WATER GOVERNANCE MAPPING REPORT: TEXTILE INDUSTRY WATER USE IN TURKEY

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SWEDEN TEXTILE WATER INITIATIVE

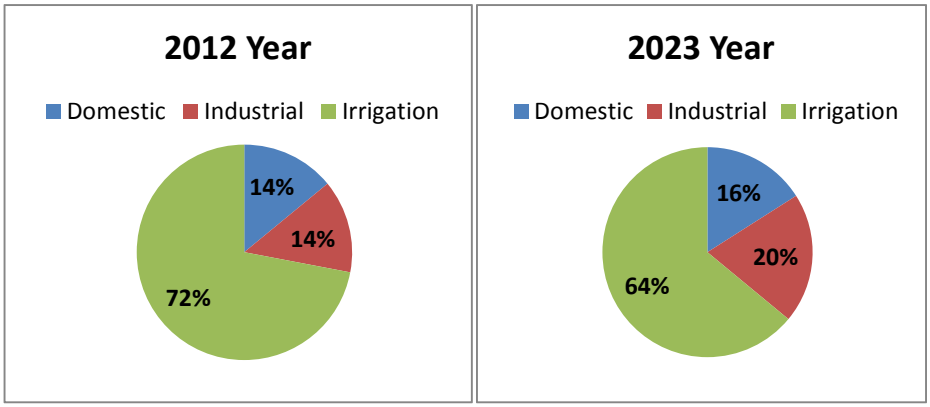
Executive Summary

Turkey's textile industry has experienced technological and institutional advances over time and is gradually entering a maturity phase. It contributes significantly to the country's economy through 7.2% of recorded industrial employment and 18% of total export revenues making it the second biggest export earner. With its rather complex production system, the industry poses considerable environmental impacts through its intensive resource use and waste discharges to the environment. Water and wasterwater management is one of the main environmental issues of the industry with an estimated use of 350,000 m^3/day, which does not include poorly recorded groundwater use as its main water source. Water consumption is between 60 to 120 L/kg for cotton products and 110-650 L/kg for wool. Textile and garment industry is the second most water consumptive industry after basic metal industry, with a total annual water use of 191.5 million m^3 or about 15% of the total water use of the manufacturing sector.

The long term viability of Turkey's textile industry and its further growth are determined by the industry's sustainability across the supply chain, especially in water management. Sustainability performance is also a crucial part of ithe industry's innovative capacities in response to the ever changing consumer demands globally. Capacity building to improve the industry's sustainability performance involves a broad range of stakeholders. This report in particular looks at mapping the governance landscape in relation to textile water use in Turkey: existing actors, their roles and responsibilities as well as regulations and programmes in managing textile water use.

Turkey's development goal has set a target for the clothing sector to reach USD 52 billion export value in 2023. By 2018, which is the end of 10th Development Plan, the export target is USD 32 billion, which is double the current export value. For textile sector specifically, the export goal by 2023 is USD 20 billion, securing a 3.6% share of the global textile market and an interim target of USD13 billion by 2018, compared with USD 7.7 billion in 2011. Nevertheless, R&D expenditure as a critical condition to achieve textile sector development goal has been lagging, especially compared to the national picture.

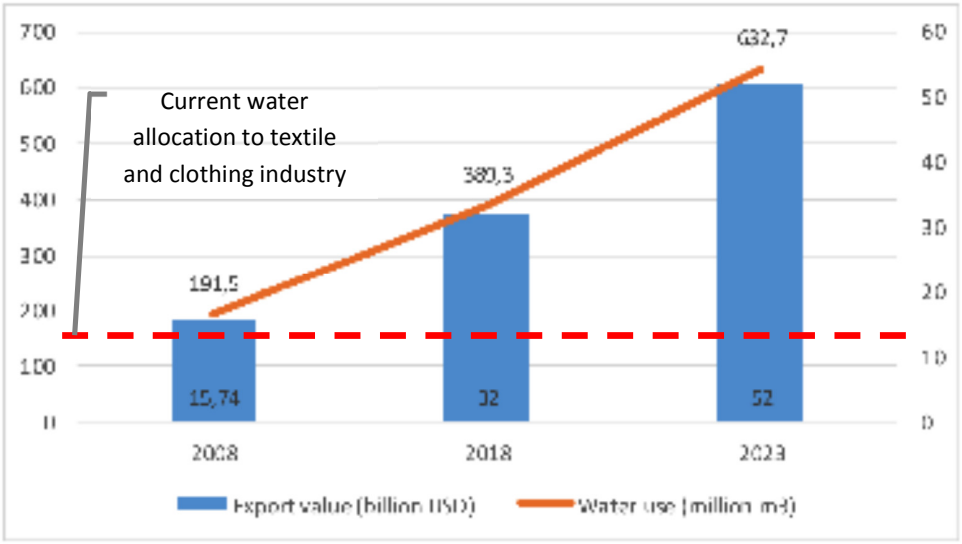
Current water availability in Turkey is 1519 m^3 water/capita/year and predicted to be 1120 m^3 water/capita/year in 2030, rendering Turkey as a country with water shortage problem. By 2023 Turkey's total water consumption will be 112 billion m^3, comprising of 72 billion m^3 for irrigation, 18 billion m^3 for drinking and human consumption, and 22 billion m^3 for industry. Considering the effects of existing population and economic growth rate and a change in water consumption habits, there will be increasing pressure on Turkey's water resources in the future.



Water Use by Sectors in Turkey

Physical water risks for the industry materialize in both quantity and quality aspects. In terms of quantity, total water use of the industry is 1.22 billion m^3/year, out of which the main freshwater source is groundwater (66.7% of its water supply). At the same time the industry is a major water user, consuming 20.2 % of municipal water supply and 28.2% of recorded groundwater abstraction. High water consumption of the industry against the already scarce freshwater availability in the country poses the industry to considerable quantitative water risk.

Under business-as-usual scenario, the industry will have a water demand of roughly 632.7 million m^3 by 2023 in order to achieve Turkey's development target for the sector. With current water allocation merely 18% of the predicted demand, the industry will need to drastically improve its water use efficiency to ensure its sustainability and viability. Currently, water reuse merely practiced by 1% of the industry's total water use. The lack of reuse have serious implications on the depletion of those freshwater sources. As a solution, continuous microfiltration systems and reverse osmosis may be considered as good alternatives to increase reuse.



Predicted Water Demand for Textile and Clothing Industry in Turkey

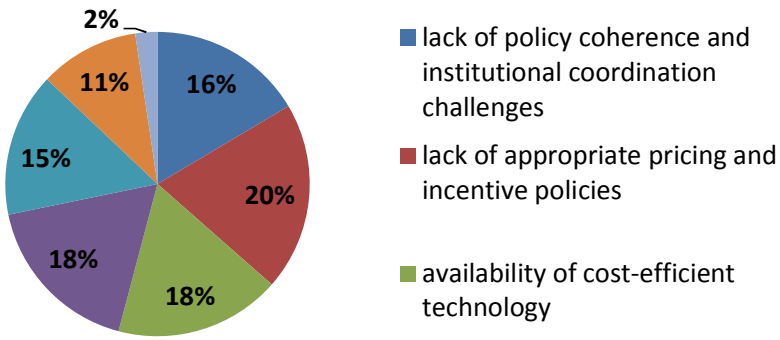
On the qualitative aspect, the textile industry is the sector with the highest wastewater discharge after the metal industry. From a total wastewater volume of 1.115 million m^3, 57% of that is discharged without treatment. The use of the ecosystem services of natural water bodies to dissolve pollutants is increasing. When wastewater discharge increasing in line with higher textile production, natural water resources availability is depleted. Apart from the fact that not all the textile and leather production units have wastewater treatment plants, only 13 % of the treatment plants in textile industry and 11% in leather industry have filtration units, which are necessary for improving the efficiency of removing pollutants in textile wastewater, e.g. suspended solids, BOD, COD, and SO_4.

In essence, two main water risks for the industry are: 1) further depletion of the already scarce freshwater resource will impose higher scarcity risk to the industry; and 2) inappropriate treatment and discharge of effluent further reduce future availability of quality freshwater.

A survey was conducted to get stakeholder's view from both public and private actors on which physical water risks are of high priority for the textile industry. Most of the respondents expressed that "water pollution prevention and control" is the priority issue in Turkey. "Water use efficiency" and "secure water supply across competing uses, including water allocation to the textile industry" are the next important priority issues, respectively.

Turkey has undertaken activities to harmonize its legislations with those of the European Union, including environmental regulations, eventhough legislation enforcement and sanction remain challenging problems. The textile sector in Turkey has initiated some preparations for the Textile Industry Environmental Declaration that informs essential environmental effects of a given product. The key actors that regulate and audit water-related issues related to the industry are the Ministry of Forestry and Water Affairs, the Ministry of Environment and Urbanization, and the General Directorate of State Hydraulic Works under the Ministry of Forestry and Water Affairs. The general approach of Turkey's environmental legislation is mainly towards end-off pipe treatment, but cleaner production and integrated environmental management have gained importance with EU harmonization requirements. The Integrated Pollution Prevention and Control (IPPC) Directive in particular is considered as the most important environmental regulatory framework regulation that control pollutions caused by large industrial plants through the use of Best Available Technology (BAT). There are also a number of existing research and policy initiatives toward sustainable textile industry. The Textile Technology Platform, for instance, are related with determining bio-materials and bio-technologies and environmentally friendly activities.

According to the stakeholders, the main barrier in managing water risks and capturing opportunities effectively is the lack of appropriate pricing and incentive policies. The next main barriers are the availability of cost-efficient technology and the need for effective Centralized Effluent Treatment Plants.



Main Barriers for Managing Water Risks and Taking Opportunities Effectively

With regard to the performance of water governance, the interviewed stakeholders stated that wastewater discharge permits and pricing options have the lowest performance rates, especially in accountability principle as these policy instruments are not applied with high importance for industrial water use. Contrary to this, water allocation for the textile industry is seen to be highly accountable. More than half of the respondents were satisfied with the monitoring and enforcement in industrial water use.

This report suggests the following priority areas for building the industry's capacities in managing water risks and improving its environmental sustainability:

1) Identification of key challenges in improving good governance in water pollution prevention and control, in terms of transparency, accountability, and participation, from policy design, implementation, coordination and enforcement aspect.

2) Exploration of appropriate incentive and pricing policies to encourage faster adoption of water-efficient and cleaner technology for the industry, including analysis on the effectiveness of existing regulations and incentives or the potential for new policies.

3) Investigation of cost-efficient cleaner technologies, especially those that will effectively improve the effluent quality and that is appropriate for the industry with regard to the scale, characteristics, and production line of the textile units.

4) Enquiry of the main barriers and potential solutions to improve the performance of existing CETPs and encourage construction of new CETPs.

5) Investigation of alternative solutions to improve water supply reliability for the industry that contributes to water security across various water users in Turkey.

The capacity building workshop organised in Istanbul have identified concrete actions that can catalyse sustainable textile water management in Turkey:

1. Nature: real time monitoring of waste water discharges.
2. Economy: Designing integrated wastewater treatment plant.
3. Society: ISO 70001 Water Traceability Management.
4. Health and wellbeing: improved regulation.

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Chapter 1 Introduction

1.1. Background

With its vibrant economy and strategic location at the crossroads of Europe and Asia, Turkey has grown to be the world's 20 largest economies. The country benefits from the large tracts of arable land, long coastline and young growing population. In the last few decades, the country has undertaken a series of economic reforms and experienced a transition from agriculture and manufacturing based economy to a more diversified economy with a large global services sector. Following the global financial crisis, Turkey came out with the global third highest growth rate in 2010 and attracted substantial increase in foreign direct investments. Despite this tremendous growth, the country has struggled with a relatively high unemployment rate and high import dependence on energy resources, which affect the competitiveness of its industries, including the textile industry[1].

The textile industry has a long history and cultural importance that traced back to the 16th centuries. Turkey's textile industry has undergone an evolution of technological and institutional advances over time and it is gradually entering a maturity phase. Textile is one of the most important industries in Turkey that contributed to 7.2% of the recorded industrial employment in 2011[2]. The textile and apparel industry contributed to 18 percent of the country's total export revenues in 2010. The ready-made clothing industry itself is the second biggest export earner after the automotive industry. Nevertheless, the sector suffers from weakening position in international markets due to increased input costs and increasing demand for sustainability requirements.

