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A detailed map of GHG related activity data in Poland, ready for use in Work Package 1. Deliverable 3.1

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Geoinformation technologies, spatio-temporal approaches, and full carbon account for improving accuracy of GHG inventories

Deliverable 3.1. A detailed map of GHG related activity data in Poland, ready for use in Work Package 1

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Work package 3. Improving accuracy of inventories by means of spatio-temporal statistical methods

Deliverable 3.1. A detailed map of GHG related activity data in Poland, ready for use in Work Package 1

Content

1. **Maps of population density and GDP density for Poland**
2. **Maps of activity data for Energy sector: stationary sources**
3. **Maps of activity data for Energy sector: mobile sources**
4. **Maps of activity data for Industry and Agriculture**

List of figures

Figure 1.1. Relative change of population in Poland, 2000-2009

Figure 1.2. Population density of Poland, 2009

Figure 1.3. GDP per capita in Poland, 2009 (PLN/person, current prices)

Figure 1.4. GDP in Poland, 2009 (PLN/km2, current prices)

Figure 1.5. Relative GVA generated in industry (sectors B,C,D,E)

Figure 1.6. GDP generated in agriculture, forestry and fishing in Poland (Section A) (PLN/km^2, current prices)

Figure 1.7. GDP generated in industry in Poland (Sections B,C,D,E) (PLN/km^2, current prices)

Figure 1.8. GDP generated in industry excluding manufacturing in Poland, (Sections B,D,E) (PLN/km^2, current prices)

Figure 1.9. GDP generated in manufacturing in Poland, (Section C) (PLN/km^2, current prices)

Figure 1.10. GDP generated in construction in Poland (Section F) (PLN/km^2, current prices)

Figure 2.1. Coal and natural gas consumption for Electricity and Heat Production in voivodeships

Figure 2.2. Localization of heat/power plants

Figure 2.3. Population using gas system (% of total population, Poland)

Figure 2.4. Dwelling fitted with central heating (% of total living area, Poland)

Figure 2.5. Disaggregated data on coal consumption in residential sector (kg/km^2, Poland)

Figure 2.6. Disaggregated data on liquefied gas consumption in residential sector (10^3 ton/km^2, Poland)

Figure 2.7. Disaggregated data on natural gas consumption in residential sector (TJ/km^2, Poland)

Figure 3.1. Gasoline consumption by passenger cars (municipalities of Poland, 10^3 tons)

Figure 3.2. Diesel consumption by passenger cars (municipalities of Poland, 10^3 tons)

Figure 3.3. LPG consumption by passenger cars (municipalities of Poland, 10^3 tons)

Figure 3.4. Gasoline consumption by buses (municipalities of Poland, 10^3 tons)

Figure 3.5. Diesel consumption by buses (municipalities of Poland, 10^3 tons)

Figure 3.6. LPG consumption by buses (municipalities of Poland, 10^3 tons)

Figure 3.7. Gasoline consumption by lorries (municipalities of Poland, 10^3 tons)

Figure 3.8. Diesel consumption by lorries (municipalities of Poland, 10^3 tons)

Figure 3.9. Gasoline consumption by special vehicles and tractors (municipalities of Poland, 10^3 tons)

Figure 3.10. Diesel consumption by special vehicles and tractors (municipalities of Poland, 10^3 tons)

Figure 3.11. Automobile roads' capacity (Poland)

Figure 3.12. Spatial distribution of population (municipalities of Poland)

Figure 4.1. Cement plants' capacities (Gg)

Figure 4.2. Glass plants' capacities (Gg)

Figure 4.3. Fragment of geodatabase with data on population of livestock owned by individual farms in Poland

Figure 4.4. Population of cattle (dairy) owned by individual farms in Poland

Figure 4.5. Population of cattle (non-dairy) owned by individual farms of Poland

Figure 4.6. Population of swine owned by individual farms of Poland

Figure 4.7. Population of poultry owned by individual farms in Poland

Figure 4.8. Population of horses owned by individual farms in Poland

Figure 4.9. Population of sheep owned by individual farms in Poland

Figure4.10. Population of goats owned by individual farms in Poland

Figure 4.11. Evergreen coniferous forest of Poland

Figure 4.12. Broadleaf forest of Poland

Figure 4.13. Mixed forest of Poland

List of tables

Table 2.1. Fossil fuel used by power/heat stations of Polish voivodeships

Table 2.2. Information on power / heat stations

Table 2.3. Consumption of fossil fuels in residental sector of Poland

Table 3.1. Road motor vehicles by age groups (in %)

