POCACITO

european post-carbon cities of tomorrow

INDIVIDUAL CASE STUDY ASSESSMENT REPORT

ISTANBUL

ISTANBUL TECHNICAL UNIVERSITY

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AUTHOR(S)

Prof. Dr. Tüzin BAYCAN, ITU

Res. Ass. Aysun AYGUN, ITU

With contributions by:

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LIST OF ABBREVIATIONS

FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GVA	Gross Value Added
ISKI	Istanbul Water and Sewage Administration
ISTAC	Istanbul Environmental Management Industry and Trading Company
KPI	Key Performance Indicator
TOBB	Turkish Union of Chambers and Commodity Exchanges
Toe	Tonne of oil equivalent
TurkStat	Turkish Statistical Institute

I INTRODUCTION

This document is an overview of the key indicators for the POCACITO case study of Istanbul. Istanbul is a city located in north-west of Turkey, in Marmara region. It is a megacity with over 13 million population and centre of economic, cultural and social activities. This document gives information about Istanbul, its opportunities, challenges and main environmental, social and economic performance.

II APPROACH AND METHODOLOGY

II.I MODEL AND CONCEPT

The concept within POCACITO is defined with following steps for initial assessment case study cities.

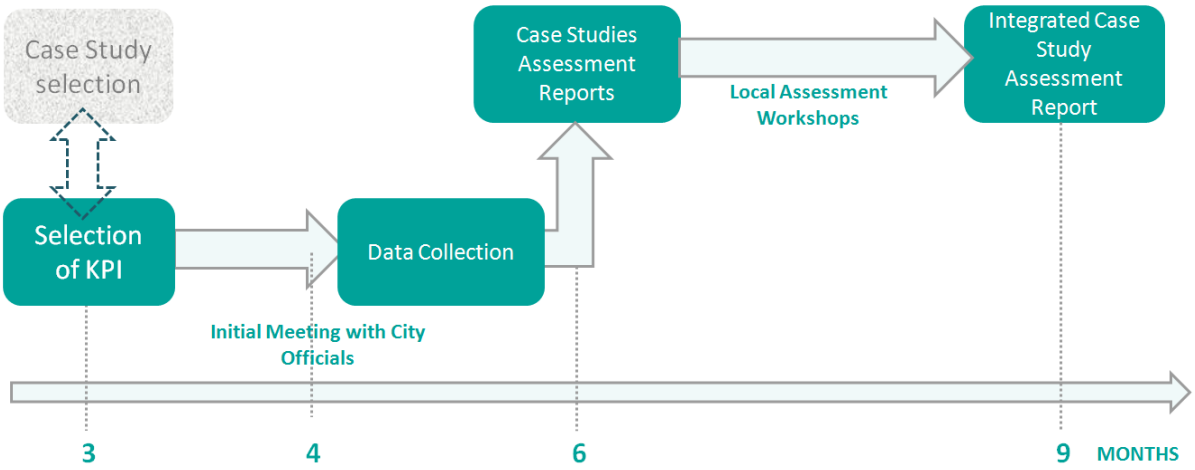


Figure 1: Methodological approach of the initial assessment

The key performance indicators are used to define Istanbul's dynamics. The indicators are classified into 3 dimensions including social, environmental and economic aspects. For each category, sub-dimensions are defined by a set of indicators which creates a data set for identification and comparison. For the Istanbul case data is not available at all for some indicators as well as for all years for some indicators. In addition, the geographic level of data is not the same for all indicators. If available municipality level data has been used, otherwise, regional (NUTS II) or national level data has been used depending on their availability.

II.II DATA COLLECTION PROCESS

In Turkey, TurkStat is the main data source for statistical documents. For the data collection process of the case study city Istanbul, TurkStat has been mainly used. However, all data are not available at the city level in TurkStat, so additional data sources were needed. The data have been collected in

cooperation with Istanbul Metropolitan Municipality Department of Environmental Protection and Istanbul Development Agency. The reports, documents have been useful in this process. Istanbul Environmental Plan Report (2009), Green City Index by Siemens (2009), Istanbul with Numbers by Istanbul Chamber of Commerce (2010), GHG Inventory of Istanbul by Istanbul Metropolitan Municipality (2010), Household Research by Istanbul Metropolitan Municipality (2006) have been the main reports and documents used for data collection. Moreover, Istanbul Water and Sewerage Administration and Ministry of Energy and Natural Resources have been the other institutional data sources.

Table 1: List of key performance indicators

DIMENSION	SUB-DIMENSION	INDICATOR	Geographical level	Year	Source
SOCIAL	Social Inclusion	Variation rate of unemployment level by gender	NUTS II	2004-2012	TurkStat
		Variation rate of poverty level	NUTS II	2006-2012	TurkStat
		Variation rate of tertiary education level by gender	NUTS II	2008-2012	TurkStat
		Variation rate of average life expectancy	NUTS II	2012, 2013	TurkStat
	Public services and Infrastructures	Variation rate of green space availability	Istanbul Metropolitan Municipality	2004-2012	Istanbul Metropolitan Municipality
	Governance effectiveness	Existence of monitoring system for emissions reductions	Istanbul Metropolitan Municipality	N/A	N/A
ENVIRONMENT	Biodiversity	Variation rate of ecosystem protected areas	Istanbul Metropolitan Municipality	2004, 2014	Istanbul Environmental Plan Report, 2009, Istanbul Metropolitan Municipality
	Energy	Energy intensity variation rate	Istanbul Metropolitan Municipality	2008-2012	TurkStat
		Variation rate of energy consumption by sectors	TURKEY	2003, 2008	Ministry of Energy and Natural Resources
	Climate and Air Quality	Variation rate of carbon emissions intensity	Istanbul Metropolitan Municipality	2006,2010	Green City Index, Siemens, 2009 GHG In ventory of Istanbul, Istanbul Metropolitan Municipality, 2010

DIMENSION	SUB-DIMENSION	INDICATOR	Geographical level	Year	Source
		Variation rate of carbon emissions by sector	Istanbul Metropolitan Municipality	2010	GHG In ventory of Istanbul, Istanbul Metropolitan Municipality, 2010
		Exceeding rate of air quality limit values	Istanbul Metropolitan Municipality	2010,2011, 2012	Istanbul Metropolitan Municipality
	Transport and mobility	Variation share of sustainable transportation	Istanbul Metropolitan Municipality	2006,2008	Green City Index, Siemens, 2009 Household Research, Istanbul Metropolitan Municipality, 2006
	Waste	Variation rate of urban waste generation	Istanbul Metropolitan Municipality	2005-2012	ISTAC
		Variation rate of urban waste recovery	Istanbul Metropolitan Municipality	2006-2011	ISTAC
	Water	Water losses variation rate	Istanbul Metropolitan Municipality	2001-2012	Istanbul Water and Sewerage Administration, 2012
	Buildings and Land Use	Energy-efficient buildings variation rate	Istanbul Metropolitan Municipality	2009-2014	http://www.usgbc.org/leed
		Urban building density variation rate	Istanbul Metropolitan Municipality	2009,2011	Istanbul Environmental Plan Report, 2009, Istanbul Metropolitan Municipality
ECONOMY	Sustainable economic growth	Level of wealth variation rate	NUTS II	2004-2011	TurkStat
		Variation rate of GDP by sectors	NUTS II	2007-2011	TurkStat
		Employment by sectors variation rate	NUTS II	2004-2009	TurkStat
		Business survival variation rate	Istanbul Metropolitan Municipality	2009,2010, 2011	TOBB
	Public Finances	Budget deficit variation rate	N/A	N/A	N/A
		Indebtedness level variation rate	Istanbul Metropolitan Municipality	2006-2012	Istanbul Metropolitan Municipality

DIMENSION	SUB-DIMENSION	INDICATOR	Geographical level	Year	Source
	Research & Innovation dynamics	R&D intensity variation rate	NUTS II	2010,2011	TurkStat

In order to be able to compare data in different years, different sources have been used for different years. While doing so, some problems have been confronted such as; the units are introduced differently in different sources. Another problem is about introducing the data under different categories (for example, the share of sustainable transportation is categorised differently in different sources). All data in this report have been used as their original form in the sources.

III OVERVIEW OF THE CASE STUDY CITY

III.I TERRITORY

Istanbul is located in the north-west of Turkey, Marmara region. According to Nomenclature of Territorial Units for Statistics Turkey has 12 NUTS 1, 26 NUTS 2, 81 NUTS 3 statistical regions. Within this frame Istanbul is defined as region in those 3 statistical regions as TR1 Istanbul, TR10 Istanbul, TR100 Istanbul. Istanbul extends over two continents; Asia and Europe. Istanbul's two sides are divided with Bosphorus passing through between Asia and Europe sides. Also Bosphorus connects Black Sea and Marmara Sea, separates Asia Continent from Europe Continent. Istanbul has 39 municipal districts. The local government is organised as the Metropolitan Municipality for the entire Istanbul territory and 39 district municipalities responsible for their district territory.

Figure 2: Istanbul's location in Europe

Figure 3: Istanbul's location in Turkey

Figure 4: Maps of Istanbul

Istanbul is one of the world's metropolitan cities with its strategic location; cultural, economic, demographic dynamics; and relation with different countries.

Istanbul is a connection point between the Balkans, Caucasus, Middle East, Middle Asia, North Europe, Black Sea countries and Mediterranean countries with its central geographical location. Europe and Asia is connected in terms of highway and seaway through Istanbul in the shortest way. Moreover, it dominates the sea connection of Black Sea countries to Mediterranean. The 4th Pan European Corridor which is one of the 10 main transportation axes determined by European Union starts from Dresden and ends in Istanbul. The city has two important ports: Haydarpasa and Ambarli, and two airports: Ataturk and Sabiha Gokcen for international transport, export, and import.

Istanbul has both Black Sea and Mediterranean climate characteristics because of its geographic location. Summer is hot and humid, and winter is rainy and cold, sometimes snowy. The felt temperature is hotter in summer, colder in winter because of humidity. The annual average temperature is 13.5^{o}C. The average temperature is 2°C - 9°C in winter, 18°C - 28°C in summer.

III.II POPULATION

The population of Istanbul is 13.854.720 (TurkStat, 2012). It consists 18.3% of Turkey's population which is 75.627.384. Male population is 49.8% (6.897.832) and female population is 50.2%

(6.956.908) among the total population. The distribution of the population according to age cohorts is; 23.2% 0-14 age cohort, 71% 15-64 age cohort, 5.7% over 65 age.