Since the textile industry in Turkey is quite fragmented and involves rather complex production system with various production processes, it uses significant amount and various kinds of chemicals, raw materials, energy and water. As a result, it poses considerable environmental impacts through its intensive resource use and waste discharges to the environment. Water and wasterwater management is one of the main environmental issues of the industry with an estimated water use of 350,000 m^3/day, which does not include poorly recorded groundwater use as its main water source. The Turkish Statistical Institute reported that the industry was the second largest industrial water consumer in 2008 (15% of industrial water use). Water pollution problems are increasing as the sector has grown considerably. Wasteful energy use is another major environmental concern of the industry, which is the third most intensive sector in Turkey after iron/steel and cement industries.[3] As water and wastewater management is intricately linked to energy use by the industry, tackling water issues address the two major environmental issues of the industry simultaneously.

Located in a semi-arid region, Turkey has some of the highest levels of water scarcity threat of the countries in Europe as measured by human water security (HWS)[i] according to a recent study by Vörösmarty et al (2010).[4] Most areas in the country are densely populated and face a very high water

[i] The adjusted Human Water Security Threat (HWS) indicator takes into account multiple pressures on the environment as well as existing investment level in water infrastructure and the way these combine with each other as reflected in water flows in river basins.

stress level. There is a declining trend of per capita water availability from 3700 m^3 in 1997 to currently 1300 m^3. This water scarcity risk is predicted to be increasing with rapidly rising population and rising temperature from climate change and Turkey will be a water deficit country in the future.[5] Water pollution both for surface and ground water resources also intensifies in line with increasing population, industrialisation and increased use of fertilizer and herbicide in agricultural practices. Most basins in Turkey were indicated to have very high water stress level which means that the basins have been heavily exploited or "environmentally water stressed".[6]

Water resources and energy are the main natural resources that determine the sustainable growth of Turkey's economy. Turkey's water policy is still dominated by water resources development through massive dam development programme to meet the demand for both electricity and water resources. Sustainability and ecological concerns still take a secondary importance eventhough there has been increasing efforts to protect water bodies through substantial investments in sewage systems and waste-water treatment plants. Institutional reform with stronger mandate for environmental protection of the water resources, which is mainstreamed to the policies of water use sectors, is seen as crucial.[7]

Considering the increasing water scarcity in the country, the long term viability of Turkey's textile industry and its further growth are determined by the industry's sustainability across the supply chain, especially in water management. Sustainability performance of the industry is also a crucial part of its innovative capacities in response to the ever changing consumer demands that pose increased competition globally. Capacity building to improve the industry's sustainability performance involves a broad range of stakeholders, from the companies themselves, other supporting industries, civil societies as well as good water governance of textile water use. This report in particular looks at mapping the governance landscape in relation to textile water use in Turkey: existing actors, their roles and responsibilities as well as regulations and programmes in managing textile water use. This governance landscape will need to address the challenges of water risks faced by the industry and improve the industy's capacities in managing those risks.

1.2. Objective

This report aims to:

a) Assess physical water risks pertaining to the textile industry in Turkey.
b) Investigate water governance landscape and governance related (regulatory) water risks in relation to the textile industry in Turkey.
c) Inform priority areas for the needs of capacity building in sustainable water management in the textile industry in Turkey.

1.3. Methodology

The information, analysis and recommendation in this report are built on:

a) Comprehensive desk research and data review of international and local sources.
b) Interviews with a number of stakeholders, which include public actors (government agencies, researchers, experts, and civil societies) as well as private actors (business associations, suppliers and technology solution providers).
c) Feedback from the stakeholders gathered through interviews and capacity building workshop held on 9 November 2016 in Istanbul.

Chapter 2 Textile and Leather Industry in Turkey

2.1. The Significance of the Textile Industry

Textile sector is one of the most important industries in Turkey. Its contribution to GDP is around 7% and its share in total export volume of Turkey is 18.3% based on 2013 data. There are more than 52,000 companies within the textile industry employing 918,000 workers and most of them are small and medium enterprises (SMEs).[8] As a whole, the clothing and textile industry contributed to 10 percent of GDP and 14.15 percent of industrial production in Turkey.

Turkey has a significant role in the global textile industry. Its contribution to the global trade was valued at USD 13 billion (4%) for textile and USD 17 billion (3.3%) for clothing in 2014. On the upper supply chain, Turkey is the eight largest cotton producer and fourth largest cotton consumer in the world. Further down in the supply chain, Turkey is the seventh largest clothing supplier in the world and third largest in Europe. The country has set a target for textile and clothing industry of achieving USD 52 billion export revenues by 2023.

Approximately 65% of total textile production is exported. In terms of material composition, cotton constitutes to 80% of exported clothing; while for the fabric structure, 62% of export is knitted clothing and the rest is woven clothing.[8] The textile sector export and import data of 10-year period between 2005 and 2014 is shown in Table 1.[9] Although there are fluctuations in both export and import values, from 2009 export values are continuously increasing.

Table 1. Turkey Textile and Clothing Foreign Trade for Ten Years (US $)

Year	Export	Annual Variation	Import	Annual Variation
2005	13,422,476,709	-	751,144,589	-
2006	13,569,690,083	1.1%	1,039,973,044	38.5%
2007	15,577,956,348	14.8%	1,520,571,873	46.2%
2008	15,251,170,762	-2.1%	2,122,526,496	39.6%
2009	12,868,195,771	-15.6%	2,020,994,943	-4.8%
2010	14,205,917,174	10.4%	2,704,270,671	33.8%
2011	15,648,660,734	10.2%	3,165,676,374	17.1%
2012	15,753,400,255	0.7%	2,502,472,382	-20.9%
2013	17,150,270,228	8.9%	2,971,397,265	18.7%
2014	18,499,643,985	7.9%	3,062,519,116	3.1%

Source: Ministry of Economy Information System, 2015.

2.2. Textile Industry Water Use in Turkey

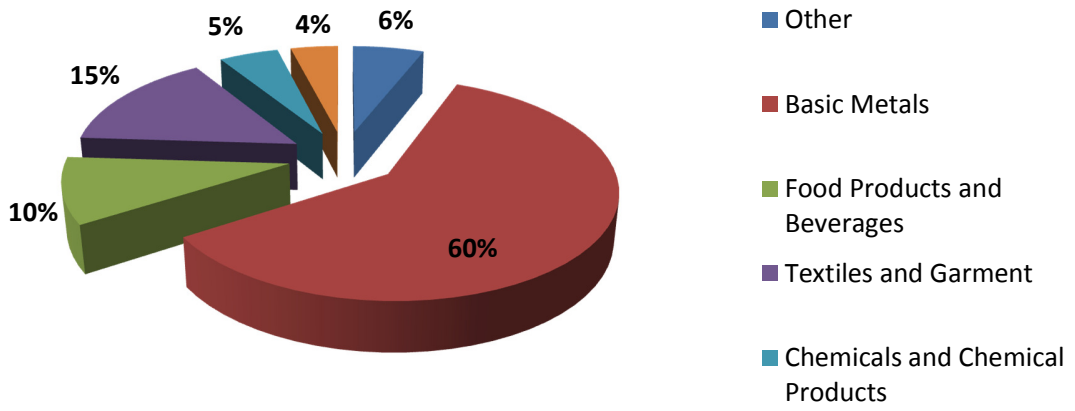
Environmental data for textile sector in Turkey is not easily available. Rather than textile sector specific data, the most relevant available data is the total water consumption for manufacturing industry. As a highly water intensive sector, Turkey textile sector consumes 350000 m^3/day water.[10] Considering the type of produces, water consumption is between 60 to 120 L/kg for cotton products and 110-650 L/kg for wool.[11] Water requirements of wet processes for cotton textile are elaborated in Table 5.[12]

Table 2. Water Requirements for Cotton Textile Wet Finishing Operations

Process	Requirements in L/1000 kg of product
Sizing	500-8200
Desizing	2500-21000
Scouring	20000-45000
Bleaching	2500-25000
Mercerizing	17000-32000
Printing	8000-16000

Source: Shakih, 2009.

Based on 2008 Turkish Statistical Institute data, textile and garment industry consumed 191.5 million m^3 water, which makes 15% of the total water consumption of Turkish manufacturing sector. This makes the textile sector as the highest water consuming industry after basic metal industry as shown in Figure 1.[10]



Source: TTGV, 2012.

Figure 1. Water Consumption Allocation for Turkish Manufacturing Sector

2.3. Outlook of the Textile Industry

Turkey has set the goals for each development sector by 2023, which coincides with the one hundredth anniversary of the foundation of our republic. In essence, the primary objective of the targets of Turkey's textile sector is to increase export values through design, fashion, brand and research and development (R&D) based studies. This goal is translated into the following targets:

1) Creating conducive conditions to be a fashion-brand-generating country, rather than merely serving the global textile brands,
2) Strengthening the role of organizing country position by utilizing the advantage of organizational power and the geographic location of textile industry,
3) Using new technologies, catalyzing innovative and multi-functional product to become one of the leading countries for increased technical textile production and export,
4) Generating productivity growth through modernization and reorganization of production capacity,
5) Increasing added value in export through production of special and high added value products, special fibers and high-tech yarns,
6) Increasing competitive capacities through strategic partnerships and organizations,
7) Strengthen foreign retailing in marketing,
8) Technology renewal of existing production infrastructure, increasing labor force quality and making productivity oriented by environmental friendly investments.

The clothing sector aims to reach USD 52 billion export value in 2023. The target at the end of 2018, which is the end of 10th Development Plan, is doubling the current value of USD 16.2 billion to USD 32 billion.

The export goal for the textile sector by 2023 is USD 20 billion, securing a 3.6% share of the global textile market. This is an increase from USD 7.7 billion in 2011 and the interim target of more than USD 13 billion by 2018.[13] The sector aims to cover 3.67% of Turkey's total exports by 2023, which comprises of the following targets:[14]

a) Fiber and yarn: USD 2.5 billion,
b) Woven fabric: USD 5 billion,
c) Knitted fabrics: USD 3.5 billion,
d) Technical textiles and non-woven surface fabrics: USD 4 billion,
e) Textiles for the home: USD 4 billion,
f) Other textiles: USD 1 billion.

Based on 2023 vision of Turkey, the export projection of textile, clothing and garment industries are summarized in the Table 3 while the employment projections for the sectors are shown in Table 4.

Table 3. Export Projection (Million Dollars)

Export Projection	2008	2009	2010	2011	2012[a]	2008-2012 Variation %	2013[b]	2018[c]	2013-2018 Variation %
Clothing and Garment Industry Export Income (1)	15,740	13,208	15,500	16,200	16,200	2.9	17,350	32,000	84.4
World Clothing and Garment Industry Export (2)	407,525	360,164	397,558	465,838	465,838	14.3	530,000	810,000	52.8
Turkey's Share in World Clothing and Garment Trade (%)	3.86	3.67	3.90	3.48	3.48	-10.0	3.27	3.95	20.7
Textile Sector Export	6,817	5,514	6,600	7,300	8,000	17.4	8,800	13,200	50.0
World Textile Export	243,199	199,500	247,457	291,278	291,278	19.8	285,000	360,000	26.3
Turkey's Share in World Textile Sector %	3.06	2.35	2.68	2.51	2.75	-10.1	3.09	3.67	18.8

Note: [a] Accrual Estimation, [b] Target, [c] Projection.

Source: Ministry of Development, 2014.

As an emerging market economy, Turkey is one of the world's newly industrialized country in terms of agricultural products, textiles, motor vehicles, ships and other transportation equipment, construction materials, electronics and home appliances. In recent years, Turkey has had a rapidly growing private sector, even though the state still plays a major role in the industry.[15]

Table 4. Textile, Clothing and Garment Sectors Employment Projection (people)

Sector	2009*	2013	2018	2023
Textile	331,438	400,000	550,000	700,000
Clothing and garment	358,116	500,000	750,000	1,000,000

Note: *Social Security Institution Records.

Source: Ministry of Development, 2014.