Table 3.2. Fuel consumption for transport needs

Table 3.3. Fuel consumption by transport categories

Table 3.4. Road motor vehicles in total

Table 3.5. Vehicle miles travelled

Table 3.6. Road motor vehicles by fuel type in total
Table 3.7. Fuel use for transport needs and in agriculture
Table 3.8. Road vehicles and tractors, in total
Table 4.1. Statistical data on Cement Industry in January, 2010
Table 4.2. Statistical data on Cement Industry in February, 2010
Table 4.3. Statistical data on Cement Industry in March, 2010
Table 4.4. Statistical data on Cement Industry in April, 2010
Table 4.5. Statistical data on Cement Industry in May, 2010
Table 4.6. Statistical data on Cement Industry in June, 2010
Table 4.7. Statistical data on Cement Industry in July, 2010
Table 4.8. Statistical data on Cement Industry in August, 2010
Table 4.9. Statistical data on Cement Industry in September, 2010
Table 4.10. Statistical data on Cement Industry in October, 2010
Table 4.11. Statistical data on Cement Industry in November, 2010
Table 4.12. Statistical data on Cement Industry in December, 2010
Table 4.13. Livestock population of Polish voivodeships, 2010

1. Maps of population density and GDP density for Poland

A map of population density is a key data for estimation of spatial distribution of GHG emissions in a number of sectors (e.g., residential sector) as well as for producing a map of GDP.

The GDP map can serve a proxy for estimation of spatial distribution of GHG emissions in some sectors, e.g., Industrial Processes. While using the GDP map for such purposes one should also look at GDP structure to determine the share of GDP produced in respective economy sector and try to locate respective production zones, e.g. industrial zones where the emissions are generated (e.g., combining the GDP map with maps of land cover and inhabited places).

The spatial GHG inventory is produced on 2x2 km grid starting from the year 2009 therefore we prepare the maps of respective resolution using 2009 statistical data.

Map of population density

A map of population density for the EU+Croatia with spatial resolution 100x100 m and 2000-2001 census data (raster; Galelo, 2010) and a map of population of Poland for small administrative units (municipality – in Polish *gmina*) for the years 1999-2009 (vector; IMAGIS, 2012) are used (*Figure 1.1*).

The territory of Poland has been clipped from the original population density map, and then the map obtained had been aggregated to the 2x2 km grid.

A new column with relative change of population density in 2000-2009 has been added to the attribute table of the IMAGIS map. Then the map was converted to 2x2 km raster snapped to the population density map, and the projection was set up similarly to the population density map (see Annex).

Having those operations done the population density of 2000 in each grid cell (high resolution) was multiplied by the relative change of population in municipality. The map obtained shows the number of persons per km^2 (*Figure 1.2.*)

Map of GDP density

The map of GDP density was produced by multiplication of GDP per capita (current prices) in administrative regions of Poland for the year 2009 (GUS, 2012) and for population density (similar method used by Sachs et al. (2001), Gaffin et al. (2004)). The statistical data were put on the map (IMAGIS, 2012) using the appropriate codes of sub-regions (*podregiony*). The map was converted to 2x2 km raster snapped to the population density map (*Figure 1.3*), and the projection was set up to be similar to the population density map (see Annex).

Then in each grid cell the GDP was multiplied by the population density. The map shows GDP density in Zl/km^2 for 2009 (Zl = Zloty = PLN) (*Figure 1.4.*).

