically extracted raw materials, such as fossil fuels, metal ores, non-metallic minerals, and harvested biomass. Second, we calculated the physical trade balance (PTB), which is calculated as physical imports minus physical exports. Third, we calculated domestic material consumption (DMC), which is the sum of DE and PTB. Although DE only comprises raw material and biomass, physical imports and exports contain all stages of products, from raw materials to semi-finished and final products. For ease of presentation of the results of the analysis, all materials have been aggregated into five broader material categories: fossil fuels and products thereof, biomass and products thereof, metal ores and products thereof, non-metallic construction minerals and products thereof, and industrial non-metallic minerals and products thereof. The detailed composition of these broader material categories is

shown in Table 1. The “and products thereof” is further in the text abbreviated as “APT”.

For 1855–1913, the indicators have been compiled for the lands of Bohemia and Moravia-Silesia, which were parts of the Austro-Hungarian monarchy. For present-day Slovakia, which was part of the Hungarian kingdom at that time, very sparse aggregate data were available for this period. In 1918, Slovakia and a small part of present-day Ukraine (Ruthenia) joined Bohemia and Moravia-Silesia and formed the Czechoslovak Republic. In 1938, Bohemia and Moravia-Silesia were occupied by Nazi-Germany and formed the Bohemian and Moravia-Silesian Protectorate, while Slovakia became an independent state. After the Second World War, Czechoslovakia was reconstituted (now without Ruthenia) and lasted till 1992. In 1993, Czechoslovakia split into the Czech Republic (former Bohemia and Moravia-Silesia) and Slovak Republic. For 1918–1992, indicators have been compiled for the whole of Czechoslovakia. From 1993, the indicators cover both the Czech Republic and the Slovak Republic. Since the foundation of Czechoslovakia in 1918 until its split in 1993, various forms of government and state systems were in place in this country (for a detailed summary see Kuskova et al. (2008)). For the sake of simplicity, we call the country Czechoslovakia for this entire period, although the official name changed from time to time. Fig. 1 shows a map of Czechoslovakia 1918–1938 broken down into its constituent parts, which indicates the territorial expanse of the country throughout the monitored period.

The study based the time series of indicators on official data records (both national and international) as much as possible. A great source of inspiration for our work was the study of Kuskova et al. (2008), which compiled time series for biomass and fossil fuels for Bohemia and Moravia-Silesia/Czechoslovakia for 1830–2002. We adopted these time series, but revised the data for 1990–2002, which seemed to be somewhat underestimated compared to the official EW-MFA of the Czech and Slovak Republics (Czech Statistical Office, 2006a, 2008; Kovanda et al., 2008, 2010;



Fig. 1. Czechoslovakia (1918–1938).

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