Although R&D is a critical condition to achieve textile sector development goal, R&D investment level in the sector has been lagging, especially compared to the national picture. According to TurkStat data, the national R&D expenditures[ii] in Turkey have been increasing in the last decade, with the total R&D expenditures in 2012 amounted to USD 7.27 billion, which was five times more than ten years before. At the same time, the increase in the R&D intensity[iii] was less than twice. Although there was an increase of almost 600 percent in ten years, the total R&D expenditures of the sector were about 58 million dollars as of 2012. In addition, the share of R&D expenditures of the textile and apparel industry in the total R&D expenditures of Turkey was less than 1%. Table 5 shows the details of this situation, which is adapted from TurkStat data.

[ii] R&D expenditures are any expenses related to the research and development activities to produce goods and services.

[iii] R&D intensity is the ratio between R&D expenditures and the sales of goods and services.

Table 5. R&D Expenditures of the Turkish Textile and Apparel Industry

Year	Turkish Economy (million USD)	Textile and Apparel Industry (million USD)	The Share of Textile and Apparel Industry	R&D Intensity of Turkish Economy
2002	1,221	-	-	0.53%
2003	1,468	8,219	0.56%	0.48%
2004	2,032	9,188	0.45%	0.52%
2005	2,853	26,935	0.94%	0.59%
2006	3,067	25,374	0.83%	0.58%
2007	4,674	32,414	0.69%	0.72%
2008	5,316	39,043	0.73%	0.72%
2009	5,216	40,039	0.77%	0.85%
2010	6,162	41,755	0.68%	0.84%
2011	6,663	55,854	0.84%	0.86%
2012	7,271	58,892	0.81%	0.92%

Source: Adapted from TurkStat, 2015.

Chapter 3 Water Resources Situation in Production Country

3.1. Turkey's Water Resources

Turkey's water resources consist of natural lakes, rivers, reservoirs, and groundwater. There are more than 120 natural lakes around the mountains, including small lakes, and they are distributed across four main regions: Lakes Region, South Marmara, Lake Van region, and Lake Tuz region. Lake Van, as the largest and deepest lake in Turkey, has 3712 km^2 area and 1646 m depth. Besides natural lakes, there are 706 reservoirs in Turkey. The largest ones are Ataturk Dam with 817 km^2 area, Keban Dam with 675 km^2 area and Karakaya Dam with 268 km^2 area.[16]

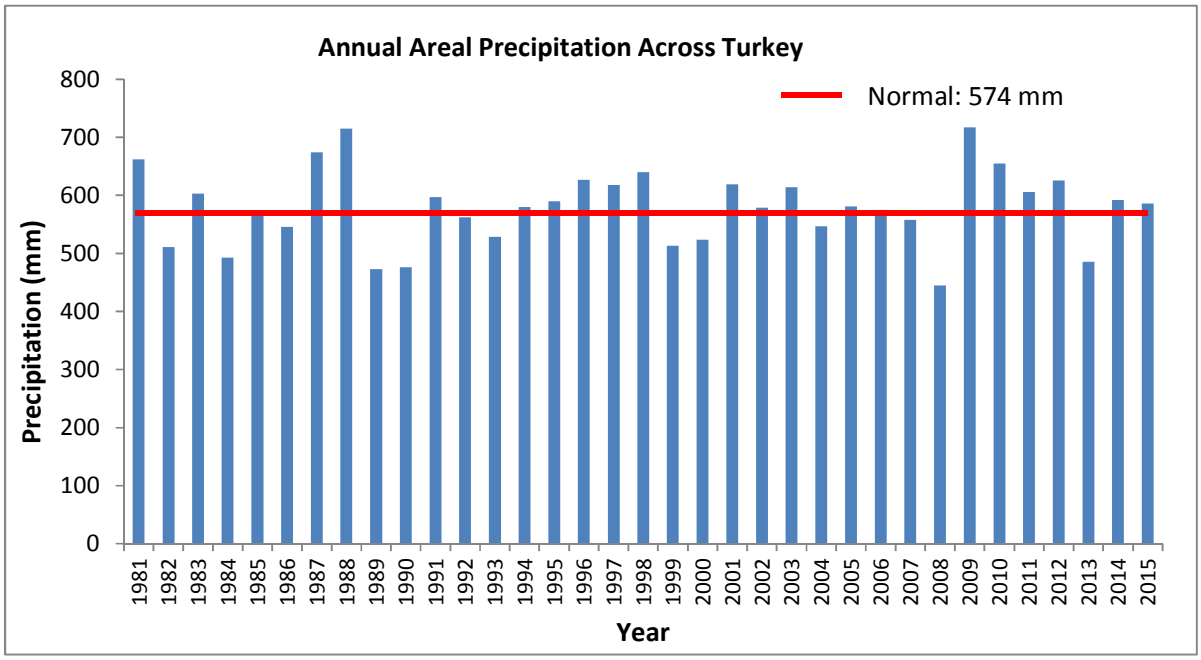
Turkey comprises of 26 river basins with a total surface area of around 780,000 km^2, in which six of them are in the large category (larger than 30,000km^2), 16 in the medium category (10,000-30,000km^2) and four in the small category (smaller than 10,000km^2). These basins are illustrated as follows.

Source: Ulugtekin et al. 2009.[17]

Figure 2. Turkey's River Basins

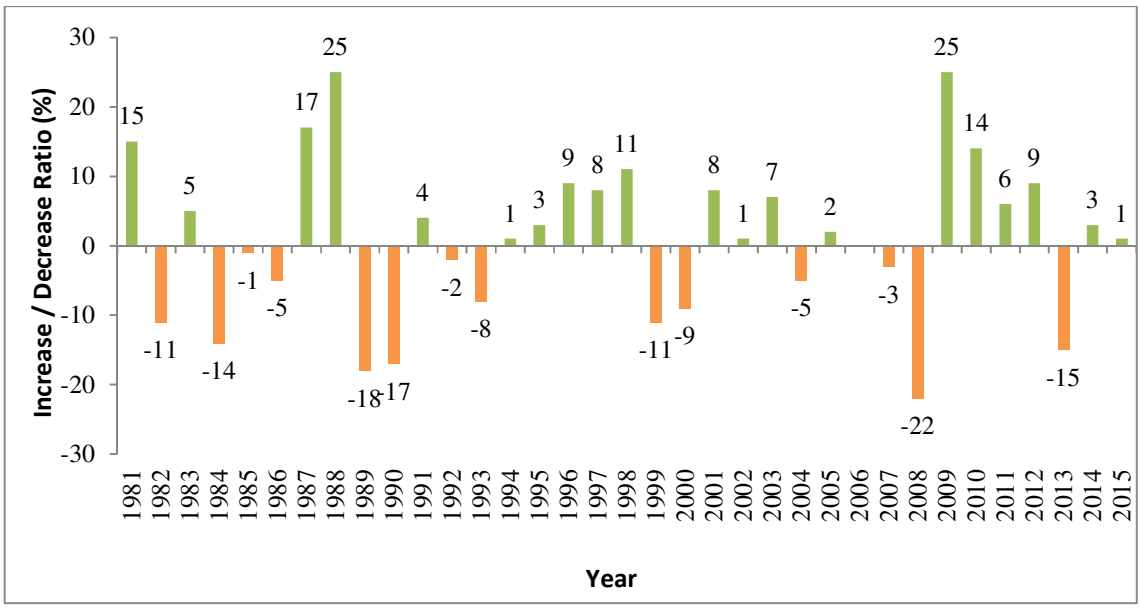
Average annual precipitation in Turkey is 643 mm, which corresponds to approximately 501 billion m^3 water annually. Of this amount, 274 billion m^3 evaporates to the atmosphere from soil and water surfaces and plants (evapotranspiration), 69 billion m^3 of the annual precipitation feeds the groundwater and 158 billion m^3 contributes to surface flow and reaches to sea and lakes in closed basins. 28 billion m^3 of the groundwater infiltration rejoins surface water resources by springs.[16] The annual areal precipitation data

between 1981 and 2015 can be seen in the Figure 3. Average areal precipitation for long years (1981-2010) was 574 mm. Figure 4 shows annual areal precipitation anomaly.[18]



Source: Turkish State Meteorological Service, 2016.

Figure 3. Annual Areal Precipitation across Turkey



Source: Turkish State Meteorological Service, 2016.

Figure 4. Annual areal precipitation anomaly in Turkey

The total renewable water potential of Turkey is calculated as 234 billion m^3. However, because of the technical and economic feasibility, the total consumable surface water potential is approximately 98 billion m^3 per year, consisting of 95 billion m^3 water from domestic rivers and 3 billion m^3 water neighboring riparian countries. Together with 14 billion m^3 groundwater potential, total average surface and groundwater potential of Turkey is 112 billion m^3 per year. The General Directorate of State Hydraulic Works reported Turkey's water budget as follows.

Table 6. Turkey Water Budget

Parameter		Amount
Average annual precipitation		643 mm/year
Annual precipitation		501 billion m^3
Evaporation		274 billion m^3
Seepage to groundwater		41 billion m^3
Surface water	Annual surface flow	186 billion m^3
	Usable Surface Water	98 billion m^3
Ground water	Annual extractable water amount	14 billion m^3
	Total usable water (net)	112 billion m^3
Water use	Irrigation water use	32 billion m^3
	Drinking water use	7 billion m^3
	Industrial water use	5 billion m^3
	Total water use	44 billion m^3

Source: General Directorate of State Hydraulic Works, Turkey.

Considering the amount of water per capita per year, countries can be classified as

- Water poor : usable water amount is less than 1000 m^3/ capita.year
- Water shortage : usable water amount is less than 2000 m^3/ capita.year
- Water rich : usable water amount is more than 8000-10000 m^3/capita.year

With usable water amount of around 1519 m^3 water per capita per year, Turkey is a country with water shortage problem.

By 2023 Turkey's water consumption is predicted by DSI to be at 72 billion m^3 for irrigation, 18 billion m^3 for drinking and human consumption, and 22 billion m^3 for industry which makes 112 billion m^3 in total.[19]

Based on Turkish Statistical Institute, Turkey's population will reach 100 million in 2030, which renders the usable water amount per capita per year to be around 1120 m^3. Considering the effects of existing population and economic growth rate and a change in water consumption habits, there will be increasing pressure on Turkey's water resources in the future, provided that the existing resources will not be

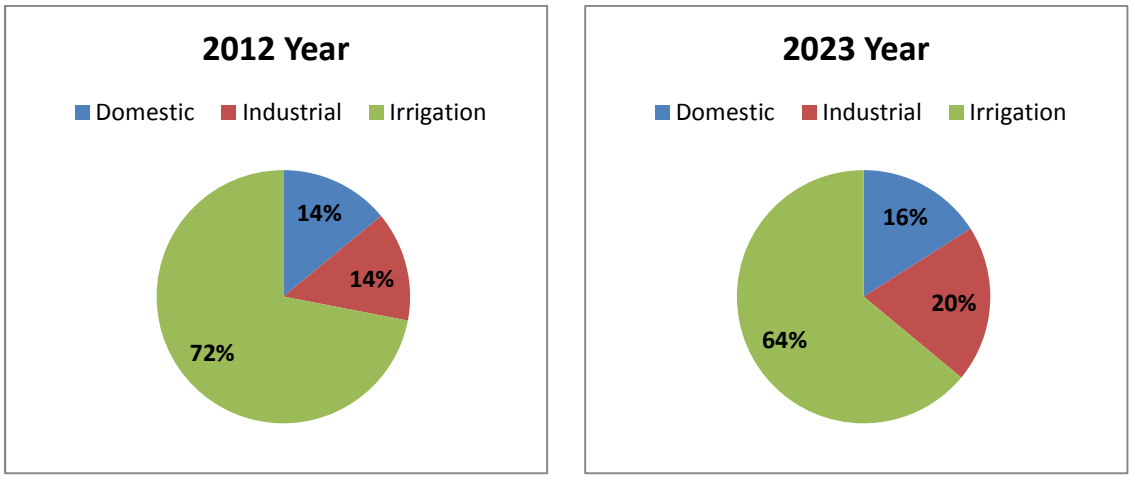
depleted in 20 years. For this reason, Turkey needs to protect its water resources and use them efficiently in order to keep healthy and sufficient amount of water for future generations.[16]

In 2011, 50 billion m^3 water was consumed in various sectors in Turkey; 36 billion m^3 in the agriculture, 7 billion m^3 in the water supply, and 7 billion m^3 in the industry. This sum corresponds to the development of only 45% of the available exploitable potential of 112 billion m^3. Turkey aims at using the available water resource potential in the country by 2023, which is the centenary of Turkish Republic. [34]

Table 7. Water Consumption by Sectors in Turkey

Water Consumption	2012	2023
Industrial	7 billion m^3	22 billion m^3
Domestic	7 billion m^3	18 billion m^3
Irrigation	36 billion m^3	72 billion m^3
TOTAL	50 billion m^3	112 billion m^3

Source: Ministry of Forestry and Water Affairs, 2012.