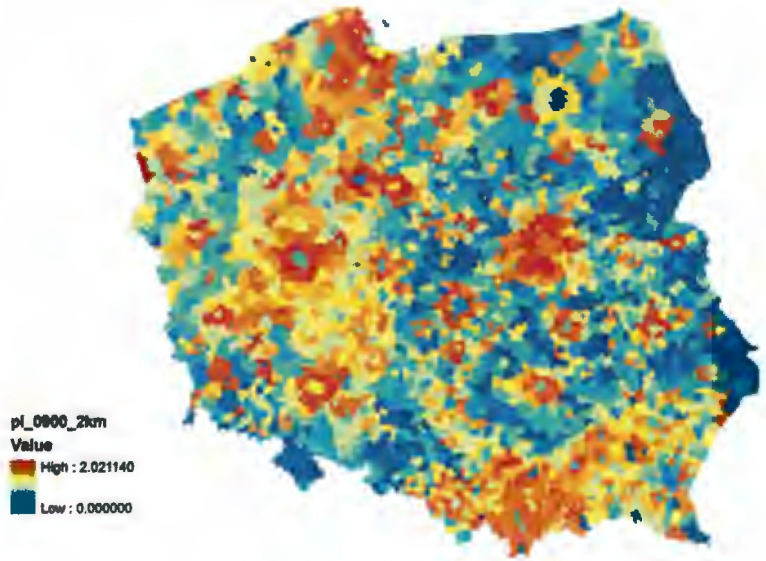

Figure 1.1. Relative change of population in Poland in 2000-2009

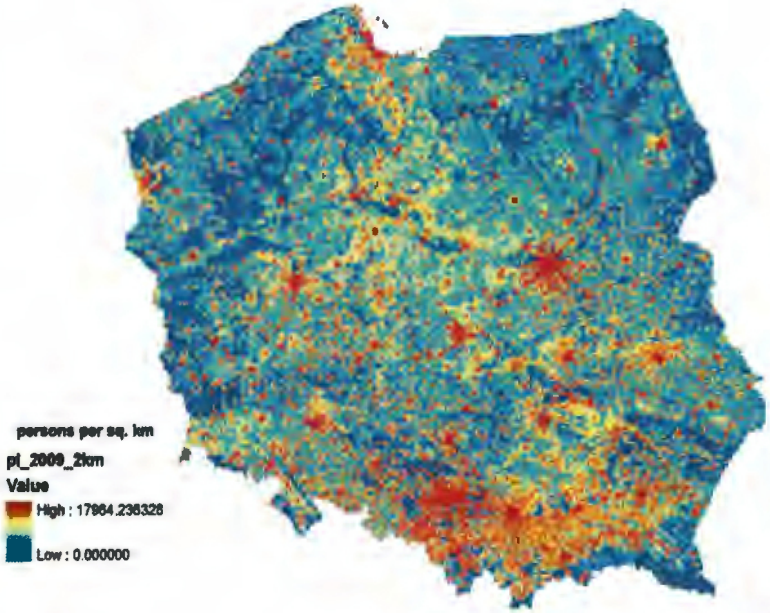

Figure 1.2. Population density of Poland in 2009

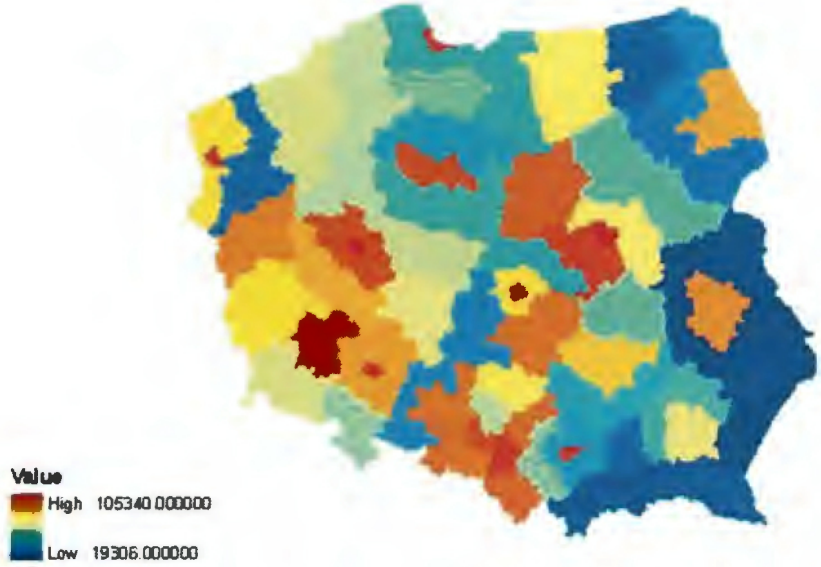

Figure 1.3. GDP per capita in Poland, 2009 (PLN/person, current prices)