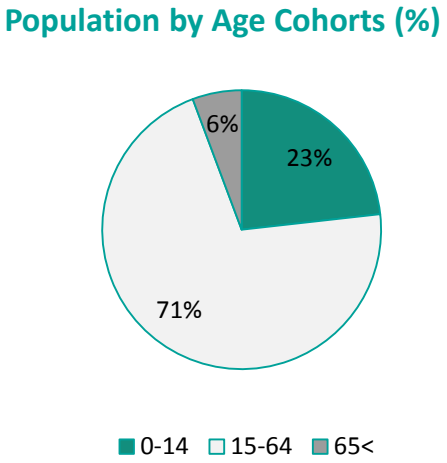


Figure 5: Population of Istanbul by age cohorts (%)

Source: TurkStat, 2012

The urban population is 77.3% in Turkey while it is 99.0% in Istanbul. Istanbul has a relatively small area but large population which causes a high density of population. The population density is 2666 inhabitants/km^2. Turkey's average population density is 98 inhabitants/km^2 which corresponds to 1/27 of Istanbul's population density. The population increase rate is 1.7% and higher than Turkey's average rate of 1.2% (Istanbul Development Agency, 2014).

With its population over 12 million, Istanbul metropolitan region has become a mega-city, ranking 8 out of 78 OECD metropolitan regions in terms of population size and first for population growth since the mid-1990s. Istanbul used to concentrate about 5% of national population in 1950's whereas it is 20% today (OECD, 2008)

Table 2: Population change over years in Istanbul and in Turkey

Year	Istanbul Population	Rate in Turkey Population
1927	806.863	5.91%
1970	3.019.032	8.48%
1990	7.309.190	12.94%
2009	12.915.58	17.8%
2012	13.854.720	18.3%

Source: Turkstat

The population has continuously increased in Istanbul since 1927. The proportion in Turkey's population has already increased. Istanbul gets immigrants from all over Turkey. Especially after

1950's the migration to Istanbul has increased rapidly. The rapid increase of population has caused an extension of urban area without control, the number of illegal settlements and slums has increased, environmental pollution and disruption have emerged, urban services and facilities have become insufficient. In recent years migration impacts on Istanbul population have decreased in comparison to previous years. However, Istanbul still has a dynamic demographic structure with immigrations and emigrations. The population of inhabitants who born in any other city constitutes 1/3 of inhabitants who born in Istanbul (OECD, 2008).

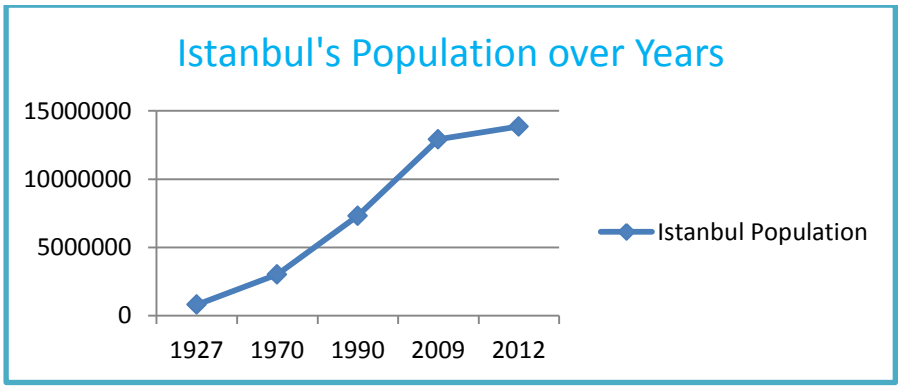


Figure 6: Population of Istanbul over years

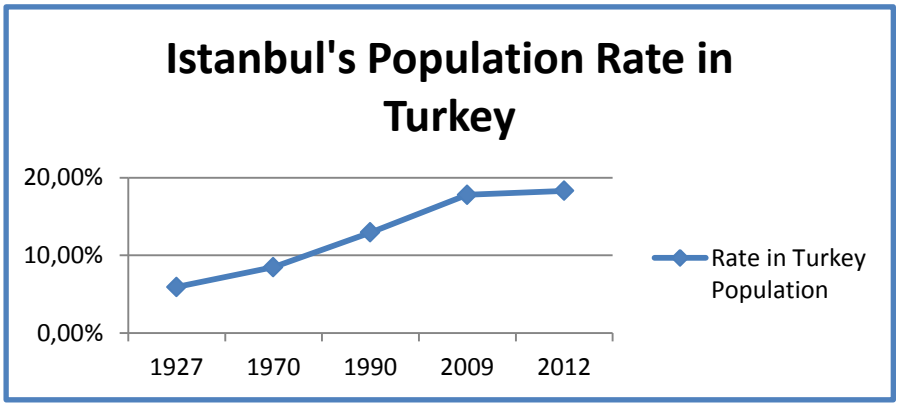


Figure 7: Population of Turkey over years

6% of population is foreign residents. Population with higher education is 12.1%, employment rate is 51.1% and unemployment rate is 11.3% which is higher than Turkey's unemployment rate 9.2%. Unemployed population of Istanbul consists of 22.6% of Turkey's unemployed population.

III.III ECONOMY

Istanbul's GDP was $ 14,591 in 2008 while GDP was $ 9,384 in Turkey. Istanbul's GDP was 8,210 PPS in 2009. According to Green City Index by Siemens, GDP per head in 2009 is 14,615 Euros. Istanbul has also higher export and import per person than the region's and Turkey's average. It produces almost 27% of national GDP, 38% of total industrial output, more than 50% of services, and generates 40% of tax revenues (OECD, 2008). GDP per capita of Istanbul has already exceeded the national average by

more than 70%. According to TurkStat data among 44,472 newly established companies and cooperatives, 15,839 were located in Istanbul while among 10,395 closed companies and cooperatives 5,274 were in Istanbul in 2009. Among the total enterprises in Turkey which is 3,474,992 829,119 of them were in Istanbul (Istanbul Development Agency, 2014). The city gets the lion's share of total FDI and generates half of total exports in Turkey (OECD, 2008). In sectorial GDP, services is the dominant sector with 73.1%. It is higher than Turkey's service sector ratio, 64.3%. The industry sector is 26.7% which is under the ratio of Turkey, 27.2%. Agriculture has 8.5% in Turkey while it is 0.2% in Istanbul. Istanbul is the center of industrial and commercial activities because of its geographic location. Parallel to the country's economic trends, the weight of service sector has increased in Istanbul's economy. In this frame the main economic activities that contribute to Istanbul's development are culture, tourism, logistic and finance (Istanbul Development Agency, 2014).

Istanbul faces challenges to become a hub for finance, logistics, culture and tourism in Euro-Asia region as well as its development in general. The labour intense activities are major in Istanbul's economy however there is a change towards an economy that based on knowledge industry. Constraints on human capital development and the informal sector have hindered productivity levels and increased income disparities (OECD, 2008). Over-migration is a challenge for Istanbul's economy, infrastructure, housing, etc.

Istanbul maintains a sizeable low value-added and labour-intensive manufacturing sector, mainly textiles and supply chain. This sector represents 37% of total labour force and 26% of GDP and 80% of total exports (OECD, 2008). As a result of economic growth and the dominance on national economy the city attracts migrants from other parts of Turkey as well as from neighbour countries.

Migration has also encouraged the informal sector of the economy which is 30% of the city's working labour force as economic growth has been insufficient in providing jobs for a large number of newcomers into the labour market (OECD, 2008). Those informal small firms have helped to relieve urban employment problems during the economic crisis.

Table 3: Portion of national GDP for Istanbul by sectors

Sector	Istanbul GDP Ratio 1987	Istanbul GDP Ratio 2000
Agriculture	1.4	0.7
Manufacture	26.8	29.2
Construction	17.8	18.8
Commercial	29.3	27.5
Logistic	21.7	21.7
Finance	43.0	55.2
Personal Services	38.8	39.5
Total Sectors	21.0	22.6

Source: TurkStat

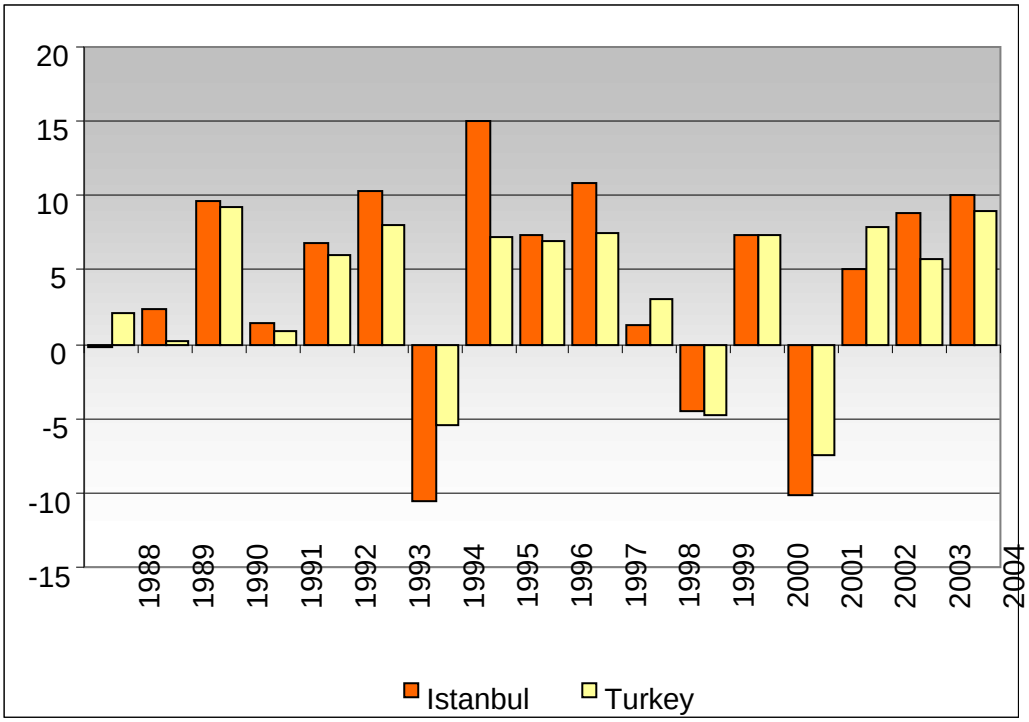


Figure 8: GDP real growth of Turkey and Istanbul (1989-2004)

Source: OECD, 2008

The allocation of the production in Istanbul has caused regional development disparities in the country. Turkey is characterised by the growing gap between East and West. Over the years directives have caused the east getting poorer and migration flows to the west.