Source: Ministry of Forestry and Water Affairs, 2012.

Figure 5. Water Use by Sectors in Turkey

3.2. Climate Change Effects on Turkey's Water Resources

Climate change will impose further stress on water resources in Turkey. The main effect of climate change on water resources is the change in water cycle resulting in a decrease in usable water flow in Turkey. Precipitation is projected to decrease and temperatures will increase.[19] The increase in annual mean temperature is predicted to be around 2°C to 3°C for 2071-2100 period relative to 1961-1990 period. This

temperature increase will be higher in the eastern part of the country both in winter and summer, which leads to a decrease in surface water flow.[20] Due to the impacts of climate change, a reduction of up to 30% is estimated in Turkey's surface water resources, snow storage and ground water potential.[19] The snow water equivalent will be reduced up to 200 mm over the high plains of Eastern Anatolia and the eastern part of the Black Sea. Instead of snowfall, rainfall will be seen during winter.[20] This change will cause water shortages in elevated areas where water requirements are dependent on snow cover.[19]

In order to predict the climate change effects on water resources, a project called "Effects of Climate Change on Future of Istanbul and Turkey Water Resources" was conducted between 2008 and 2010 by the Water Foundation upon the request of Istanbul Metropolitan Municipality. The project finds that some decrease in the effect of climate change in terms of water shortages is expected in Southeastern, Central Anatolia and Aegean Regions while some increase is expected especially in Eastern Black Sea and Southwestern Mediterranean Regions. Moreover, frequency, duration and intensity of drought and wet periods will change.[21]

Beside the impacts on water quantity, climate change will also affect water quality. As a result of increased temperature and changed precipitations, sea levels will increase and this may cause saltwater intrusion to fresh water sources.[19] Furthermore, eutrophication in surface waters will increase. Salination and eutrophication of water source will cause economic burden in addition to their effects on ecology.[20]

Chapter 4 Physical Water Risk Outlook of the Textile and Leather Industry

4.1. Water Supply and Demand of the Textile Industry

Water supply has been a severe problem recently in Turkey. Droughts and water losses are compounding water shortages, while the capacities of reservoirs are at a fraction of their usual capacities. The Turkish government has invested on large water supply infrastructure, with almost 800 dams and a large number of water service and supply development projects completed or in-progress. There have been concerns about future water availability for domestic, irrigation and industrial purposes, and whether Turkey can manage its water resources through constructive management policies and irrigation methods.

Around 74% of freshwater is used for agricultural purposes, 15% for domestic and the remaining 11% for industrial purposes. Ministry of Forestry and Water Affairs of Turkey indicates that there are 313 reservoirs in Turkey, as well as 203 small lakes, which are used as reservoirs. A number of industries in Turkey are highly reliant on water, including petrochemicals, metal production, and mining.[22]

Based on the Turkish Statistical Institute records, Turkey's total annual water supply for the manufacturing sector is 1,224 million m^3, in which 9.2 % (113.11 million m^3) of that is consumed by the textile and clothing industry. The main source of water supply for the industry (around 66.7%) is groundwater. The textile and clothing industry water use constitutes to about 20.2 % (10.18 million m^3) of the total municipal water supply and 28.2% of groundwater use, as shown in the following table.[23]

Table 8. Water Supply Sources for the Textile and Clothing Industry (*10,000 m^3/year)

Manufacturing Industry	Total	Municipal Water Supply	Spring	Sea	Lake	River	Dam	Ground water	Tanker	Others
Textile Products	9,356	626	29	-	-	30	48	6,569	469	1,585
Clothing	1,955	392	68	-	-	3	-	975	184	333
Country Total	122,362	5,033	667	65,675	2,399	6,827	8,647	26,722	1,494	4,928

Source: Turkish Statistical Institute, 2005.

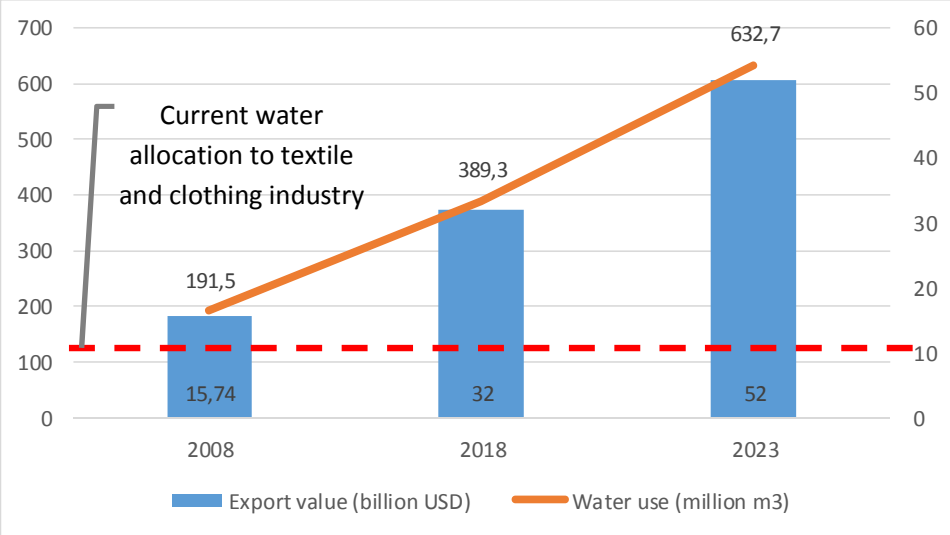
Considering the types of water consumption by the manufacturing sector, water consumption by the textile and clothing industry is mainly used for process water (about 78.2%), followed by domestic water. Reuse water constitutes 4.2% of the industry's water consumption. This database has trivial variance in terms of absolute values with that from the Turkish Statistical Institute records but still provides the same insights.[24]

Table 9. Water Demand Based on Industrial Sector and Usage (*10,000 m^3/year)

Manufacturing Industry	Total	Process water	Boiler water	Cooling water	Domestic water	Others	Reused water
Textile Products	9,196	7,330	523	235	740	368	425
Clothing	1,891	1,340	108	-	370	73	36
Country Total	121,506	31,255	4,679	74,678	7,241	3,653	41,030

Source: Turkish Statistical Institute, 2005.

Considering the targets of Turkey's textile sector to reach export values of USD 52 billion by 2023, it is estimated that the textile and clothing water demand will rise roughly to 632.7 million m^3 under business-as-usual, while water allocation for the industry at the current level is 113 million m^3 or merely 18% of the demand. This means that the industry needs to drastically improve its water use efficiency and/or find additional sources of freshwater supply.



Source: authors' analysis.

Figure 6. Predicted Water Demand for Textile and Clothing Industry in Turkey

Nowadays, reuse fraction of water in industrial water use is 34% and just 1% of it takes place in the textile industry, in spite of the highest amount of "process water" use in the industry. It means that most of the large consumed water in the industry is merely discharged as wastewater. As freshwater source of the textile industry comes from groundwater, streams, and lakes, this water wasting and lack of reuse have serious implications on the depletion of those freshwater sources. As a solution, continuous microfiltration systems and reverse osmosis may be considered as good alternatives to increase reuse. Continuous microfiltration systems (CMFs) in particular can be used for sustainable water use approach.[40]

4.2. Water Quality Risks of the Textile Industry

Effluent from the textile industry is a major source of environmental pollution, especially in the water bodies. Among the various stages of textile production, the operations in the dyeing plant, which include pre-treatments, dyeing and finishing, produce the most pollution. Textile dyeing wastes contain several organic compounds, high Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). When disposed into water bodies or onto land, these effluents will result in ecological decomposition and harm aquatic life. Besides the damages to the fishery industry and the associated economic losses to fishermen and farmer, there may be additional impacts on human health.

A large amount of water is used for yarn washing, bleaching, printing and end-product washing processes of the textile industry. After the metal industry, the textile industry is the sector with the highest wastewater discharge. From a total wastewater volume of 1.115 million m^3, 57% of that is discharged without treatment.

Wastewater characteristics of each production process differs substantially (Table 10). For example, wastewater from desizing and boiling processes contain high BOD; that from bleaching processes contain Absorbable Organic Halogens; while that from dying processes contain high BOD, COD and metal. Wastewater from dying, printing and finishing processes also contain high Volatile Organic Compound (VOC). The use of rivers, lake and groundwater as additional resources is highly prevalent in the textile sector due to lower costs. Since a large amount of water is used in the production processes from the beginning, a large amount of water is also wasted. The use of the ecosystem services of natural water bodies to dissolve pollutants is increasing. When textile production is increasing and likewise its wastewater discharge, natural water resources availability is depleted (BUTEKOM, 2014).[25]

The typical characteristics of textile wastewater for each process are presented in Table 10. The results are in line with previous studies and highlight the urgency for textile wastewater treatment to remove or reduce the pollutant level to within the acceptable discharge limits. These limits are determined by the Water Pollution Control Regulation that will be elaborated in the next chapter. [26]

According to Turkish Statistical Institute records in 2010, 73% of total population of Turkey is connected to sewage system. Total wastewater, including municipal and industrial wastewater, discharged to the sewage system is 3.6 million m^3/year and almost 75% of the wastewater discharge is treated. There are not any statistics about the exact amounts of municipal and industrial wastewater separately. Except the organized industrial zones, wastewater from several industries is mixed with municipal wastewater. Industrial wastewater generated from organized industrial zones has to be treated before being discharged to drain.

According to Istanbul Water and Sewerage Administration (ISKI), chemical oxygen demand, total suspended solids, total sulphur, SO_4 and oil and grease parameters should be controlled before discharging wastewater to sewerage. In Table 11, the threshold of discharge standards are presented. [39].

Different types of municipal wastewater treatment plants in Turkey is elaborated in Table 12.

Table 10. Textile Wastewater Characterization

Parameter	Unit	Type	Value				
			Desizing	Washing	Bleaching	Dyeing	Printing
pH	-	Wool	-	7.6-10.4	6	4.6-8	-
		Cotton	8.8-9.2	7.2-13	6.5-13.5	9.2-10.1	-
		Synthetic	-	8-10	-	11.7	-
Total COD	mg/L	Wool	-			7920	-
		Cotton	950-20000	8000	288-13500	1115-4585	-
		Synthetic	-	-	-	620	1515
Total BOD_5	mg/L	Wool	-	2270-60000	400	400-2000	-
		Cotton	-	100-2900	90-1700	970-1460	-
		Synthetic	-	500-2800	-	530	590
Total Solids (TS)	mg/L	Wool	-	28900-49300	910	-	-
		Cotton	-	-	2300-14400	-	-
		Synthetic	-	-	-	-	150-250
Total Suspended Solids (TSS)	mg/L	Wool	-	1000-26200	900	-	-
		Cotton	18-800	184-17400	130-25000	120-190	-
		Synthetic	-	600-3300	-	140	-
Total Dissolved Solids (TDS)	mg/L	Cotton	530-6900	-	4760-19500	-	-
Dissolved Organic Carbon (DOC)	mg/L	Wool	-	5800	-	-	-
		Cotton	250-2750	-	320	-	-
Total Phosphorus (TP)	mg/L	Cotton	4-10	-	6-60	-	-
		Synthetic	-	-	-	-	21
Phosphate	mg/L	Wool	-	89	-	-	-
Total Kjeldahl Nitrogen (TKN)	mg/L	Cotton	70	-	40	-	-
		Synthetic	-	-	-	-	164
Ammonia (NH_4-N)	mg/L	Wool	-	604	-	-	-
		Cotton	9-19	-	8-19	-	-
		Synthetic	-	-	-	-	129
Sulfur (S^{2-})	mg/L	Wool	-	0-2	-	-	-
		Cotton	-	-	-	325-900	-
Sulfate (SO_4^{2-})	mg/L	Cotton	-	-	-	1750-2690	-
Chloride (Cl^-)	mg/L	Fibers	-	-	90-100	26000	-
Oil and Grease	mg/L	Wool	-	580-55000	-	-	-
Cr^{2-}	mg/L	Wool	-	50	-	-	-
Color	ADMI	Wool	-	2000	-	2225	-
		Cotton	64-1900	694	153	1450-4750	-
		Synthetic	-	28900-49300	910	-	-
Water Consumption	L/kg fiber	Wool	-	4-77.5	-	40-150	280-520
		Cotton	-	2.5-43	30-50	38-143	-
		Synthetic	-	17-67	-	38-143	-

Source: Bisschops and Spajers, 2003.