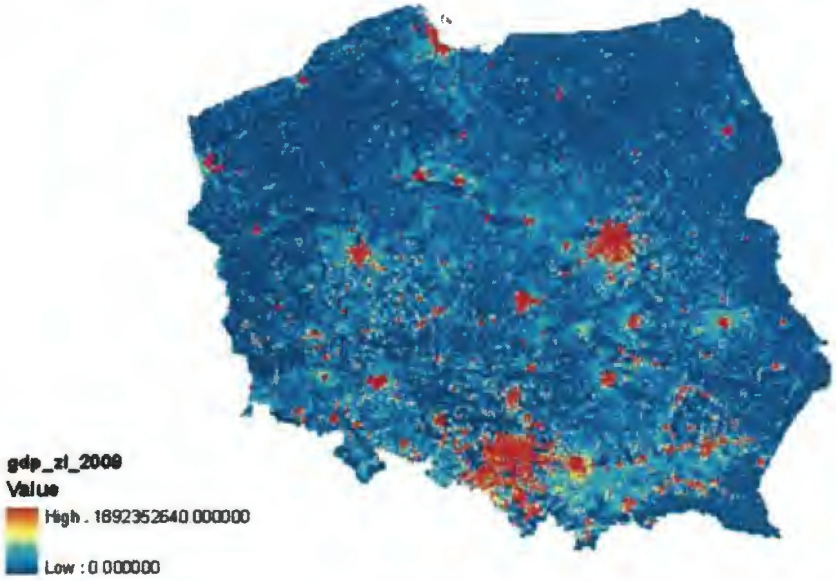

Figure 1.4. GDP in Poland in 2009 (PLN/km^2, current prices)

The GDP density maps for economy sectors have been produced by multiplying the GDP density map and maps of relative gross value added (GVA) (*Figure 1.5.*) in respective economy sectors. The GVA data for administrative regions of Poland for 2009 come from the database of the Central Statistical Office of Poland (GUS, 2012). In the database the economy sectors are grouped, using the following scheme:

- agriculture, forestry and fishing (section A) (*Figure 1.6.)*
- industry (sections B,C,D,E) (*Figure 1.7.)*
- manufacturing (section C) (*Figure 1.9.)*
- construction (section F) (*Figure 1.10.*)
- trade; repair of motor vehicles; transportation and storage; accommodation and catering; information and communication (sections G,H,I,J)
- financial and insurance activities; real estate activities (sections K, L)
- other services (sections M,N,O,P,Q,R,S,T)

Additionally the GDP density map for industry without manufacturing (sections B,D,E) (*Figure 1.8.*) is produced. The GVA for the sections B,D,E is obtained by subtracting GVA for section C from GVA for sections B,C,D,E.

The economy sectors are listed in Annex 2.

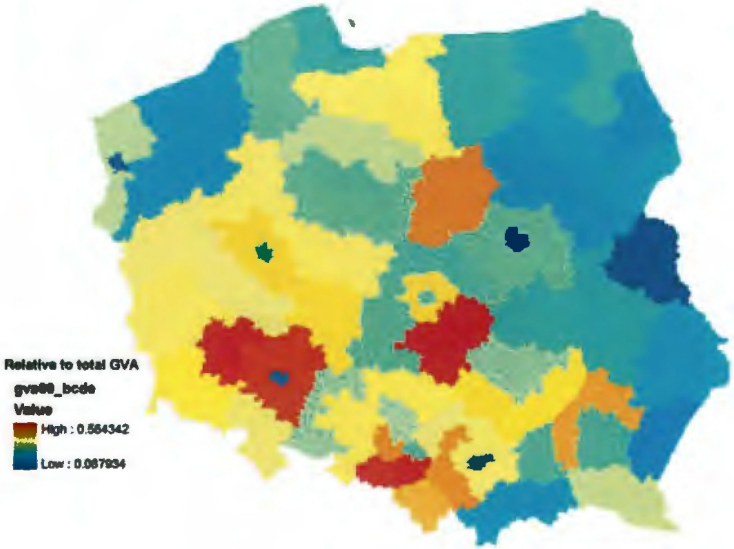

Figure 1.5. Relative GVA generated in industry (sectors B,C,D,E)