Istanbul has developed rapidly in production and efficiency. Between 1987 and 2004 Turkey's growth rate is 3.2% while Istanbul's is 3.7%. According to international standards, Istanbul ranked 12th among the 45 OECD metropolitan regions in terms of economic growth rate for the period 1995-2000.

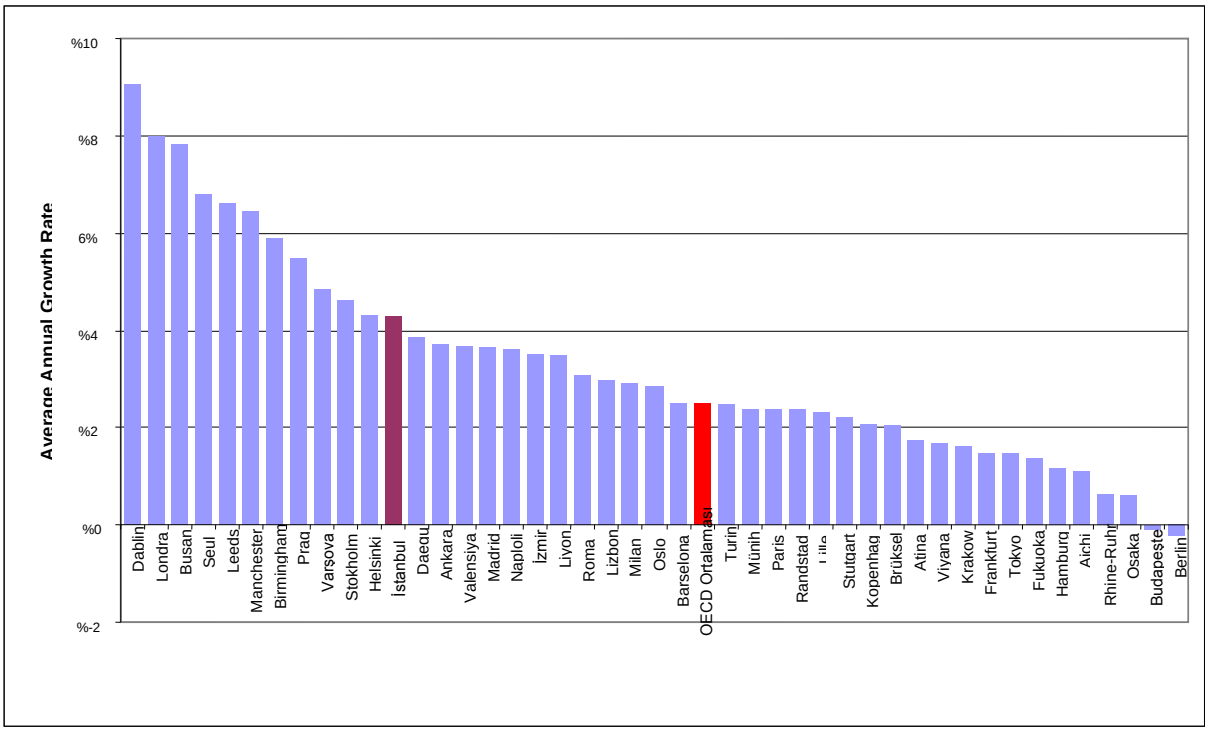


Figure 9: Economic growth in selected OECD metropolitan regions

Source: OECD, 2008

IV KEY STRATEGIES AND PROJECTS

IV.I STRATEGIES AND ACTION PLANS

STRATEGY/ACTION PLAN FACTSHEET	
Title	***Improvement in Public Transport and Popularization of Usage***
Dimension of KPIs	Transport and Mobility
Period	2014-2023
Strategy/Action Plan description (short description – max 15 lines for each sub-section)	
Objective	Improving public transport infrastructure especially rail transit systems to sustain equal accessibility to citizens. Integrating different and alternative transportation modes. Preventing the dominance of automobile usage as primary transportation mode.
Measures	Constructing new metro lines and railways. Construction of more connection/transit station to integrate different modes. Increasing the capacity of vehicles.

Targets	Increasing the ratio of railway systems in the network. Preparing long-term comprehensive public transportation strategies.
Links and Contacts	
Promoter	*Istanbul Metropolitan Municipality*
Document/website	http://www.ibb.gov.tr/tr-TR/kurumsal/Birimler/ulasimPlanlama/Documents/%C4%B0UAP_Ana_Raporu.pdf
Contact E-mail	-

IV.II KEY PROJECTS

PROJECT FACTSHEET	
Title	***Airport Carbon Accreditation***
Dimension of KPIs	Transportation and carbon emissions
Area of implementation (city, neighbourhood, etc.)	Istanbul Ataturk International Airport
Implementation period	2009 - n.d.
Project description (short description – max 15 lines for each sub-section)	
Aims	Reducing carbon emissions in airports
Activities	Energy management, energy efficiency, sustainability
Promoters/Beneficiaries; Partnership	Airports Council International (ACI) Europe, TAV Airports
Financing	TAV Airports
Outcomes and impacts	14% increase in number of passengers, 4.6% decrease in the total carbon emission
Main factors of success	Innovative energy implementations and policies
Reproducibility and transferability	Can be conducted to any other airports
Links and Contacts	
Promoter	Airports Council International (ACI) Europe
Website	http://www.airportcarbonaccreditation.org/
Contact E-mail	-

V CASE STUDY CITY ASSESSMENT

V.I ENVIROMENTAL PERFORMANCE

V.I.I Variation Rate of Ecosystem Protected Areas

According to Istanbul Environmental Plan Report (2009), the natural protected areas in Istanbul extent 39,497.6 ha for 2004 and according to Istanbul Metropolitan Municipality it is 52,212 ha for 2014. The geographical level of the data is municipality level.

Additionally, Turkey is in process of a new regulation of determining the environmental protection areas. With this new regulation all environmentally protected areas are planned to examine again and to determine the protection level according to identified criteria. This process is not completed yet, therefore the protection levels of those natural areas and the size of them may change over time.

Table 4: Ecosystem protected areas (ha)

YEAR	ha	VARIATION
2004	39,497.6	
2014	52,212	**32.1 %**

Source: Istanbul Metropolitan Municipality
Geographic Level: Municipality

V.I.II Energy Intensity Variation Rate

Energy intensity is measured at national level in Turkey. Therefore the data is not available at the city level in appropriate form. In order to calculate the energy intensity of Istanbul, we have used total electricity consumption data between 2008 and 2012 and gross added value data for the same time period as input. The source for those data is TurkStat. Energy intensity rate is obtained by dividing the total energy consumption into GVA.

The results show that there is a decrease in energy intensity since 2008 in Istanbul. This means less energy consumption with more GVA which represents more efficient energy management.

Table 5: Energy Intensity (toe/euro GVA)

YEAR	Toe/euro	VARIATION
2008	0.023	-
2009	0.022	-0.01
2010	0.021	-0.01
2011	0.026	0.05
2012	0.020	-0.06

Source: TurkStat
Geographic Level: Municipality

V.I.III Variation Rate of Energy Consumption by Sectors

The data of energy consumption by sectors could not be found at urban (Istanbul) level. Therefore, for this dimension, national level data from Ministry of Energy and Natural Resources has been used. The data is only available for 2003 and 2008. The data for each sector can be seen in Table 6. In the source the data is categorized as; residential and services, transportation, industry, agriculture, and others. Therefore the data has been used as it is in original.

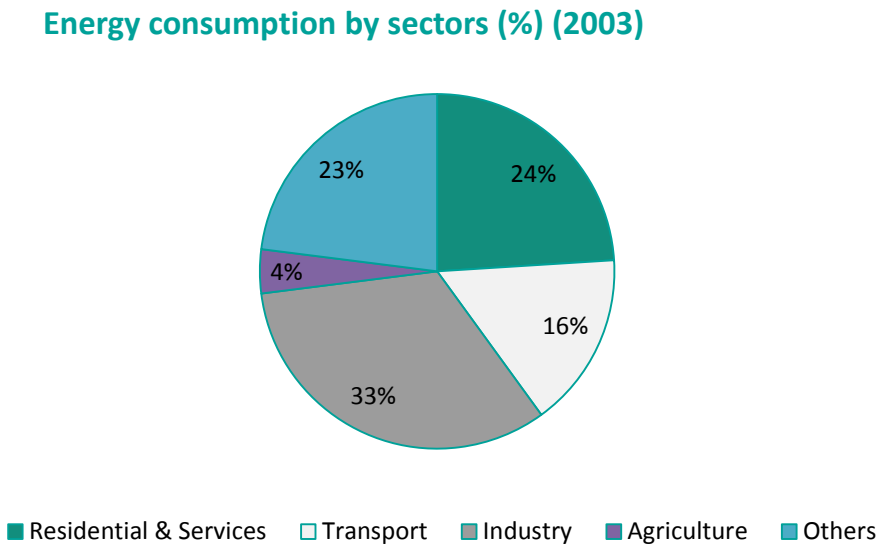
According to data, the most energy consuming sector is residential and services in 2008 while it is industry in 2003 in Turkey. Industry sector is the second one in energy consumption in 2008 in Turkey. The third sector is transportation for both years in Turkey. Agriculture is considerably less energy consuming sector when compared with the other sectors.

The energy consumption for residential and services has increased 12%, transportation has increased 4%, industry has decreased 1%, agriculture has increased 3% and other sectors have decreased 18% from 2003 to 2008 in Turkey.