Table 11. Threshold of Discharge Standards According to ISKI

Parameter	Value (mg/L)
COD (chemical oxygen demand)	4000
TSS (total suspended solids)	500
Tot-S (total sulphure)	2
SO_4	1700
Oil and Grease	250

Source: Istanbul Water and Sewerage Administration (ISKI), 2010.

Table 12. Number of Municipal Wastewater Treatment Plans by Type in Turkey

Type	Number
Physical Wastewater Treatment Plant	57
Biological Wastewater Treatment Plant	244
Advanced Wastewater Treatment Plant	70
Natural Wastewater Treatment Plant	89
Total Number of Wastewater Treatment Plants	460

Source: Business Monitor International (BMI), 2014.

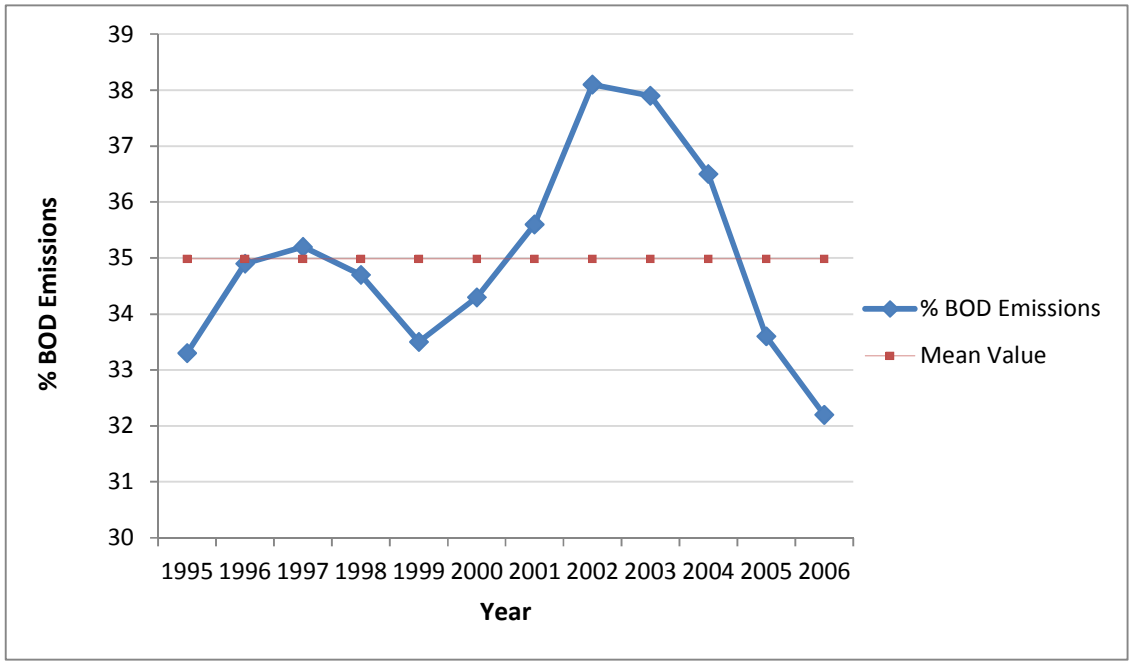
Although total industrial wastewater is approximately 1% of total wastewater, high pollution level of industrial wastewater creates a serious threat to the environment. In addition to the fact that not all the textile and leather production units have wastewater treatment plants, only a proportion of the treatment plants have filtration units as shown in Table 13. Filtration is used as a tertiary treatment to improve the treated wastewater quality and generally granular filtration is applied for those types of wastewater. The role of this unit is to enhance the efficiency for removal of suspended solids, biochemical oxygen demand, chemical oxygen demand and SO_4, which are present in textile wastewater. It also helps to remove the color of the effluent.

Table 13. Wastewater Treatment Facilities in the Manufacturing Sector

Sector	Total amount of plants	Plants with filter	Percentage of plants with filter
Textile	224	29	13
Leather	94	10	11

Source: National Productivity Center, Anahtar, 2012.

As reported by World Development Indicators (WDI) in 2014[27], water pollution attributed to the textile industry is about 32.2% of total biochemical oxygen demand (BOD) emissions. Emissions of organic water pollutants are measured by BOD, which refers to the amount of oxygen that bacteria in water will consume for breaking down the pollutants.



Source: The World Bank, 2014.

Figure 7. Water Pollution Attributed to the Textile Industry in Turkey (percentage of total BOD emissions)

In essence, two main water risks of the industry's current water practice are: 1) depletion of the already scarce freshwater resource will further impose scarcity risk to the industry; and 2) inappropriate treatment and discharge of effluent that will further reduce future availability of quality freshwater. The possible solution may be changing water source with different kind of water sources like sea, basin, lake; and reuse of wastewater for industrial activities.[38] In the future, reaching high quality water with less energy consumption will be possible for Turkey with reuse of wastewater, efficient use of water sources and technological developments in treatment processes and methods.

4.3. Stakeholder's Perceptions on Physical Water Risks for Turkey's Textile Industry

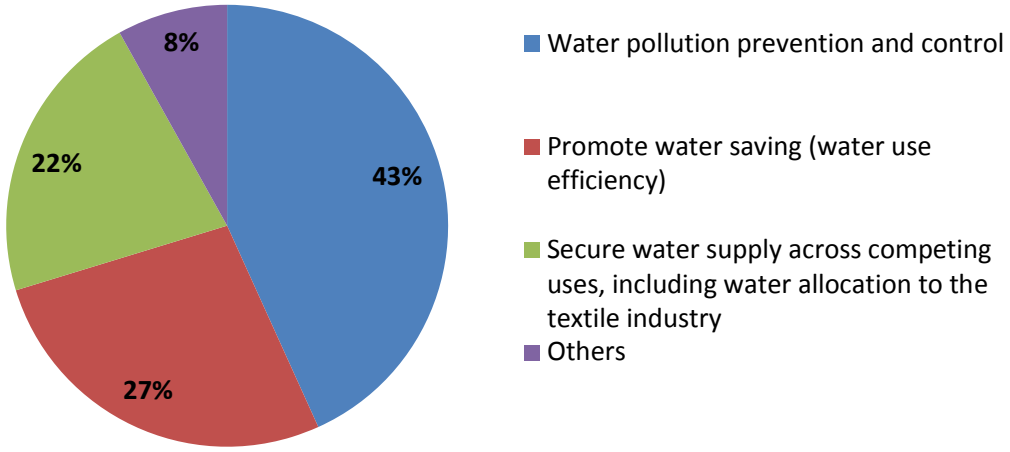
Due to the growing urban population and rapid expansion on commercial and industrial sectors, higher volume of good quality water is needed. The gap between water supply and demand will cause increased tensions in the future as renewable groundwater reserves decline. This is especially the case for industrial sectors like textile industry that is much dependent on groundwater sources.

The country's water risks culminated in the 2014 water crisis for a couple of reasons. First, there is increasing scarcity of water availability in many areas as Turkey consumes more water each year than the

natural renewable rate generated through rainfall or recycled water. Although Turkey has access to water from two of the largest rivers in the region, these rivers are transboundary waters and there needs to be a better cooperation among riparian countries in co-managing these shared water resources. The other reason is the lack of an efficient water management plan and awareness on conservative water consumption habits among domestic and industrial users. These inefficient water use and management impose a high pressure on water supply to meet the demand.

According to NASA studies, Turkey has the second worst rate of water evapotranspiration in the world. The decline in water resources is predicted to cause further issues in the future. There are some precautions and plans for future water supply. The ongoing projects include constructing 54 new water storage facilities, 25 pumping stations, and the expansion of the municipality distribution network.[22]

To understand stakeholder's perspective on which physical water risks are of high priority for industrial sectors in general and for the textile industry in particular, a survey was conducted by interviewing actors from the private sector, government institutions and non-governmental organizations. The list of the stakeholders involved in this study is presented in Annex B. The results of the survey are illustrated below.



Source: Survey Results, 2016.

Figure 8. Priority Water Risk Issues in Turkey

Most of the respondents expressed that "water pollution prevention and control" is the priority issue in Turkey. "Water use efficiency" and "secure water supply across competing uses, including .water allocation to the textile industry" are the next important priority issues, respectively.

Chapter 5 Water Governance Landscape Pertaining to the Textile and Leather Industry

5.1. Turkey's Landscape of Water Governance

Environmental protection and improvement activities in Turkey have strategic targets within the frame of the National Environmental Action Plan (NEAP). These targets determined on the issue are prevention and reduction of the pollution, facilitated access to the basic environmental infrastructure and services, incitement of the utilization of sustainable resources, promotion of the sustainable applications related with the environment and minimization of the level of exposure to environmental risks.

As a candidate state to the EU, Turkey has covered many activities regarding harmonization of its whole legislation with the legislation of European Union. The environmental laws, regulations and standards are being published expediently in line with the requirements. There exists a legislation enforcement and sanction problem in Turkey. Ministry of Environment and Urbanization is giving a significant importance to realization of the activities related with the industrial sector on a platform that brings together all related parties.

As all other industrial sectors, the textile sector in Turkey has initiated some preparations for the Textile Industry Environmental Declaration.[28] Environmental declaration is currently being developed by the Turkish authorities for textile industry, concerning the communication of the essential environmental effects of a given product. As a basis for the environmental declaration, ISO has published a technical report, which recognizes the impossibility of a universal environmental declaration and instead proposes the drafting of targeted requirements for different products, which will be defined in a cooperation between the stakeholder groups involved in the production of each type, principally the industry, and the researchers. According to the ISO proposal, research data should be generated on the environmental effects of products using the life cycle assessment method, on the basis of which the stakeholder groups of each product will cooperate with researchers to draft and submit to the ISO their views on the essential environmental effects of product chains, in other words, on their environmental indicators.[35]

5.1.1. Water Governance Structure

The stakeholders in Turkish textile sector comprise a wide range of actors, including government institutions, non-governmental organizations and private sector. Being one of the most valuable sectors of Turkey's economy, the textile sector is under the responsibility of different ministries. The main government institutions involved in establishing policies in relation to water governance is mapped in Figure 9. [33]

