

Relationship between Material Consumption and Socioeconomic drivers. IPAT Model. Case Study in Central Asia - Uzbekistan (1992-2011)

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1. Introduction

This article presents the socio-metabolic transition of the Republic of Uzbekistan through analysis of entire economy material flow accounts by a range of categories and sub categories for the period 1992-2011. Disaggregated Economy Wide-Material Flow Analysis EW-MFA indicators: Domestic Extraction DE, Imports IMP, Exports EXP, Domestic Material Consumption DMC and Physical Trade Balance PTB have been compiled for assessment Uzbekistan and other international economies. This study purpose is to identify the drivers of national material use patterns and to assess the progress of dematerialization and resource sustainability. To undertake analysis the relationships between economic growth, resource use and environment we employed IPAT model in Uzbekistan and held comparative analysis with international economies for the period of 1991-2008 due to the lack of comparable data sets.

2. Methodology and Data Sources

EW-MFAs are consistent compilations of the overall material inputs into national economies, the changes of material stock within the economic system and the material outputs to other economies or to the environment. In the EW-MFA framework, materials are tracked from the extraction of national resources to the stocks and accumulation within the economy, and finally to the waste and emissions dispensed into the environment (Xu and Zhang, 2007). For data collection of each material flows we used the official national statistics where possible, in some cases international sources were applied. It should be noted that in all calculation we used physical unit in million tons (Mt).

3. IPAT Model

To undertake further analysis of the quantitative relationship of population, economic growth and technological change, empirical analysis has been undertaken using the IPAT model (Ehrlich and Holdren 1997). The IPAT model being: environmental impact (I) with population (P), affluence (A) and technology (T). This allows us to study the relationships between economic growth, resources and environment. The equations can be described as:

$$DMC(I) = Population(P) \times GDP/Population(A) \times DMC/GDP(T) \quad (1)$$

4. Research Area

Uzbekistan is the third largest of the five post-communist countries in Central Asia. Since independence 1991 the government policy model was based on an incremental transformation of the economy. Since the early stage of transition, the country achieved a positive economic growth rate. In the new millennium, the average economic growth rate purchasing-power-parity GDP (PPP) has exceeded 9% annually The 1992–2011 period is relevant to this research because it represents the transition of the economy in Uzbekistan.

5. Findings

Between 1992 and 2011, in Uzbekistan, DMC increased from 216 to 343 Mt, with an average annual growth rate of 2.63%. In relation to the population, DMC per capita had an insignificant change and maintained a stable trend of 10 t/cap average (Figure 1). The similarity of overall DMC could be seen in Uzbekistan and Turkmenistan with an

average of 10 tonnes per capita. However, development of DMC components differs between the two countries during the period of study. One third of Uzbekistan DMC per capita is composed of biomass (33%) while Turkmenistan showed a 55% average share of DMC biomass during the 1992-2008 period. Fossil fuels accounted for one fifth (20%) in Uzbekistan total DMC, while it shows one third of (30%) for Turkmenistan in a same period. Additionally, the overall decline of DMC of fossil fuels per capita and shift of economic structure to less material intensive-toward services in Czech Republic, Kazakhstan, UK and Uzbekistan economies showed significant decrease of CO₂ emissions in 1992-2008.

6. Discussion

There was a weak dematerialization in Uzbekistan, which was indicated by the decline of material intensity from 7.86 to 3.97 tons per US dollar in 1992-2008. However, the material intensity of Uzbekistan was approximately two times higher than Kazakhstan and Turkmenistan, five times higher than the Czech Republic and the UK, respectively, during the period of study (Figure 2). In the Czech Republic, Kazakhstan and the UK material intensity continuously decreased while the GDP of these countries continuously increased during same period. This trend indicates absolute decoupling of these economies. The means of absolute decoupling is that the growth rate of resource use is declining while the growth rate of the economy continuously increased (UNDP 2011). For Uzbekistan and Turkmenistan growth of DMC was slower than economic growth of GDP, which indicated relative decoupling during the entire period.

7. Conclusion

Economic development and increase of industrial base in Uzbekistan grows resource consumption that consequently processed as waste and pollution to the environment. For that reason, in Uzbekistan serious actions and national regulation has to be taken on the concept of sustainable consumption and production places emphasis on the sustainable and effective management of resources throughout the value chains of goods and services. It encourages process developments that utilize fewer resources and reduce waste; including hazardous substances, while offering environmental benefits and frequent productivity and economic gains.

8. Reference

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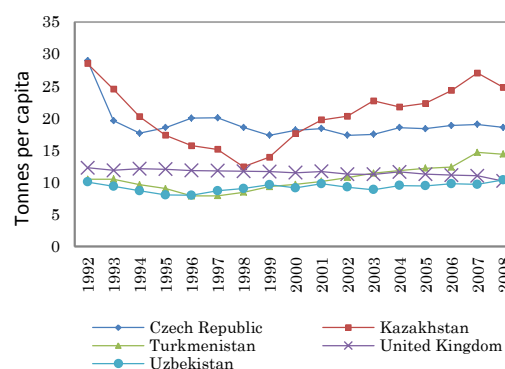


Figure 1. Domestic Material Consumption, international comparison (1992-2008).

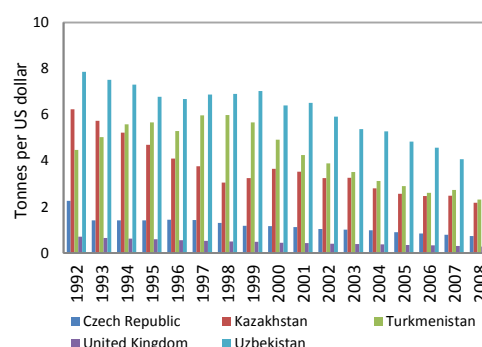


Figure 2. Material intensity DMC per GDP, international comparison (1992-2008).