Industrial Development and Green Transformation A Firm-level Study on Turkish Manufacturing

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UNCTAD • Ankara, 29-30 January 2025

Challenges for Turkey

- Digital transformation
- Restruction in the world economy
- Equitable income distribution
- Climate crisis
 - Green transformation and decarbonization
 - $\circ~$ Ratification of the Paris Agreement in 2021: net zero emissions by 2053
 - EU Carbon Border Adjustment Mechanism (CBAM)

Green transformation in Turkish manufacturing

Why manufacturing?

- Hub for the creation and diffusion of new (including green) technologies
- Main energy consumer and source of CO2/greenhouse gases emissions
- Produces most of the (manufactured) exports and determines how the Turkish economy is integrated into the global economy
- Major source of (good/decent) jobs and enables other sectors to create good/decent jobs

Data sources

- Entrepreneur Information System, 2016-2021
 - Balance sheets and income statements
 - Foreign trade statistics
 - Buyer-supplier transactions
- Energy consumption and CO2 emissions at the firm level
 - Scope 1: Direct
 - Fuel combustion
 - Industrial processes and product use (IPPU)
 - Scope 2: Indirect (electricity consumption)

CO2 emissions in Turkey

- 2000-2022 average annual growth rates of
 - GDP 4.9%
 - Manufacturing 5.5%
 - CO2 3.0% (from 232 to 441 mt)
- CO2 emissions by source (2022)
 - 87% fuel combustion
 - 35% energy industries
 - $\circ~15\%$ manufacturing and construction
 - 20% transportation
 - 16% other sectors
 - 13% IPPU

- CO2 emissions by sector (2022)
 - 33% manufacturing
 - 31% electricity and gas
 - 5% transportation
 - 8% all other sectors
 - 23% households

Dirty sectors in manufacturing, 2021

NACE	Sector	CO2 emissions in 2021 (million tons)			
code		Fuel	Electricity	IPPU	Total
1081	Manufacture of sugar	2.1	0.1	0.0	2.2
1310	Preparation and spinning of textile fibres	0.6	1.7	0.0	2.4
1320	Weaving of textiles	1.0	1.1	0.0	2.1
1330	Finishing of textiles	1.4	0.6	0.0	2.0
1712	Manufacture of paper and paperboard	1.3	0.7	0.0	2.0
1920	Petroleum refineries	10.3	0.1	0.0	10.4
2016	Manufacture of plastics in primary forms	2.4	0.2	0.0	2.6
2331	Manufacture of ceramic tiles and flags	2.4	0.4	1.4	4.3
2332	Manufacture of bricks, tiles and construction products	0.7	0.2	0.3	1.2
2351	Manufacture of cement	13.5	3.9	44.2	61.7
2352	Manufacture of lime and plaster	0.7	0.2	2.8	3.6
2363	Manufacture of ready	1.7	0.4	0.0	2.0
2410	Manufacture of basic iron and steel and of ferro-alloys	30.2	6.4	11.9	48.4

Energy intensity in manufacturing



CO2 intensity in manufacturing



Energy intensity in clean and dirty sectors



CO2 intensity in clean and dirty sectors



Determinants of the decline in CO2 intensity

- Use of electricity
 - Use of renewable resources
- Energy efficiency
- Changes in sectoral composition
- Changes in within industry

Decomposition analysis, 2007-2001

- CO2 intensity: 0.31 → 0.18 kg/TL (-0.13 kg/TL)
- Eenergy intensity: $0.215 \rightarrow 0.126$ TL/TL (-0.095 TL/TL)

How?

- Within effect
- Between effect
 - Inter-industry
 - Intra-industry
- Entry-exit

Decomposition analysis, 2007-2021

	CO2 intensity				Energy intensity		
	Total	Fuel E	Electricity	IPPU	Total	Fuel	Electricity
Change (kg/TL or TL/TL)	-0.133	-0.058	-0.049	-0.025	-0.095	-0.057	-0.038
Contributions (%)							
Within	-24.0	-41.8	37.1	-101.8	-32.5	-118.4	20.7
Between	111.0	132.4	54.3	171.6	152.6	208.6	69.1
Inter-industry	83.1	81.0	27.2	196.8	65.4	87.5	32.3
Intra-industry	27.8	51.4	27.2	-25.2	87.2	121.1	36.8
Entry-exit	13.1	9.4	8.5	30.3	10.0	9.8	10.2

CO2 intensity: CO2 emissions/value added (2021 prices, kg/TL)

Energy intensity: Expenditures on energy/value added (2021 prices, TL/TL)

Policies

- Energy efficiency
 - Energy Efficiency Law No 5627 (2007)
- Energy dependence
 - Domestic coal
 - Renewable sources (solar and wind and nuclear)
- Construction sector development
- Energy technologies
- Carbon taxes emission trading system (ETS)

Environmental policy stringency index, 2020



Primary energy sources and domestic coal



Electricity generation by energy source



Construction sector development

GDP Manufacturing Construction



Public energy technology R&D expenditures in GDP, 2022



Source: IEA, Energy Technology RD&D Budgets

Future

- Decarbonization of power generation
 - Phasing out coal
- Development and use of clean/green/digital technologies
- Structural change
 - Energy efficiency sectors/activities
 - New and traditional materials
 - Green products and technologies

Thanks for listening...