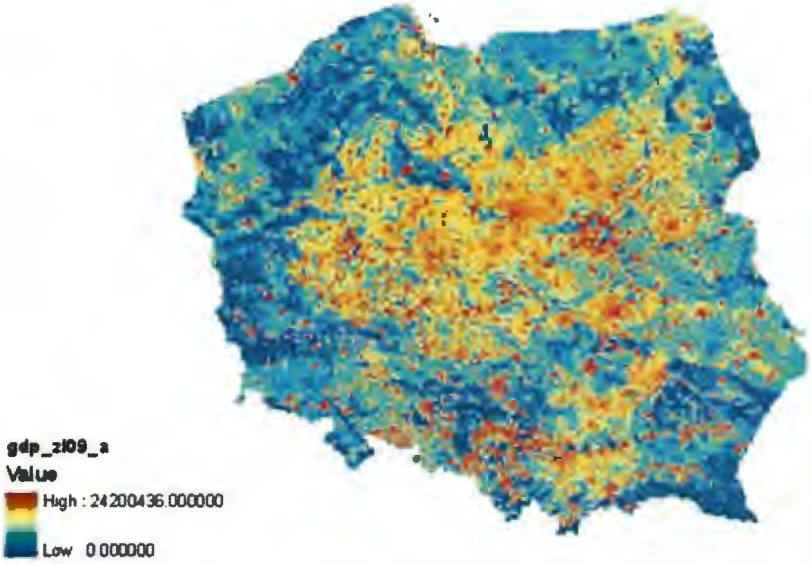

Figure 1.6. GDP generated in agriculture, forestry and fishing in Poland, 2009 (Section A) (PLN/km^2, current prices)

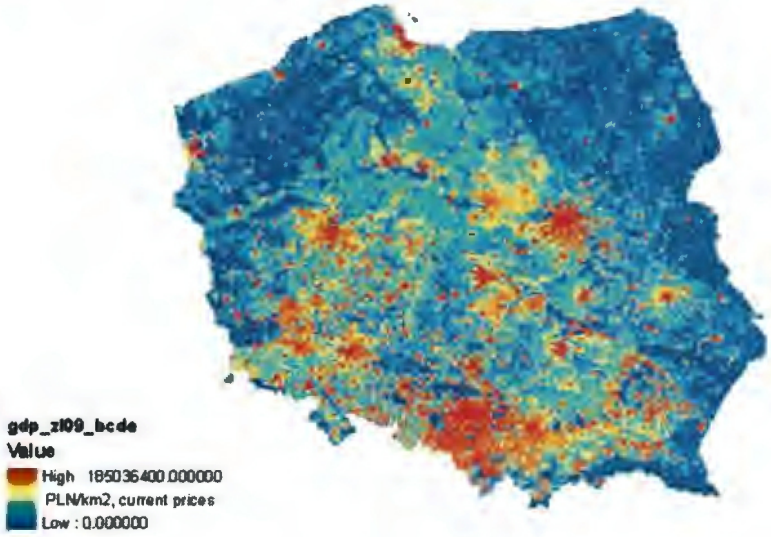

Figure 1.7. GDP generated in industry in Poland, 2009 (Sections B,C,D,E) (PLN/km^2, current prices)

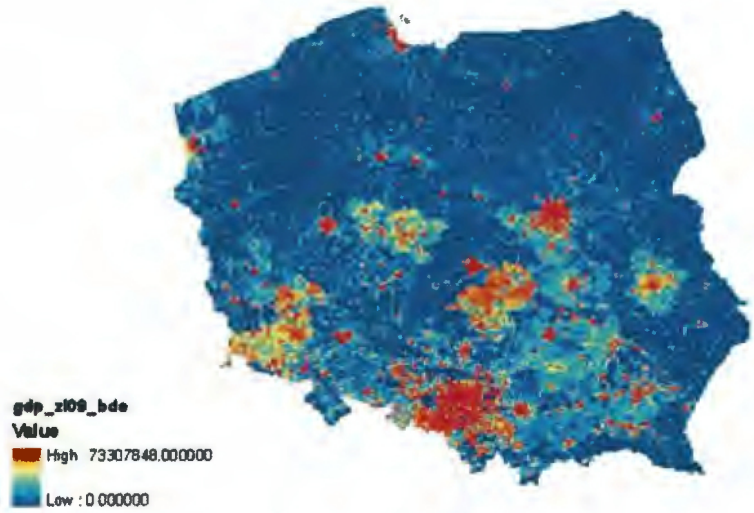

Figure 1.8. GDP generated in industry excluding manufacturing in Poland, 2009 (Sections B,D,E) (PLN/km^2, current prices)