Table 6: Energy consumption by sectors (%)

YEAR	RESIDENTIAL& SERVICES (%)	TRANSPORTATION (%)	INDUSTRY (%)	AGRICULTURE (%)	OTHERS (%)
2003	24	16	33	4	23
2008	36	20	32	7	5
VARIATION	12	4	-1	3	-18

Source: Ministry of Energy and Natural Resources
Geographic Level: National



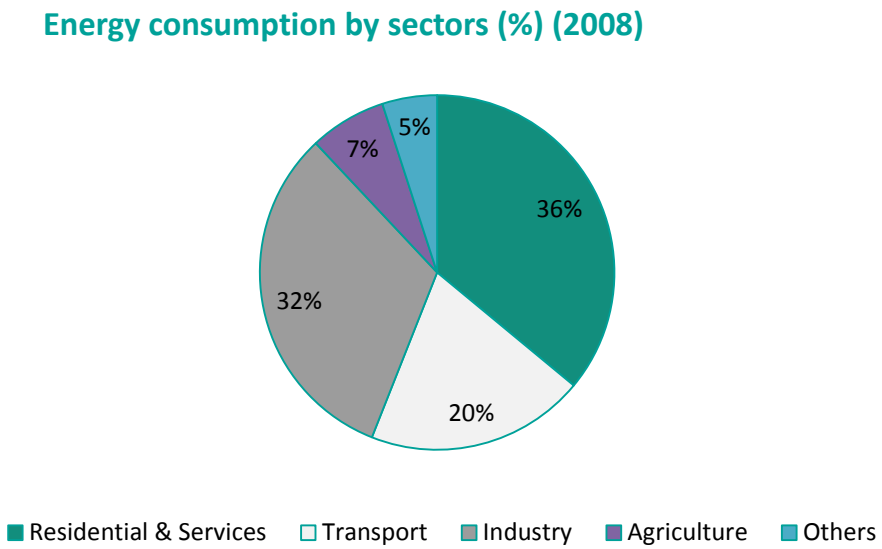


Figure 10: Energy consumption by sectors (%) (2003 and 2008)

V.I.IV Variation Rate of Carbon Emissions Intensity

The data for Istanbul's carbon emissions intensity is available in two different sources for two different years. According to Green City Index by Siemens the carbon emission per head is 3.25 tCO_2e in 2006 for Istanbul, at the municipality level. According to 2010 GHG Inventory of Istanbul, the carbon emission per head is 3.31 tCO_2e. In order to calculate the carbon emission intensity, carbon emission per head is divided into GVA dollars per person (since GDP for Istanbul is not available, GVA is used) in relevant year values. In conclusion, carbon emission intensity for 2006 is 0.315 tCO2/1000 dollars and it is 0.246 tCO2/1000 dollars for 2010. When the values compared, carbon intensity decreased 0.069 in 2010 which is relevant to increase in GVA.

Table 7: Carbon emissions intensity

YEAR	CARBON EMISSIONS PER HEAD	GVA	CARBON EMISSION INTENSITY	VARIATION
2006	3.25 tCO_2e	10,314 dollars/person	0.315 tCO2/1000dollars	
2010	3.31 tCO_2e	13,416 dollars/person	0.246 tCO2/1000dollars	- 0.069

Source: GHG Inventory of Istanbul 2010, Green City Index

Geographic Level: Municipality

V.I.IV Variation Rate of Carbon Emissions by Sector

The data is obtained from 2010 GHG Inventory of Istanbul. The data is only available for 2010 and it is at the municipality level. In the source the sectors are listed as: residential, commercial, industrial, transportation, solid waste disposal, incineration and open burning, waste water treatment and discharge. The amount of carbon emissions by sector can be seen in Table 8.

As obviously seen in the table the highest carbon emission created by residential sector and followed by transportation. The urban settlement area and car ownership increase in Istanbul means more carbon emissions by those sectors can be expected in the future. Since data is available only for 2010, variation rate of carbon emissions by sectors could not be presented.

Table 8: Carbon emissions by sectors (tonCO2)

YEAR	RESIDENTIAL (tonCO2)	COMMERCIAL (tonCO2)	INDUSTRIAL (tonCO2)	TRANSPORTATION (tonCO2)	SOLID WASTE DISPOSAL (tonCO2)	INCINERATION & OPEN BURNING (tonCO2)	WASTE WATER TREATMENT & DISCHARGE (tonCO2)
2010	15,282,654	4,872,008	6,626,962	13,309,358	1,598,736	4,357	768,283

Source: GHG Inventory of Istanbul 2010

Geographic Level: Municipality

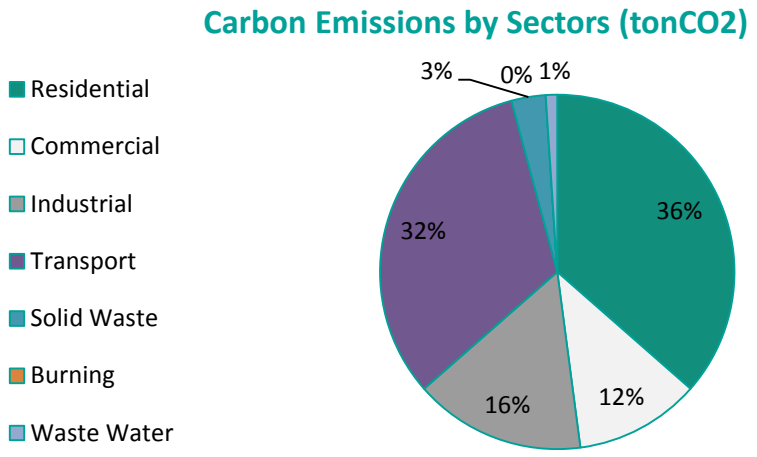


Figure 11: Carbon emissions by sectors (%)

V.I.V Exceeding Rate of Air Quality Limits Value

The data is obtained from Istanbul Metropolitan Municipality, Environment Preservation Department for 2010, 2011, 2012. The data is avaliable for SO2, NO2, M10, M2,5. The exceeding rate of air quality limits value can be seen in Table 9 for each year.

Table 9: Exceeding rate of air quality limits value (no of days)

YEAR	SO2	VARIATION	NO2	VARIATION	M10	VARIATION	M2.5	VARIATION
2010	0	-	35	-	157	-	0	-
2011	0	-	2	-33	122	-35	0	-
2012	0	-	0	-2	173	51	0	-

Source: Istanbul Metropolitan Municipality
Geographic Level: Municipality

There is no observed exceeding rate for SO2 and M2.5 for 2010, 2011, 2012. NO2 exceeded the limit values 35 days in 2010 and 2 days in 2011. The variation is -33. M10 exceeded the limit values 157 days in 2010, 122 days in 2011, variation between those two years is -35, for 2012 exceeding was 173 days. The variation rate between 2011 and 2012 is 51.

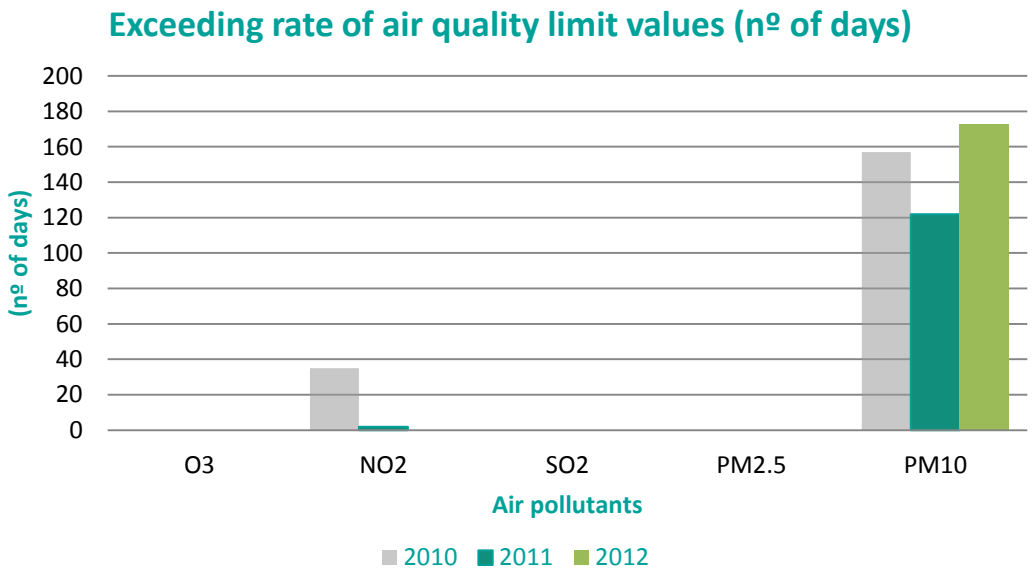


Figure 12: Exceeding rate of air quality limit values (no of days)

V.I.VI Variation Share of Sustainable Transportation

Two different sources are used for this data at the municipality level. For 2006, Household Survey has been used while for 2008 Green City Index by Siemens has been used. The data is categorized differently in each resource. Therefore, the comparison is not possible. The data can be seen in Table 10 and Table 11. According to data, the share of public transportation in 2006 was 84% (schools' and companies' staff shuttles are included in the public transportation category) and it was 54.02% in 2008.

Table 10: Share of sustainable transportation (Household survey data)

YEAR	SHUTTLE & BUS (%)	RAILWAY (%)	BOAT (%)	PEDESTRIAN (%)	PRIVATE AUTOMOBILE (%)
2006	32	2	1	49	16

Source: Istanbul Metropolitan Municipality
Geographic Level: Municipality

Table 11: Share of sustainable transportation (Green city index data)

YEAR	PEDESTRIAN+CYCLING+PUBLIC TRANSIT (%)	PRIVATE TRANSPORTATION (%)
2008	54.02	45.98

Source: Green City Index
Geographic Level: Municipality

V.I.VII Variation Rate of Urban Waste Generation

The data is obtained from ISTAC (Istanbul Environmental Management Industry and Trading Company). The data is available for the years between 2005 and 2012. The variation rate of urban waste generation over years indicates an increasing trend since 2007 for Istanbul.