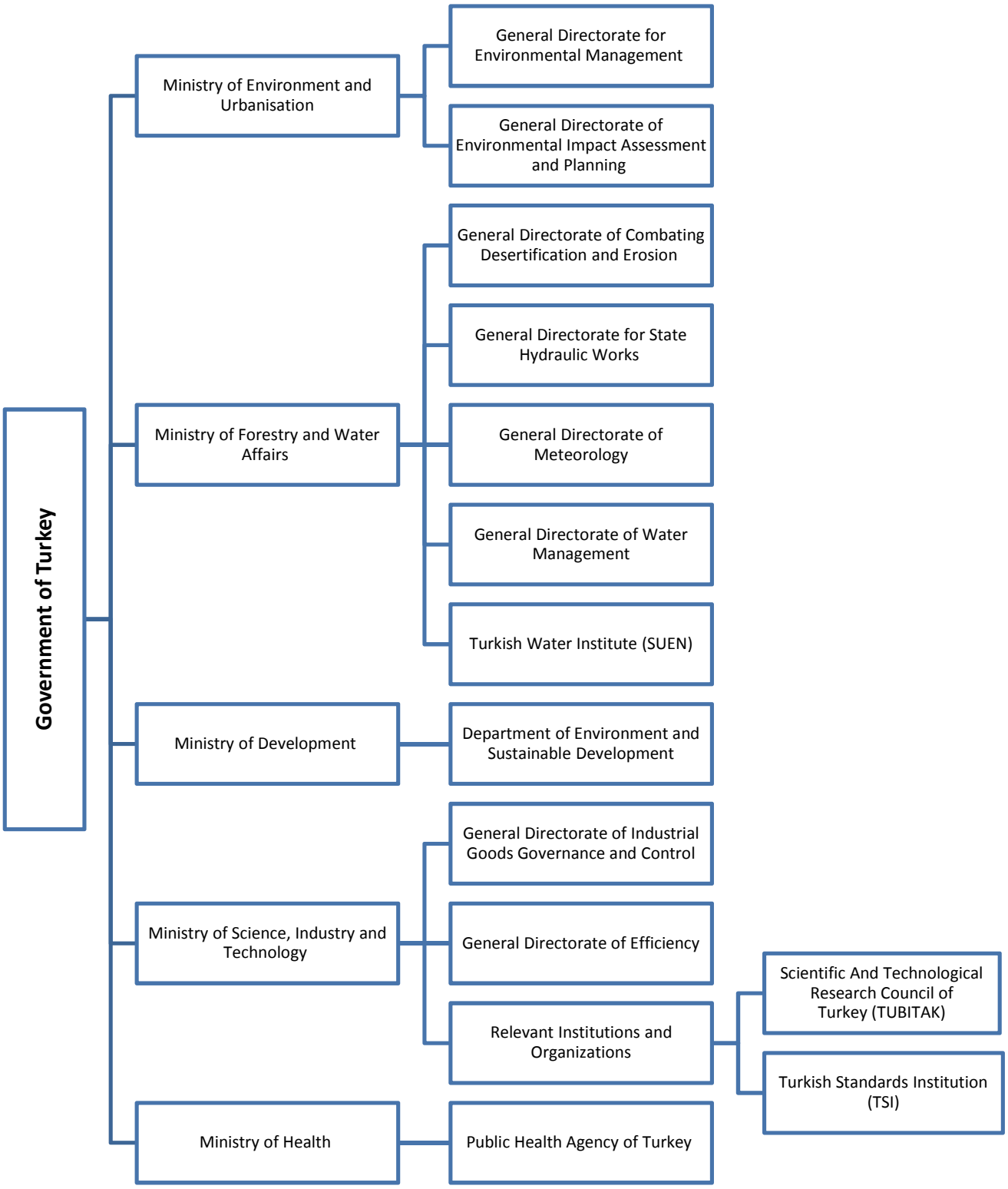


Figure 9. Water governance structure at the national level

Although all of these institutions promote sustainable textile sector and environmental friendly practices, the governmental institutions that regulate and audit water-related issues are the Ministry of Environment and Urbanization, the Ministry of Forestry and Water Affairs and the General Directorate of State Hydraulic Works.

The Ministry of Environment and Urbanization establishes regulations related to environmental management and audits. The missions of the Ministry of Environment and Urbanization are developing policies for environmental protection and remediation, preventing environmental pollution; setting standards and enforcing these standards; monitoring and auditing any kind of facilities and activities, which may create environmental pollution.

The main mission of the Ministry of Forestry and Water Affairs is providing policies related to water resources protection and sustainable usage and coordinating national water management.

The General Directorate of State Hydraulic Works is an institution affiliated to the Ministry of Forestry and Water Affairs. The mission of the institution is developing water resources according to environmental awareness and sustainability principles in order to put the country's water resources into services for beneficiaries, according to scientific and technical principles and to be protected from water damages.

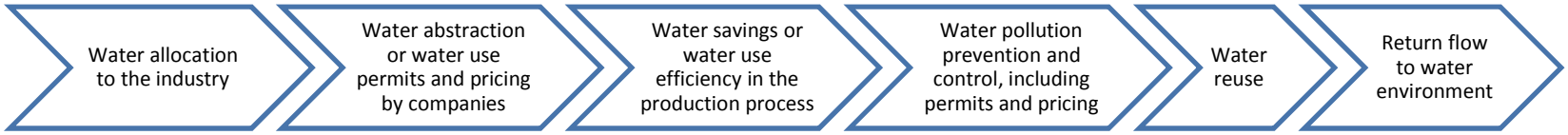
There are numerous non-governmental organizations (NGOs) in the textile sector, among others:

a. Istanbul Textile and Apparel Exporter's Association
b. Turkish Textile Foundation
c. Turkey Textile Finishing Industrialists Association
d. Turkey Cotton Textile Manufacturers Union
e. Turkey Clothing Manufacturers Association

The aims of these NGOs are mainly increasing economic value of textile products by increasing export rates; advertising Turkish brands to international markets and creating new Turkish brands; supporting sustainable development in textile sector with research and development projects; and creating network among textile companies.

5.1.2. Industrial Water Governance Value Chain

This report looks at the water governance value chain for a textile industry, which ideally consists of six main components: water allocation to the industry; water abstraction or water use permits and pricing by companies; water savings or water use efficiency in the production process; water pollution prevention and control, including permits and pricing, water reuse and return flow to water environment. Each of these industrial water value chains is mapped to each actor, including their relevant laws, regulations and existing initiatives/programme, in order to understand each actor's position on the value chains. Figure 10 presents the mapping of industrial water governance pertaining to the textile industry in Turkey.



Key actors	Ministry of Forestry and Water Affairs Ministry of Development	Ministry of Health	Ministry of Science, Industry and Technology	Ministry of Environment and Urbanization
Roles and responsibili-ties	**Ministry of Forestry and Water Affairs** To manage prevention of water resources pollution, environmental standards, permission and control, prepare the Environmental Impact Assessment Report (ÇED), plan the control projects for river basins. **Ministry of Development** To provide for the efficient and effective use of public resources allocated for public investments.	To determine the quality standards for drinking water and water for consumption, monitor these standards and preparing legislation in these areas.	To perform the duties vested with the legislation on the planning, establishment, structuring and operation of the organized industrial zones; support the establishment of water treatment facilities, infrastructure and superstructure for these enterprises.	To provide implementation with the aim of protection, prevention and control of pollution on groundwater and surface water, seas and soil.
Laws, regulations, policies	**Ministry of Forestry and Water Affairs** • Environmental Audit Regulation, 2014 • Water Pollution Control Regulation, 2004 • Control of Pollution Caused by Hazardous Substances in and around Water Bodies Regulation, 2005 **Ministry of Development** • Regulations on Research Infrastructure, 2015	• Regulation Concerning Water Intended for Human Consumption, 2013	• Regulation on Industrial Zones, 2015 • Application Regulations on Organized Industrial Zones, 2015	• Environmental Audit Regulation, 2014 • Water Pollution Control Regulation, 2004 • Control of Pollution Caused by Hazardous Substances in and around Water Bodies Regulation, 2005 • Waste Oil Control Regulation, 2008 • Regulation on Control of Hazardous Wastes, 2005 • Regulation on Restrictions Relating to Production, Supply and Use of Some Hazardous Substances, Products and Goods, 2014 • Integrated Pollution Prevention and Control Communique in Textile Sector, 2011

Figure 10. Water Governance Value Chain Pertaining to Textile and Leather Industry Water Use in Turkey

In the first step of water governance value chain Ministry of Development provides effective water allocation to the industrial investments, then Ministry of Forestry and Water Affairs ensures an efficient permission and control process, controls projects and cooperates with Ministry of Environment and Urbanization to manage prevention of water pollution according to legislation which is prepared by Ministry of Health and performed by Ministry of Science, Industry and Technology.

5.1.3. Laws and Regulations

In Turkey, the fundamental legislation related to environmental issues is the Environmental Law. It is a framework law, which all environmental regulations, bylaws, and communiques should adhere to. The general approach of Turkey's environmental legislation is mainly towards end-off pipe treatment. However, cleaner production and integrated environmental management have gained importance with EU harmonization requirements.[10]

Under the Environmental Law, there are some main regulations that industries must comply with. As one of the largest sectors in Turkey, textile sector has severe effects on the environment since it generates large amounts of solid waste, wastewater and polluting gasses.[29] Some major regulations related to textile sector and water management are given in Table 13 and their key elements are discussed as follows.

Environmental Audit Regulation, 2014

It aims to regulate procedure and principles of environmental audits of plants' at very stage from production start, operation, to termination; qualifications and liabilities of the auditing personnel, environmental management unit/environmental staff, and firms that have authorization on environmental audits.[30]

Since different kinds of chemicals are used in different stages of manufacturing, wastewater generated from textile sector is a very important issue. Effluents from textile sector are mainly characterized with high temperature, alkaline, strong odor and color. The liquids from washing operations contain organic and suspended pollution. Some chemicals are toxic and negatively affect the ecology of receiving water bodies. The main problem is the discharge of wastewater without treatment.[10]

Water Pollution and Control Regulation, 2004

The main objective of this regulation is to specify legal and technical principles needed for protecting ground and surface water resources potential of the country and using the resources in the best way in order to relate the water pollution prevention with sustainable development goals. In this regulation, quality classifications and usage aim of water bodies; planning principles and prohibitions related to water quality prevention, wastewater discharge principles and permits; wastewater infrastructure basis and monitoring and audit principles for water pollution prevention are included.[31]

The Water Pollution and Control Regulation also specifies different water body's quality standards and set rules for wastewater discharge standards for various industrial sectors and domestic usage. The relevant discharge standards for various production processes within the textile sector are presented in Annex A.[31]

Regulations Related to the Use of Hazardous Substances

In addition to the Water Pollution and Control Regulation discharge standards, the Control of Pollution Caused by Hazardous Substances in and around Water Bodies Regulation also specifies the discharge standards for hazardous substances used in textile manufacturing. Similarly, the Waste Oil Control Regulation, the Hazardous Chemicals Regulation, the Regulation on Restrictions Relating to Production, the Supply and Use of Some Hazardous Substances, Products and Goods, are other regulations which set discharge standards or limits to the use of some substances.[10]

Integrated Pollution Prevention and Control Communique, 2011

The textile sector-specific regulation is the Integrated Pollution Prevention and Control Communique in Textile Sector. The main objective of this communique is to regulate the procedure and principles related to minimizing the adverse effects of textile sector on the environment; the control of all kind of emissions, discharge and wastes that may be given to water bodies, air and soil during manufacturing; in order to encourage environmental friendly management, efficient usage of raw materials and energy, and application of cleaner production technologies. The textile facilities, where washing, bleaching, mercerization, sizing, printing, desizing and similar pretreatment, dyeing and finishing operations are applied, and whose capacity is higher than 10 ton/day, are subject to this communique.[32]

5.1.4. Existing Initiatives and Programme

Turkish textile, leather and garment industries are considered as one of the sectors experiencing an integration process with the European Union. During this process, government subsidies were adjusted and government incentives on exports were increased. R&D research funds are the most helpful government subsidies in textile industry[35] since being able to adjust to the changing structure of the global market investing in research and development is crucial. Other government subsidies come in the form of: enabling infrastructure and environment for production, appropriate market research for maximizing exports, labor subsidies to overcome informal employment rate, support for overseas country office and shops, patent support to increase the product range of the industry, support for hosting international fairs in the country, support for attending international fairs overseas, and support in any branding activities.[36]

There are numerous research projects pertaining to the textile industry. The Ministry of Development and the Scientific and Technological Research Council of Turkey (TUBITAK) provide financial support for national and international programs on environment, energy, materials and economic issues. Recent national projects for textile sector related with water governance, which are supported by the government, are listed in the Table 15. Further, Turkish Ministries, especially Turkish Ministry of Economy, also have numerous incentives to support the manufacturers who are the members of the Istanbul Textile and Apparel Exporter's Association (ITKIB). These incentives and their short descriptions are elaborated in Table 16.