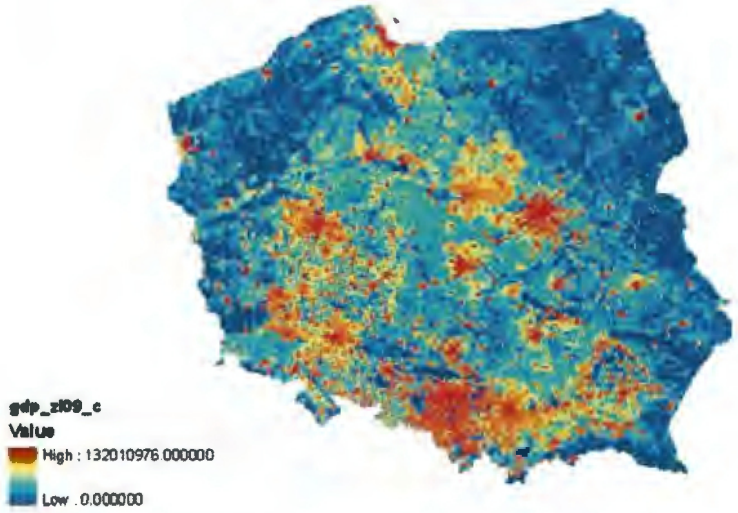

Figure 1.9. GDP generated in manufacturing in Poland, 2009 (Section C) (PLN/km^2, current prices)

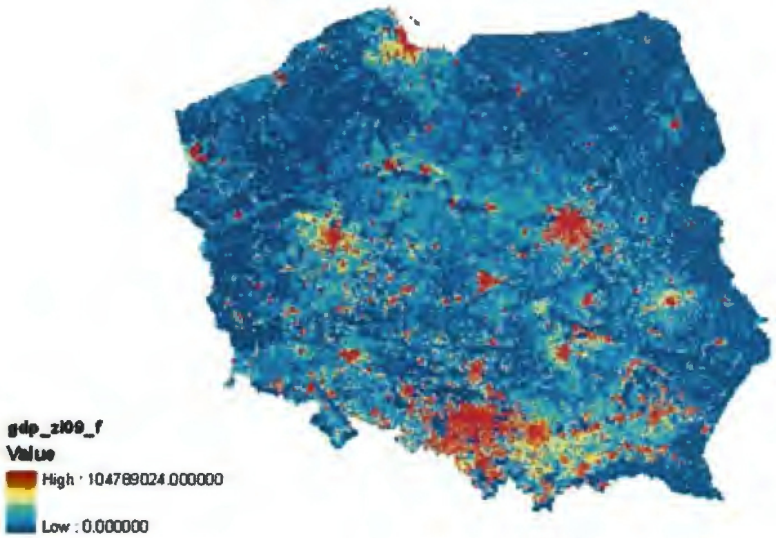

Figure 1.10. GDP generated in construction in Poland, 2009 (Section F) (PLN/km^2, current prices)

Annex 1.1. Projection parameters

Projection: Lambert_Azimuthal_Equal_Area
False_Easting: 4321000.000000
False_Northing: 3210000.000000
Central_Meridian: 10.000000
Latitude_Of_Origin: 52.000000
Linear Unit: Meter (1.000000)
Geographic Coordinate System: GCS_ETRS_1989
Angular Unit: Degree (0.017453292519943299)
Prime Meridian: Greenwich (0.000000000000000000)
Datum: D_ETRS_1989
Spheroid: GRS_1980
Semimajor Axis: 6378137.000000000000000000
Semiminor Axis: 6356752.314140356100000000
Inverse Flattening: 298.257222101000020000

Annex 1.2. Specification of the economy sectors used by the Central Statistical Office of Poland (NACE Rev. 2, p.59)

A - Agriculture, forestry and fishing

B - Mining and quarrying

C - Manufacturing

D - Electricity, gas, steam, and air conditioning supply

E - Water supply; sewerage, waste management, and remediation activities

F - Construction

G - Wholesale and retail trade; repair of motor vehicles and motorcycles

H - Transportation and storage

I - Accommodation and food service activities

J - Information and communication

K - Financial and insurance activities

L - Real estate activities

M - Professional, scientific and technical activities

N - Administrative and support service activities

O - Public administration and defense; compulsory social security

P- Education

Q- Human health and social work activities

R - Arts, entertainment and recreation

S - Other service activities

T - Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use

U - Activities of extraterritorial organisations and bodies

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