Table 12: Variation rate of urban waste generation (tone/year)

YEAR	URBAN WASTE GENERATION (tone/year)	VARIATION
2005	4,668,350	-
2006	5,161,465	10%
2007	4,889,175	-5.5%
2008	5,160,370	5.5%
2009	5,183,000	0.4%
2010	5,295,785	2.1%
2011	5,383,385	1.6%
2012	5,685,605	5.6%

Source: ISTAC

Geographic Level: Municipality

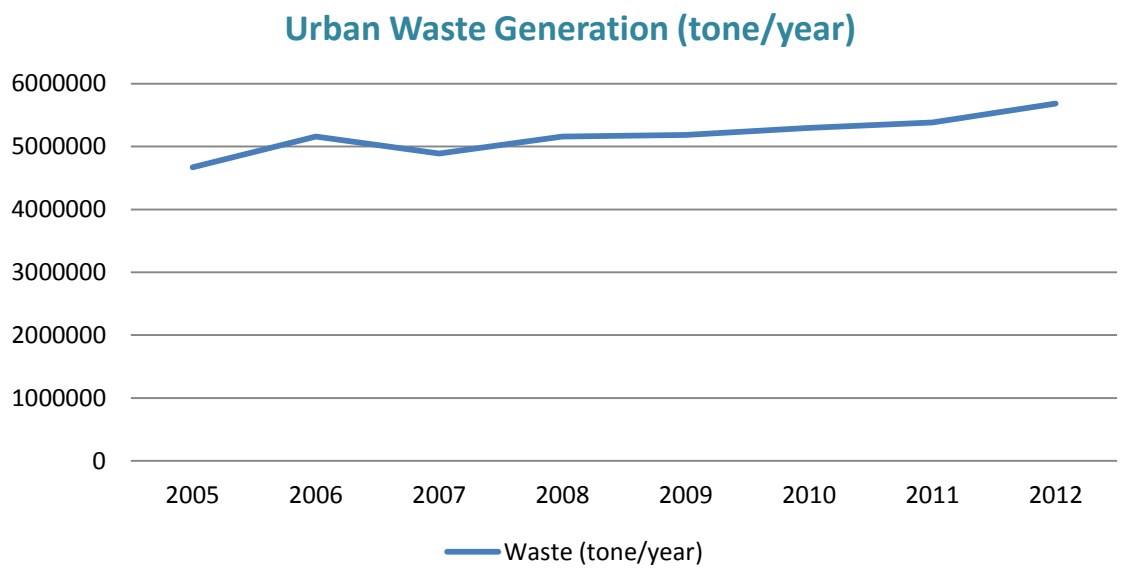


Figure 13: Urban waste generation by years

V.I.VIII Variation Rate of Urban Waste Recovery

For this dimension recycled packing waste and compost production has been used as the source ISTAC, sustained the data. The rate of the recovered waste among the generated waste has been calculated. The data has been obtained from 2006 to 2011. The variation rate of the dimension shows that there is an increasing rate for the waste recovery.

Table 13: Variation rate of urban waste recovery

YEAR	URBAN WASTE RECOVERY	VARIATION
2006	0.48%	-
2007	0.75%	0.27%
2008	0.50%	-0.25%
2009	1.17%	0.67%
2010	2.00%	0.83%
2011	2.62%	0.62%

Source: ISTAC
Geographic Level: Municipality

Figure 14: Urban waste recovery by years (%)

V.I.IX Water Losses Variation Rate

The data has been obtained for the years between 2001 and 2012 from ISKI (Istanbul Water and Sewerage Administration). The rate of water losses fluctuates over years however there is a remarkable decrease from 2001 to 2012. As the importance of sustainable water management has been understood, ISKI has taken some measures to decrease the water losses which is effective on decreasing the rate of water losses.

Table 14: Water losses variation rate (%)

YEAR	WATER LOSSES (%)	VARIATION
2001	35.33	-
2002	38.38	3.05
2003	36.14	-2.24
2004	34.65	-1.49
2005	28.43	-6.22
2006	29.44	1.01
2007	27.85	-1.59
2008	24.84	-3.01
2009	24.24	-0.6
2010	28.53	4.29
2011	25.59	-2.94
2012	24.11	-1.48

Source: ISKI

Geographic Level: Municipality

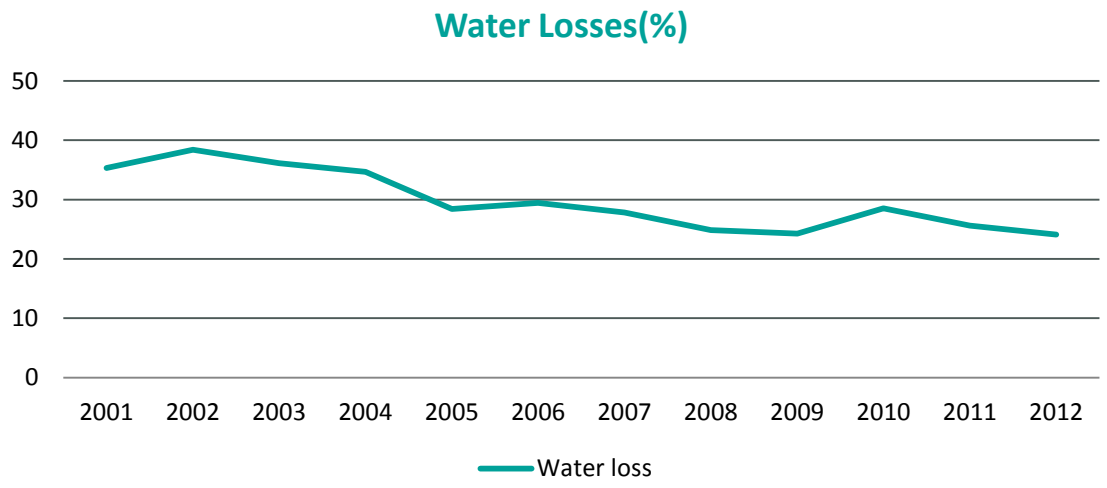


Figure 15: Water losses by years (%)

V.I.X Energy Efficient Buildings Variation Rate

For this dimension, there is no available data as the number of energy efficient buildings in the city. Therefore, the number of the buildings which have had the LEED certificate in Istanbul has been considered as energy efficient buildings. The data has been obtained from the web-site of U. S. Green

Buildings Council (http://www.usgbc.org/leed) as the certificate awarded at any level of LEED buildings in Istanbul. The first time the buildings awarded in Istanbul was 2009. The number of LEED certificated buildings in the city has increased since then. Investors give more importance to green and energy efficient buildings. For the time being there are 146 buildings in Istanbul which are candidate for the certification.

Table 15: The number of energy efficient buildings

YEAR	ENERGY EFFICIENT BUILDINGS (no)	VARIATION
2009	2	-
2010	3	1
2011	13	10
2012	21	8
2013	23	2
2014	40	17

Source: http://www.usgbc.org/leed
Geographic Level: Municipality

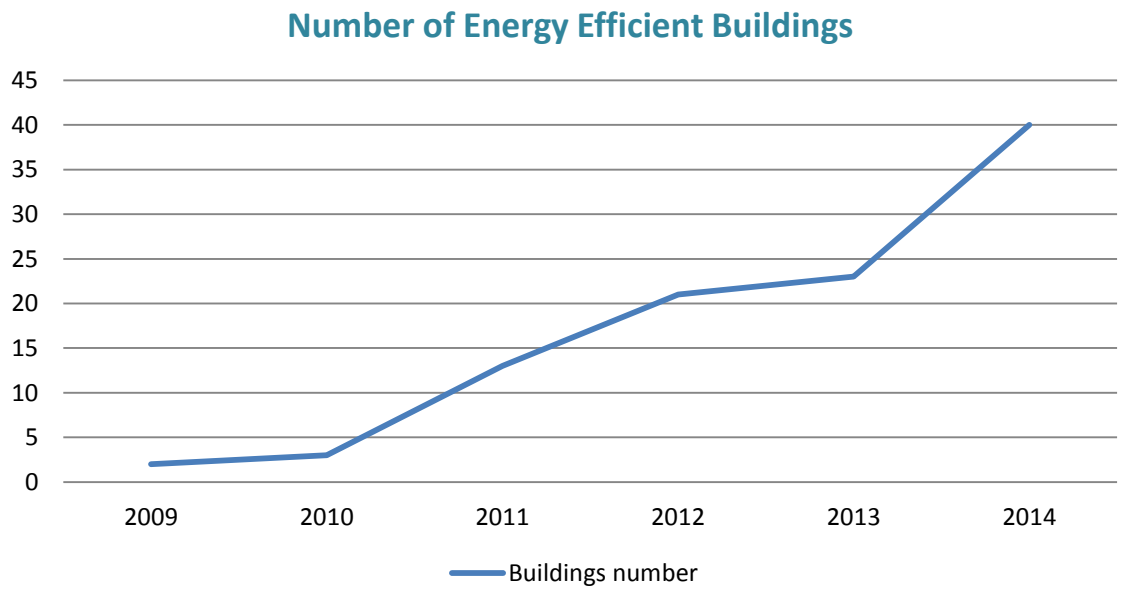


Figure 16: Energy efficient buildings by years

V.I.XI Urban Building Density Variation Rate

According to Istanbul Environmental Plan Report, the building density in Istanbul was 637.93 no/km^2 in 2009. According to Istanbul Metropolitan Municipality, the building density in 2011 was 677.51 no/km^2. The building density has been calculated by dividing the number of buildings into total surface area of Istanbul. The results show an increase in the density of buildings as expected.

Table 16: Urban building density

YEAR	NO OF BUILDINGS	ISTANBUL SURFACE AREA	BUILDING DENSITY (no/km2)
2009	3,483,758	5461 KM2	637.93
2011	3,699,930	5461 KM2	677.51

Source: Istanbul Metropolitan Municipality

Geographic Level: Municipality

V.II SOCIAL PERFORMANCE

V.II.I Variation Rate of Unemployment Level by Gender

The data has been obtained from TurkStat (Turkish Statistical Institute) for the years from 2004 to 2012 at NUTS 2 (TR1- Istanbul) level. The data before 2004 cannot be found. Unemployment rate for females has been always higher than for males. In the period from 2004 to 2009, unemployment rate decreased for both gender, however in 2009 a sudden increase has been observed. After 2009, it has continued to decrease. The highest level was in 2009 for both gender and the lowest level was in 2007 for males, and in 2005 for females. The data for each year can be seen in Table 17.