Table 14. Research Initiatives Pertaining to Textile Water Governance

Project Name	Origin of funding	Name of legal entity	Project Description
Modeling the adsorption of textile dye on organoclay using an artificial neural network	TUBITAK	Ege University, Textile Engineering İzmir- Turkey	In this project, the decolorization of textile wastewater by organoclay was modeled with artificial neural networks (ANN). In conclusion, the Reactive Red 141 dye significantly can be adsorbed by HDTMA-bentonite and decolorization can be predicted by the ANN method.
Membrane Biofilm Reactors (MBfR): a new approach for toxic organic compounds and nitrogen removal from textile wastewater	TUBITAK	Gebze Technical University, Environmental Engineering Kocaeli-Turkey	The aim of this study was to test membrane biofilm reactor (MBfR) as a new treatment technology for textile wastewater containing toxic organic substance chlorophenol (2-chlorophenol and 2,4-dichlorophenol) and nitrogen (NH4-N, NO3-N, NO2-N). The operating parameters assessed were chlorophenol, removal relationship between the membranes flux, color removal, COD, TKN, nitrogen, phosphate, and total phosphorus. Microorganism species from membrane surface was analyzed for its population dynamics. Molecular identification of biological cultures under different operating conditions were also performed.
The usage of the metal naphtenats as a textile dye and the environmental effects of this approach	TUBITAK	Namık Kemal University, Textile Engineering, Tekirdağ-Turkey	The project aims to extend the use of petroleum and petroleum by-products a new dyestuff in textile industry. It takes place in two stages. The initial stage is to research the availability of metal naphtenats, which is made by the reaction of the naphten acids and some metal compounds, in dying process by ultrasound method in textile. The amount of dispergator and the pH will be selected with the resulting optimum formula for dying. At the last stage, various fibers and fabrics will be dyed by ultrasound method under the optimum conditions.
Textile Based Advanced Composites Technology and Innovation Center	Ministry of Development	Istanbul Technical University, Textile Engineering Istanbul-Turkey	The Centre is established in Istanbul with the resources to significantly improve the competitiveness of Turkey's textile and advanced composites industries. It will develop new advanced composites based on self-clean materials, anti-microbial materials, aerogels, high-temperature, high-strength materials and smart functional materials. The Centre will also aim to generate environmental applications, such as toxic chemicals and heavy metal removal technologies.

Table 15. Government Incentives for Textile Industry

Name of the Initiative	Supporting Actor	Description
Support for International Fair Participation (Declaration number: 2009/5)	Turkish Ministry of Economy	The aim of this initiative is to cover the expenses for overseas fair participations of manufacturers who are members of Istanbul Textile and Apparel Exporter's Association (ITKIB). The reimbursements are done from a special fund called "Support and Price Stabilization Fund" given by Turkish Ministry of Economy.
Support for Market Access Documentation (Decision number: 2014/8)	Turkish Ministry of Economy	The aim of this initiative is to cover the expenses for documentation activities and consultancy services received by manufacturers who are members of Istanbul Textile and Apparel Exporter's Association (ITKIB). The scope of documentation activities can be sorted as occupational health and safety, environmental and quality control certificates which are given by accredited agents. Further, for consultancy services some laboratory experiments' expenses are covered. The reimbursements are done partially from a special fund called "Support and Price Stabilization Fund" given by Turkish Ministry of Economy.
Support for Overseas Branding and Advertising Activities (Declaration number: 2010/6)	Turkish Ministry of Economy	The aim of this initiative is to cover the expenses for brand registry applications, rental charges, export activities and overseas branding and advertising activities of newly established manufacturers. The reimbursements are done partially from a special fund called "Support and Price Stabilization Fund" given by Turkish Ministry of Economy.
Branding of Turkish Products in the External Markets, Improving "Turkish Brand" Concept and Supporting TURQUALITY[iv] (Declaration number: 2006/4)	Turkish Ministry of Economy	The aim of this initiative is to cover the expenses for both national and international branding activities, attempts of market access operations, improvement of affirmative "Turkish Brand" opinion within the scope of TURQUALITY program. The reimbursements are done from a special fund called "Support and Price Stabilization Fund" given by Turkish Ministry of Economy.
Support for Designing Activities (Declaration number: 2008/2)	Turkish Ministry of Economy	The aim of this initiative is to cover the expenses of projects coordinated by designer offices/firms and collaborative institutions (should be members of Istanbul Textile and Apparel Exporter's Association) for improving and disseminating the design and innovation approach in Turkey. The scope of the expenditures can be sorted as promotion, advertisement, marketing, employment, consulting, design and product development activities. The reimbursements are done from a special fund called "Support and Price Stabilization Fund" given by Turkish Ministry of Economy.

[iv] TURQUALITY: Turquality is a state-funded brand development and transformation program which is developed for improving the organizational and operational competence of the selected Turkish Brands to a capacity to compete with the worlds' bests brands and for international publicity of those brands.

Policy and Implementation Activities

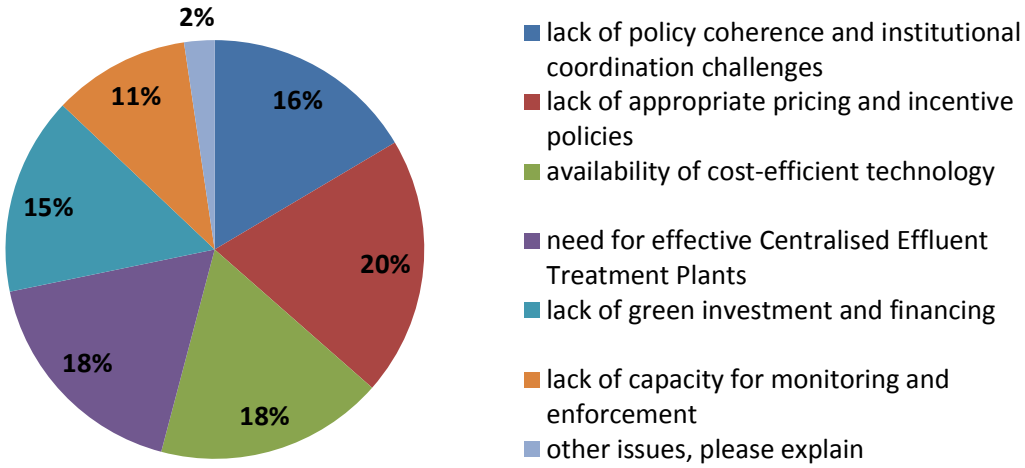
The Ministry of Industry and Trade produced report titled “Turkish Industrial Strategy Document” for EU membership application process. In this report different sectors have been analyzed regarding their regulatory framework, innovation and technology approaches and environment and energy incentives. For textile and garment industry, Integrated Pollution Prevention and Control (IPPC) Directive is considered as the most important framework regulation regarding the environment. Its aim is to control pollutions caused by large industrial plants. IPPC requires the use of Best Available Technology (BAT). Textile finishing process has the highest potential to harm the environment. The importers of textile and clothing products in EU require a certification, which proves that the products are produced with no harm to the environment using BAT. Therefore, it is important to obey the issues stated in the "Reference Document of The Best Available Techniques for Textile 215 Industry" published by European Integrated Pollution Prevention and Control Bureau, to make the export to EU Markets sustainable. In the Textile Technology Platform some of the targets projected to be attained in 2020 are related with determining bio-materials and bio-technologies and environmentally friendly activities.[37]

5.2. Regulatory Water Risks

A survey was conducted to capture stakeholder's perspective with regard to regulatory risks and other non-physical water risks impacting the textile industry. The respondents indicated interrelated comments regarding the long-term and short-term physical and regulatory water risks and opportunities for the textile industry in Turkey.

The main long-term water risk for the stakeholders is that Turkey is a water poor country and there are significant challenges regarding water supply issues. Ensuring clean and affordable water supply was perceived as an opportunity to overcome these risks. Reuse of treated water as an influent by means of technological developments, decreasing water demand in industrial activities, and efficient water management are seen as part of the solutions.

According to the stakeholders, the main barrier in managing water risks and capturing opportunities effectively is the lack of appropriate pricing and incentive policies. The next main barriers are the availability of cost-efficient technology and the need for effective Centralized Effluent Treatment Plants. The overall identified barriers are presented in Figure 11 below.



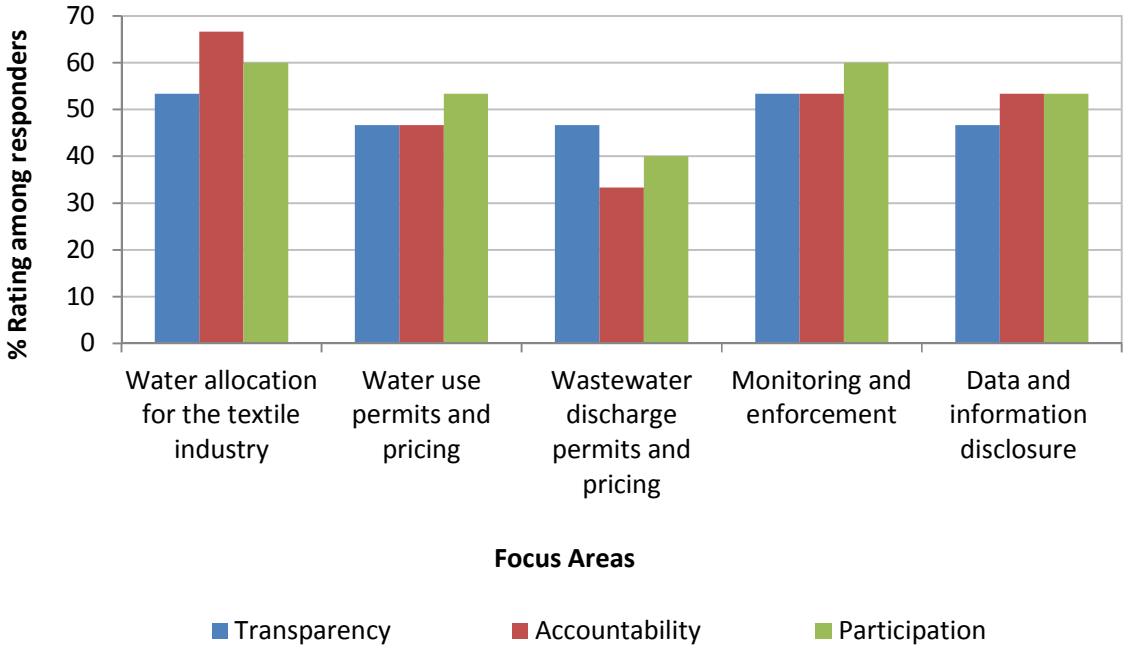
Source: Survey Results, 2016.

Figure 11. Main Barriers for Managing Water Risks and Taking Opportunities Effectively

Good water governance will enable the country to make better decisions in managing and allocating its water resources for economic and social welfare in an equitable and sustainable manner. This will equip the country to address both physical and non-physical water risks effectively. To have an understanding of a baseline of government performance on water governance pertaining to the textile industry, a scoping assessment was conducted by asking the stakeholders to score the implementation of three principles of water governance: transparency, accountability and participation. *Transparency* refers to the level of openness of governance processes and access to information; a*ccountability* is sets of control,

counterweights and modes of supervision that make officials and institutions in the public and private sector answerable for their actions; while p*articipation* refers to the possibility for citizens to provide informed, timely and meaningful input and to influence decisions at various levels.

Five focus areas for "good water governance" related to industrial water use can be categorized as: 1) water allocation for the industry; 2) water use permits and pricing; 3) water discharge permits and pricing; 4) monitoring and enforcement; and 5) data and information disclosure. The respondents were asked to rate each focus area in terms of the three water governance principles. The results of the scoping assessment can be seen in the figure below.



Source: Survey Results, 2016.

Figure 12. Assessment of Good Water Governance Performance

According to the respondents, wastewater discharge permits and pricing options have the lowest performance rates, especially in accountability principle as these policy instruments are not applied with high importance for industrial water use. Contrary to this, water allocation for the textile industry has the highest rates especially in accountability principle. Stakeholders are fully aware of the important role of textile industry in industrial water use. More than half of the respondents were satisfied on the monitoring and enforcement in industrial water use.