Table 17: Variation rate of unemployment level by gender (%)

YEAR	MALE (%)	VARIATION FOR MALE	FEMALE (%)	VARIATION FOR FEMALE
2004	11.7	-	14.9	-
2005	11.0	-0.7	13.2	-1.7
2006	10.6	-0.4	14.0	0.8
2007	9.5	-1.1	13.5	-0.5
2008	10.4	0.9	13.7	0.2
2009	15.8	5.4	19.9	6.2
2010	13.2	-2.6	17.4	-2.5
2011	10.6	-2.6	15.2	-2.2
2012	10.1	-0.5	14.4	-0.8

Source: TurkStat

Geographic Level: NUTS II

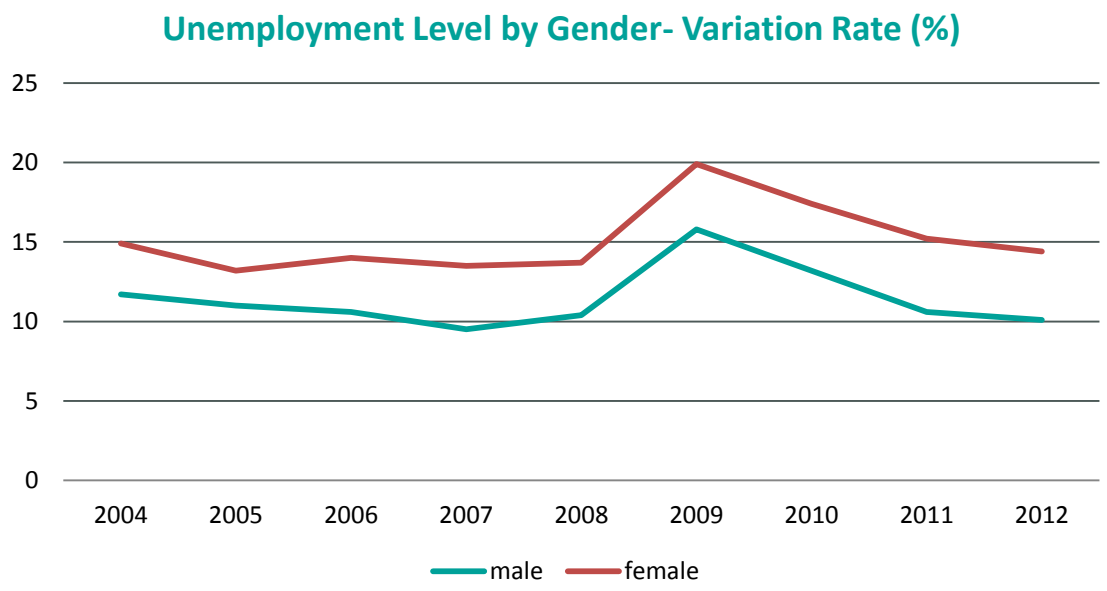


Figure 17: Variation rate of unemployment level by gender (%)

V.II.II Variation Rate of Poverty Level

The data has been obtained from TurkStat for the years from 2006 to 2012 at the NUTS 2 (TR1-Istanbul) level. The data before 2006 cannot be reached. The poverty level fluctuates over the years in Istanbul. The highest level was in 2006 with 21% and the lowest level was in 2009 with 14.9 %. The poverty rate is lower than Turkey's average for each year. The data for each year can be seen in Table 18.

Table 18: Variation rate of poverty level (%)

YEAR	POVERTY LEVEL FOR ISTANBUL(%)	VARIATION RATE OF ISTANBUL	POVERTY LEVEL FOR TURKEY (%)	VARIATION RATE OF TURKEY
2006	21.0	-	23.9	-
2007	15.8	-5.2	21.3	-2.6
2008	17.4	1.6	22.2	0.9
2009	14.9	-2.5	22.3	0.1
2010	18.7	3.8	21.2	-1.1
2011	18	-0.7	21.1	-0.1
2012	17.4	-0.6	-	-

Source: TurkStat

Geographic Level: NUTS II

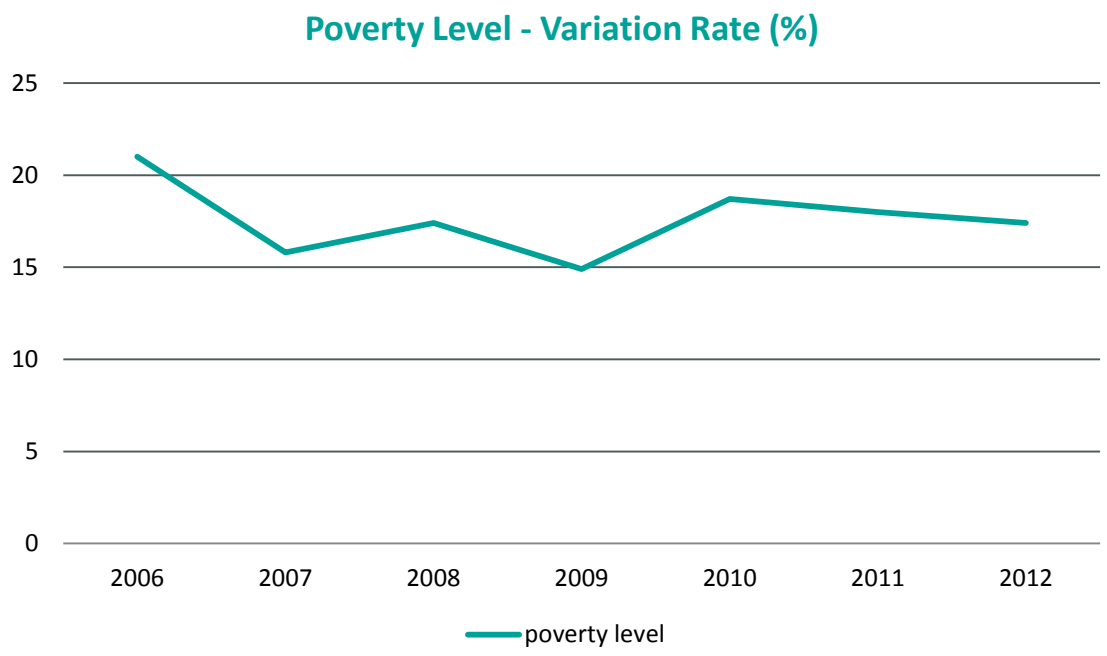


Figure 18: Variation rate of poverty level (%)

V.II.III Variation Rate of Tertiary Education Level by Gender

The data has been obtained from TurkStat for the years from 2008 to 2012 at the NUTS 2 (TR1-Istanbul) level. The data before 2008 cannot be found. The data indicates that there is a trend of continuously increase in tertiary education level for both gender. The data for each year can be seen in Table 19.

Table 19: Variation rate of tertiary education by gender (%)

YEAR	MALE (%)	VARIATION FOR MALE	FEMALE (%)	VARIATION FOR FEMALE
2008	3.92	-	3.14	-
2009	4.52	0.6	3.74	0.6
2010	4.73	0.21	3.93	0.19
2011	5.45	0.72	4.63	0.7
2012	5.71	0.26	4.98	0.35

Source: TurkStat
Geographic Level: NUTS II

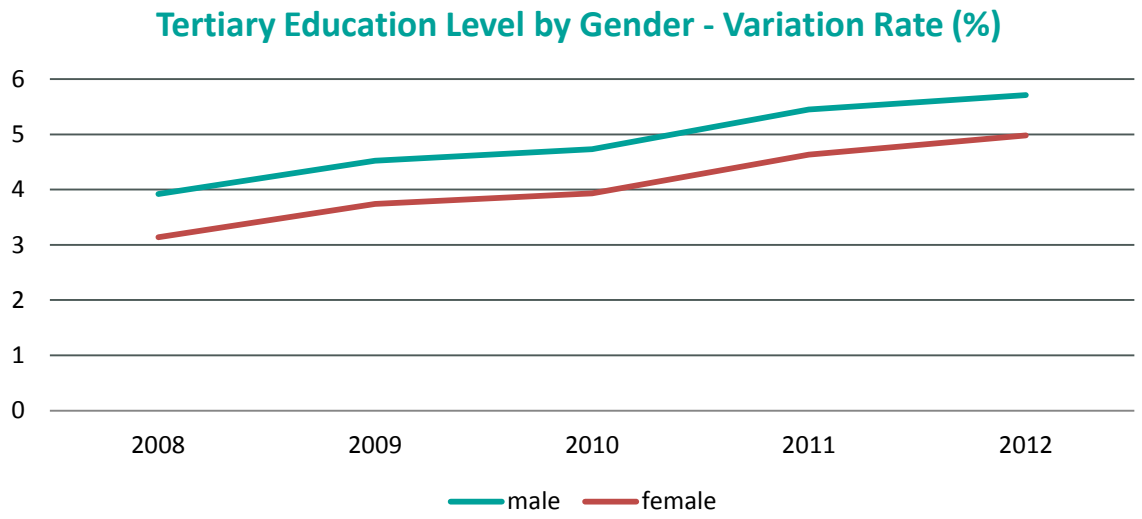


Figure 19: Variation rate of tertiary education level by gender (%)

V.II.IV Variation Rate of Average Life Expectancy

TurkStat formally produced the data in 2012 and 2013 for the first time. The life expectancy at birth for Istanbul was 77.2 in 2013 while it was 76.3 for Turkey. No more information about that dimension can be found. Life expectancy is higher than Turkey's average in Istanbul.

According to the variation rate of the data, the average life expectancy in Istanbul was decreased from 2012 to 2013.

Table 20: Average life expectancy

YEAR	LIFE EXPECTANCY IN ISTANBUL	VARIATION
2012	77.8	-
2013	77.2	-0.6

Source: TurkStat
Geographic Level: NUTS II

V.II.V Variation Rate of Green Space Availability

The data for this dimension has been obtained from Istanbul Metropolitan Municipality, Department of Parks and Gardens for the period between 2004 and 2012. In Istanbul, green areas are under the management of Istanbul Metropolitan Municipality or District Municipalities. The data contains only the green areas that are under the management of Istanbul Metropolitan Municipality. Because of the absence of a system that collects the green area information from all district municipalities, this data does not contain the amount of green spaces under the management of district municipalities.

The variation rate of green areas indicates a continuous increase in the amount of green areas in Istanbul since 2004. In 2012, the percentage of green areas in Istanbul has reached 9.09% with an increase of 3.44% since 2004.

Table 21: Green space availability (%)

YEAR	GREEN SPACE (KM2)	GREEN SPACE (%)	VARIATION
2004	308.64	5.65	-
2005	343.64	6.29	0.64
2006	384.01	7.03	0.74
2007	459.68	8.41	1.38
2008	479.83	8.78	0.37
2009	482.99	8.84	0.06
2010	483.85	8.86	0.02
2011	486.28	8.90	0.04
2012	496.93	9.09	0.19

Source: Istanbul Metropolitan Municipality
Geographic Level: Municipality

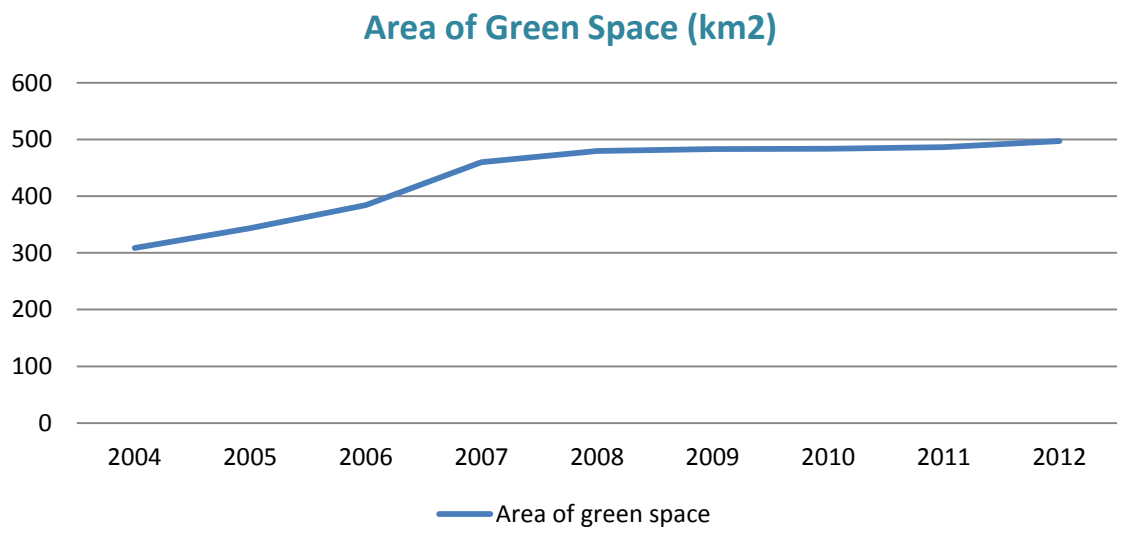


Figure 20: Green space availability by years (km2)

V.II.VI Existence of Monitoring System for Emissions Reductions

From the interviews with Istanbul Metropolitan Municipality Department of Environment Preservation and conducted researches it is concluded that there exist air pollution monitoring systems however, there is no CO2 emission monitoring system in Istanbul.

V.III ECONOMIC PERFORMANCE

V.III.I Level of Wealth Variation Rate

The data has been obtained from TurkStat for the years from 2004 to 2011. GDP per person is not available at the city level in Turkey, therefore, GVA (Gross Value Added) per person data has been used to describe the level of wealth in Istanbul. The source supplies the data as GVA dollars per person has been used for this dimension as given unit in the source.

The level of wealth has increased since 2004 except the decrease in 2009. The level of wealth for Istanbul which was 7,943 dollars/person in 2004 raised to 13,865 dollars/person in 2011. The variation rate between 2004 and 2012 is 74.5%.

Table 22: Level of wealth variation rate (GVA per person)

YEAR	LEVEL OF WEALTH (GVA per Person)	VARIATION
2004	7,943 dollars/person	-
2005	9,511 dollars/person	19.7%
2006	10,314 dollars/person	8.4%
2007	12,925 dollars/person	25.3%
2008	14,591 dollars/person	12.8%
2009	11,848 dollars/person	-18.7%
2010	13,416 dollars/person	13.2%
2011	13,865 dollars/person	3.3%

Source: TurkStat

Geographic Level: NUTS II

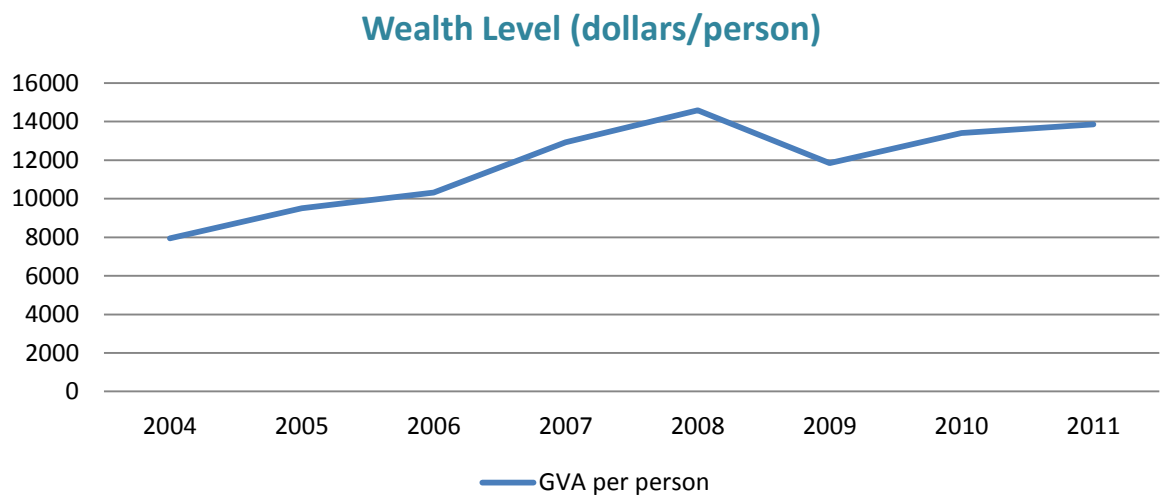


Figure 21: Level of wealth by years (dollars/person)

V.III.II Variation Rate of GDP by Sectors

The data for this dimension is available for the period 2007 - 2011 from TurkStat at NUTS 2 (TR1) level. The data is categorised as agriculture, industry and services. According to data the highest rate is services, industry follows as the second and agriculture has the lowest rate. Over the years small changes can be observed on the rate of each sector's GDP however the dominant sector has not changed. For Istanbul the weighted sector is services in terms of their rate of GDP.

Table 23: GDP by sectors (%)

YEAR	AGRICULTURE (%)	INDUSTRY (%)	SERVICES (%)
2007	0.2	27.5	72.3
2008	0.3	26.7	73.1
2009	0.2	24.9	74.9
2010	0.2	26.3	73.5
2011	0.2	27.4	72.5

Source: TurkStat

Geographic Level: NUTS II

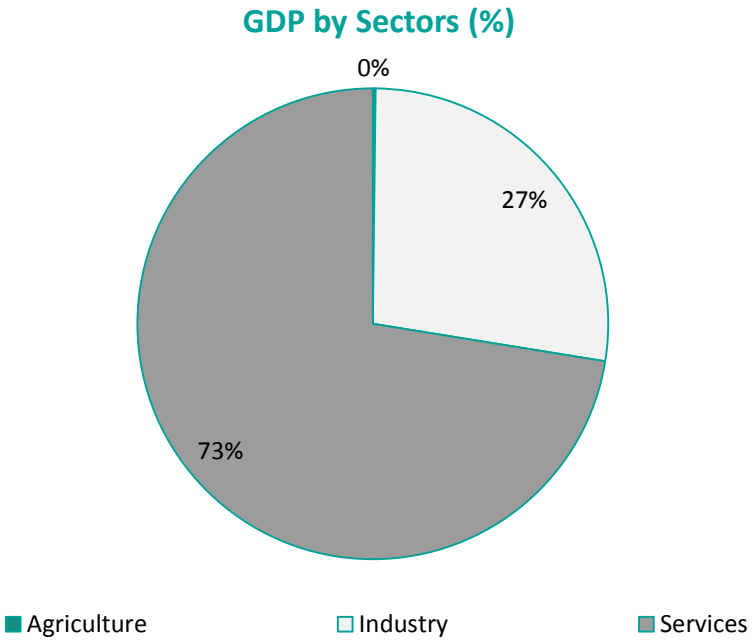


Figure 22: GDP by sectors, 2011 (%)

V.III.III Employment by Sectors Variation Rate

The data has been obtained from TurkStat for the years from 2004 to 2009. The sectors are categorised as agriculture, industry and services. When data for those years are compared, it can be observed that the rate of services continuously increases while agriculture and industry decrease. The major sector is services. It can be said that agriculture is very limited in Istanbul. The data for each year can be seen in Table 24.

Table 24: Employment by sectors variation rate (%)

YEAR	AGRICULTURE (%)	INDUSTRY (%)	SERVICES (%)
2004	0.8	42.6	56.7
2005	0.6	43	56.4
2006	0.5	41.9	57.6
2007	0.3	40.3	59.4
2008	0.4	40.1	59.5
2009	0.3	37.9	61.8

Source: TurkStat
Geographic Level: NUTS II

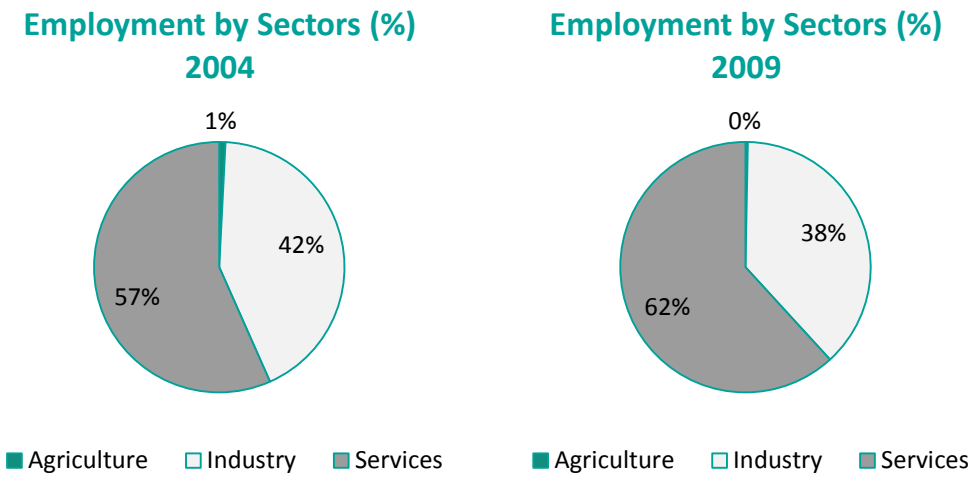


Figure 23: Employment by sectors, 2004, 2009 (%)

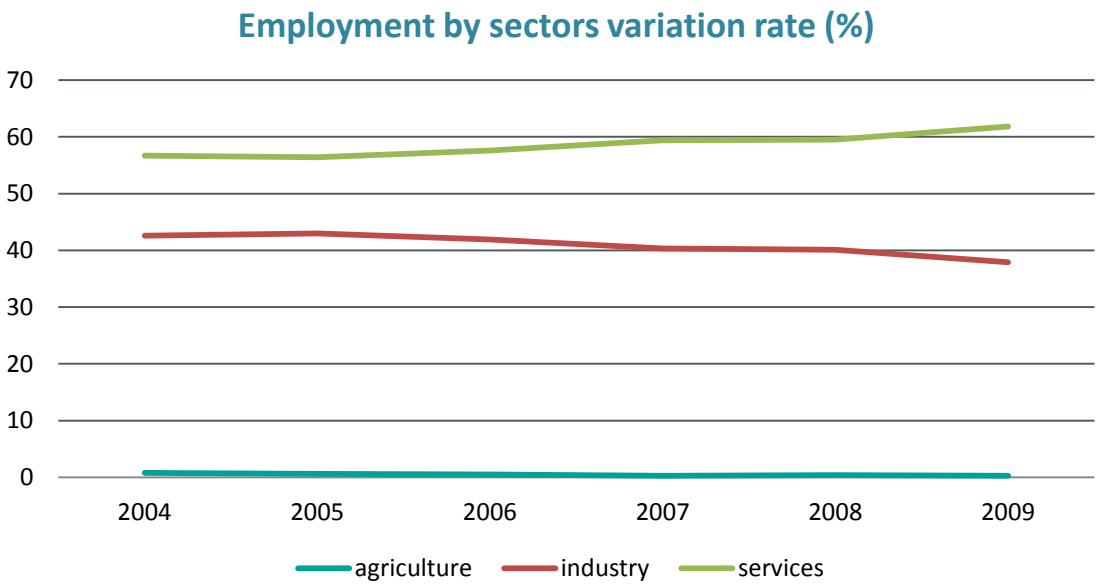


Figure 24: Variation rate of employment by sectors (%)

V.III.IV Business Survival Variation Rate

The ratio of companies surviving up to three years is not available for Istanbul. TOBB only reveals the number of opening and closing firms/companies by years. Therefore, for this dimension, the number of opened and closed firms for 2009,2010 and 2011 is given to make a comparison.

In 2010 18.18% more firms opened in Istanbul comparing with 2009 while 10.37% more firms opened in 2011 comparing with 2010. On the other hand 5.59% more firms closed in 2010 comparing with 2009 and 23.09% more firms closed in 2011 comparing with 2010.

Table 25: Number of opened and closed firms

YEAR	OPENED	VARIATION (%)	CLOSED	VARIATION (%)
2009	31216	-	11513	-
2010	36894	18.18	12157	5.59
2011	40721	10.37	14965	23.09

Source: TOBB

Geographic Level: Municipality

V.III.V Budget Deficit Variation Rate

There is no data on this dimension. The budget deficit is not determined at the local level in Turkey.

V.III.IV Indebtedness Level Variation Rate

The data has been obtained from Istanbul Metropolitan Municipality for the period 2006-2012. It has been calculated as extracting the income of the municipality from the expenditure of the municipality. The difference is the debt of the municipality for both domestic and foreign.

The level of indebtedness increased from 2006 to 2010 however in 2011 a sudden decrease that continues also in 2012 has been observed. The indebtedness level has increased 1.7% since 2006.

Table 26: Indebtedness level variation rate (%)

YEAR	INDEBTEDNESS (%)	VARIATION
2006	7.8	-
2007	17.9	10.1
2008	18.3	0.4
2009	24.1	5.8
2010	31.7	7.6
2011	13.4	-18.3
2012	9.5	-3.9

Source: Istanbul Metropolitan Municipality

Geographic Level: Municipality

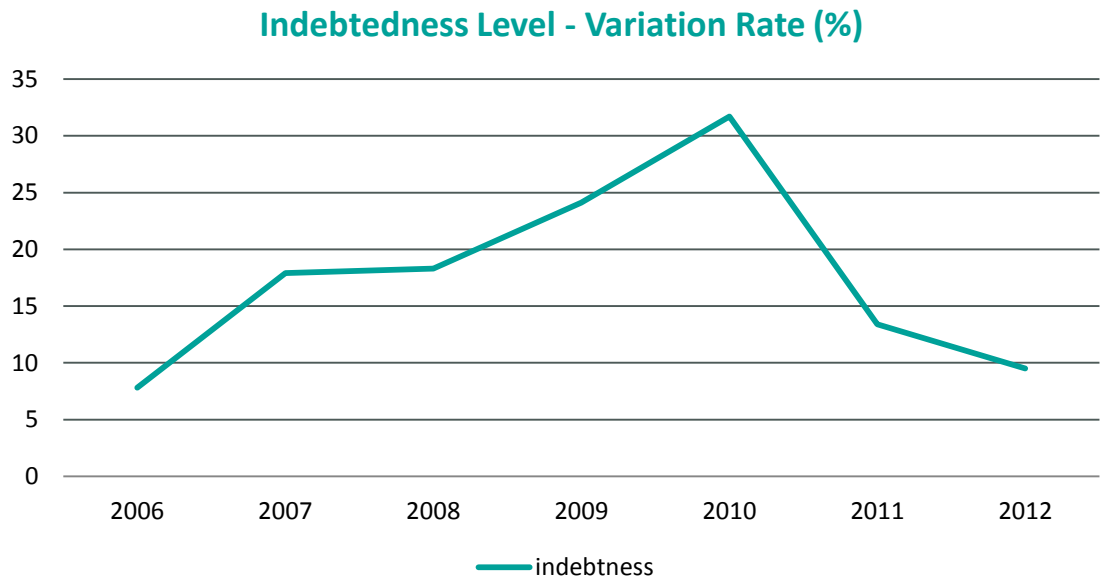


Figure 25: Indebtedness level variation rate (%)

V.III.IV R&D Intensity Variation Rate

The data has been obtained from TurkStat for 2010 and 2011. A slight change on R&D intensity can be observed from 2010 to 2011.

Table 27: R&D Intensity variation rate

YEAR	R&D INTENSITY (%)	VARIATION
2010	0.6286	-
2011	0.6857	0.05

Source: TurkStat
Geographic Level: NUTS II

VI FINDINGS AND KEY CHALLENGES

Istanbul's population has reached 13 million and continues to increase rapidly. The increase in urban population causes sprawl of the city towards peripheries, enlargement of settled and built area. This situation brings some problems such as stress on natural protection areas and forests, long travel time in traffic, air and environment pollution. Population increase is the primary challenge for Istanbul.

Data collection and monitoring for some dimensions are not supplied in Turkey. In the process of data collection that was the main challenge confronted. The system for data collection and publishing is a challenge for Turkey to be developed. Therefore, in this study some dimensions have data only for

one year even some do not have at all. This situation creates problems to find out the trend about dimensions, comparison between past and today and makes factual comments on the dynamics of the city.

Environmental performance data is available for one year in most of dimensions. The reason for this is recently created consideration on environmental issues. The data is obtained from some special studies on Istanbul. The urban sprawl threatens the natural protection areas. The trend of urban sprawl and population increase put the natural protection areas at risk. Increasing population causes also an increase in energy demand.

Public transportation investments are increased by municipality. Istanbul Metropolitan Municipality gives importance to expand the public transportation to all over the city. Transportation Master Plan of Istanbul (2011) focuses on public transportation, integration of different modes and decreasing the share of automobile in the traffic. Increasing the share of public transportation in the city is one of the main targets of the municipality.

Istanbul has improving trends on social performance. Unemployment and poverty levels are decreasing. Although there is no significant decrease and there is a stable situation in recent years, the decrease over the years is obvious. Also, Istanbul is in a better condition when it is compared to Turkey's average data. The education level increases, life expectancy is higher than Turkey’s average.

Economic performance data indicates that the wealth level is increasing in Istanbul. The city is the economic center of Turkey that attracts investments, enterprises, co-operations in Istanbul. Therefore, the city has a dynamic and developing structure in its economy. Its geographic location is an advantage for the economic development. The primary sector in Istanbul is the services sector. Services sector has both the highest GDP rate and the highest employment rate. According to economic trends of Istanbul, the rate of services sector is increasing over the years, while the rate of industry and agriculture is decreasing. Istanbul is not an agricultural city with its limited agricultural land.

When social, environmental and economic performance of the city is compared, the weakest dimension is the environmental performance. According to social performance data Istanbul has a positive trend over the years. Economic performance data also indicates a positive trend over the years. However, environmental performance is the most underestimated aspect of the city by local and national governments. The data collecting and monitoring system is not developed by governments. Urban and economic development's impact on environment is not considered. While encouraging economic investments, environmental aspects are underestimated. The importance of environment and protection of nature has recently taken into consideration. Therefore, the environmental performance of Istanbul should be seriously taken into consideration and be improved.

VII RECOMMENDATIONS

Based on the indicators in this report, the following recommendations can be given for Istanbul:

- Istanbul needs an accurate data collection and monitoring system especially on environmental dimensions
- Population increase and urban development should be controlled and developed in a more sustainable way.
- Over-migration causes transportation, infrastructure, housing, risk management problems. The migration problem should be solved by strengthening the local administration, implementing the national strategies and limiting the migration to Istanbul.
- More sustainable approaches to the city should be adopted instead of pure economic concerns.
- Cooperation of public organisations, private institutions, academics, NGOs and citizens should be sustained. The decisions, plans and regulations should be transparent. Participatory approach is necessary for the development process.
- Further environmental measures, legislative regulations can help improving environmental performance.
- Citizens should be enlighthen about future challenges of the city and how they can contribute to the future development.
- Despite the investments on public transportation private car is still main transportation mode in the city. Public transportation should be made more attractive for citizens.
- Urban renewal is in the most active period in Istanbul. Old and risky buildings are rebuilding all over the city. While rebuilding the structures, more energy efficient and sustainable buildings should be constructed.
- Carbon emissions and air quality should be monitored in order to put a target on reducing carbon emission and increasing air quality.
- Urban waste recovery amount should be improved by municipality. Citizens should be educated about recycling, separate collection of waste and using environmentally friendly products.
- The economic potential of Istanbul should be used in a more sustainable way. New solutions should be created to decrease unemployment and poverty while protecting environment.
- At the regional level, actions should aim at strengthening the networks between firms, encouraging links up and down supply chains, and facilitating the insertion of small firms into the wider process of technological and managerial change.
- Without development in other parts of the country Istanbul will continue to face the challenges that it suffers. A national strategy for managing future growth is a necessity.

VIII CONCLUSIONS

Istanbul is in the initial stage of post-carbon city development. It has a lot of challenges and advantages as well to organize a more sustainable and post-carbon city. Istanbul's geographic location, economic attraction, natural values, historical and cultural heritages, tourist attractiveness are the main advantages. On the other hand, population increase, immigration, urban sprawl and the pressure on natural areas are the major challenges of the city. Development and protection measures should be considered in a sustainable way and regulations should be made by local and national governments for social, economic and environmental viability of the city.

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