Chapter 6 Capacity Building Workshop

6.1. Workshop Organisation

This workshop on the Water Governance for Sustainable Textile Industry in Turkey was organized by Stockholm International Water Institute (SIWI) in collaboration with Sustainable Development and Cleaner Production Center (SDCPC) in Boğaziçi University, Istanbul, Turkey on November 9, 2016 as the second step in capacity building efforts for sustainable textile industry in Turkey.

The workshop highlighted the importance of water consumption in textile industry and addressed the issues of data requirement, data collection and management, stakeholder task allocation and engagement, policy development and establishment of legal framework. Turkish government representatives from the Directorate General of Water Management, Turkish Water Institute (SUEN), Ministry of Environment and Urbanization, Scientific and Technological Research Council of Turkey (TUBITAK), and the Directorate of Food, Agriculture and Livestock, industry and private sector representatives, academic institutions and independent sustainability experts participated in the event. The workshop agenda and the participant list can be found in the Annex.

6.2. Inputs from the Workshop

The workshop discussed possible indicators, trends and solutions of innovations toward sustainable textile water management from four aspects:

1. Nature: Environmental quality, resource use, habitat scenic beauty, built environment, indoor environment.
2. Economy: Business, infrastructure, production of goods and services, value creation, finances and budget, work and jobs.
3. Society: Community or group cohesion, social development, social and cultural institutions, management systems, social equity.
4. Health and well being: individual health, development, working conditions, satisfaction and fulfillment, happiness and perceived quality of life.

Participants arrive to the following proposed actions:

1. Nature: real time monitoring of waste water discharges.
2. Economy: Designing integrated wastewater treatment plant.
3. Society: ISO 70001 Water Traceability Management.
4. Health and wellbeing: improved regulation.

Chapter 7 Conclusions and Recommendations

7.1. Conclusions

As mentioned at the outset, this report aims to look at the physical and non-physical water risks as well as the water governance landscape pertaining to the textile industry in Turkey. Based on the desk research as well as interviews to the stakeholders, the report finds that:

1) The industry is gradually entering a maturity phase and facing a critical period of improving its productivity and sustainability that are necessary conditions for enhancing their competitiveness and market share in the global markets. The challenges are great as Turkey's development goal has set a target for the clothing sector to reach USD52 billion export value by 2023 (more than three times the current value), while the industry is the second most water consumptive industry after basic metal and R&D expenditure has been lagging to support technological innovations. The long term viability of Turkey's textile industry and its further growth are determined by the industry's sustainability across the supply chain, especially in water management.

2) Key physical water risks to Turkey's textile industry materialize in both quantity and quality aspects. In terms of quantity, there is a growing gap between the rising demand of roughly 632.7 million m^3 water by 2023 and the declining availability of freshwater in the future. As the sector with the second highest wastewater discharge, in which 57% of total industrial wastewater discharge is not treated, only 13 % of the treatment plants in textile industry and 11% in leather industry have the necessary filtration units for efficient removal of wastewater pollutants.

   Out of those identified physical water risks, "water pollution prevention and control" is perceived as the priority issue by the stakeholders, followed by "water use efficiency" and "secure water supply across competing uses, including water allocation to the textile industry".

   The main implications of these physical water risks are:
   a. Further depletion of the already scarce freshwater resource by the textile industry will impose higher scarcity risk to the industry; and
   b. Inappropriate treatment and discharge of effluent further reduce future availability of quality freshwater.

2) Turkey already has a fairly good water governance landscape pertaining to the textile industry due to the harmonisation with EU legislations and its development goals that require high competitiveness of the industry including its sustainability issues. The key actors of water governance are the Ministry of Forestry and Water Affairs, the Ministry of Environment and Urbanization, and the General Directorate of State Hydraulic Works under the Ministry of Forestry and Water Affairs. The regulations are shifting away from end-of-pipe approach toward cleaner production and integrated environmental management with numerous existing research and policy initiatives toward sustainable textile industry.

3) The stakeholders view that the main barrier in managing water risks and capturing opportunities effectively in the industry is the lack of appropriate pricing and incentive policies as well as the availability of cost-efficient technology and the need for effective Centralized Effluent Treatment Plants. The performance of the current water governance landscape is deemed to be the lowest when it comes to wastewater discharge permits and pricing options, especially in terms of accountability. On the contrary, the governance on water allocation issues is seen to be functioning rather well, especially on accountability.

7.2. Recommendations

Based on the findings of the report, the report suggests the following priority areas for building the industry's capacities in managing water risks and improving its environmental sustainability:

1) Identification of key challenges in improving good governance in water pollution prevention and control, in terms of transparency, accountability, and participation, from policy design, implementation, coordination and enforcement aspect.

2) Exploration of appropriate incentive and pricing policies to encourage faster adoption of water-efficient and cleaner technology for the industry, including analysis on the effectiveness of existing regulations and incentives or the potential for new policies.

3) Investigation of cost-efficient cleaner technologies, especially those that will effectively improve the effluent quality and that is appropriate for the industry with regard to the scale, characteristics, and production line of the textile units.

4) Enquiry of the main barriers and potential solutions to improve the performance of existing CETPs and encourage construction of new CETPs.

5) Investigation of alternative solutions to improve water supply reliability for the industry that contributes to water security across various water users in Turkey.

The capacity building workshop organised in Istanbul have identified concrete actions that can catalyse sustainable textile water management in Turkey:

5. Nature: real time monitoring of waste water discharges.
6. Economy: Designing integrated wastewater treatment plant.
7. Society: ISO 70001 Water Traceability Management.
8. Health and wellbeing: improved regulation.

ANNEX A: Discharge Standards for Various Textile Production Processes

Table A. 1. Discharge Standards for Fiber and Yarn Production and Textile Finishing

Parameter	Unit	Composite Sample (2 hours)	Composite Sample (24 hours)
COD	mg/L	350	240
Ammonia (NH_4-N)	mg/L	5	
Chloride (Cl^-)	mg/L	0.3	
Chromium	mg/L	2	1
Sulphur (S^{-2})	mg/L	0.1	-
Sulphide	mg/L	1	-
Oil and Grease	mg/L	10	-
Toxicity Dilution Factor	-	4	3
pH	-	6-9	6-9
Color	(Pt-Co)	280	260

Table A. 2. Discharge Standards for Woven Fabric Finishing

Parameter	Unit	Composite Sample (2 hours)	Composite Sample (24 hours)
COD	mg/L	400	300
Total Suspended Solids (TSS)	mg/L	140	100
Ammonia (NH_4-N)	mg/L	5	-
Chloride (Cl^-)	mg/L	0.3	-
Chromium	mg/L	2	1
Sulphur (S^{-2})	mg/L	0.1	-
Sulphide	mg/L	1	-
Phenol	mg/L	1	0.5
Toxicity Dilution Factor	-	4	3

pH	-	6-9	6-9
Color	(Pt-Co)	280	260

Table A. 3. Discharge Standards for Cotton Originated Production

Parameter	Unit	Composite Sample (2 hours)	Composite Sample (24 hours)
COD	mg/L	250	200
Total Suspended Solids (TSS)	mg/L	160	120
Ammonia (NH_4-N)	mg/L	5	-
Chloride (Cl^-)	mg/L	0.3	-
Chromium	mg/L	2	1
Sulphur (S^{-2})	mg/L	0.1	-
Sulphide	mg/L	1	-
Oil and Grease	mg/L	10	-
Toxicity Dilution Factor	-	4	3
pH	-	6-9	6-9
Color	(Pt-Co)	280	260

Table A. 4. Discharge Standards for Wool Washing, Finishing and Weaving

Parameter	Unit	Composite Sample (2 hours)	Composite Sample (24 hours)
COD	mg/L	400	300
Total Suspended Solids (TSS)	mg/L	400	300
Ammonia (NH_4-N)	mg/L	5	-
Chloride (Cl^-)	mg/L	0.3	-
Chromium	mg/L	2	1
Sulphur (S^{-2})	mg/L	0.1	-
Sulphide	mg/L	1	-
Oil and Grease	mg/L	200	100

Toxicity Dilution Factor	-	4	3
pH	-	6-9	6-9
Color	(Pt-Co)	280	260

Table A. 5. Discharge Standards for Knitted Fabric Finishing

Parameter	Unit	Composite Sample (2 hours)	Composite Sample (24 hours)
COD	mg/L	300	200
Ammonia (NH_4-N)	mg/L	5	-
Chloride (Cl^-)	mg/L	0.3	-
Oil and Grease	mg/L	10	-
Chromium	mg/L	2	1
Sulphur (S^{-2})	mg/L	0.1	-
Sulphide	mg/L	1	-
Phenol	mg/L	1	0.5
Toxicity Dilution Factor	-	4	3
pH	-	6-9	6-9
Color	(Pt-Co)	280	260

Table A. 6. Discharge Standards for Carpet Finishing

Parameter	Unit	Composite Sample (2 hours)	Composite Sample (24 hours)
COD	mg/L	300	200
Total Suspended Solids (TSS)	mg/L	160	120
Ammonia (NH_4-N)	mg/L	5	-
Chloride (Cl^-)	mg/L	0.3	-
Chromium	mg/L	2	1
Sulphur (S^{-2})	mg/L	0.1	-
Sulphide	mg/L	1	-

Phenol	mg/L	1	0.5
Oil and Grease	mg/L	10	-
Toxicity Dilution Factor	-	4	3
pH	-	6-9	6-9
Color	(Pt-Co)	280	260

Table A. 7. Discharge Standards for Synthetic Textile Finishing

Parameter	Unit	Composite Sample (2 hours)	Composite Sample (24 hours)
COD	mg/L	400	300
Sulphur (S^{-2})	mg/L	0.1	-
Phenol	mg/L	1	0.5
Zinc (Zn)	mg/L	12	10
Toxicity Dilution Factor	-	3	2
pH	-	6-9	6-9
Color	(Pt-Co)	280	260

ANNEX B: List of Stakeholders Engaged in the Study

Table B. 1. List of Stakeholders Engaged in the Study

Name - Surname	Company	Position	Mail Address	Questionnaire
Emel Ogul	Adana Vocational and Technical High School	Technical Teacher	emel_ogul@hotmail.com	Yes
Akgun Ertem	Ipek Fantazi Tekstil A.S.	Cost Analysis and Technical Consultant	akertem@hotmail.com	Yes
Hakan Ozcelik	WKS TEXTILVEREDLUNGS GMBH.	Quality Control Manager	hakan.ozcelik@wks-textil.de	Yes
Ufuk Ozisik	Prima Leather Industry and Trade Inc.	Technician	ufukozsk@hotmail.com	Yes
Esra Guler	Taha Giyim A.S. (LC Waikiki)		esra.guler@lcwaikiki.com	No
Hadi Ozbulut	DNM Textile for Spinning, Weaving and Dyeing	Water Treatment Manager	hozbulut@dnmtextile.com	No
Lerna Untur	Matesa Textiles	Domestic and Export Marketing and Sales Representative	lerna.untur@matesa.com.tr	No
Sevgisel Senkal	C&A Sourcing Office	Merchandiser	Sevgisel.senkal@canda.com	No
Cagdas Dogru	H&M		Cagdas.Dogru@hm.com	No
Ilhan Guclu	Kappahl		Ilhan.Guclu@kappahl.com	No
Sila Durukan	Lindex		Sila.Durukan@lindex.com	No
Yasemin Yalcinkaya	MQ		Yasemin.Yalcinkaya@mq.se	No

ANNEX C: Minutes and the Summary of the Workshop

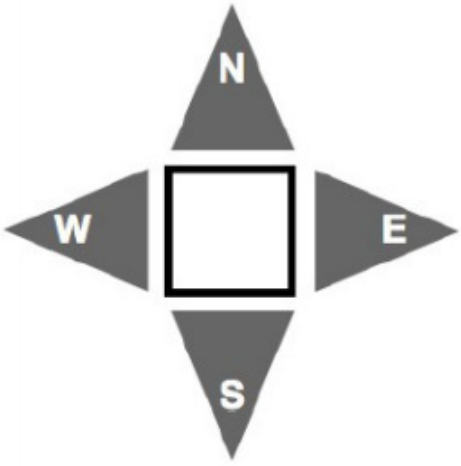
PART 1. PRESENTATIONS

Turkey's textile industry has experienced technological and institutional advances over time and is gradually entering a maturity phase. It contributes significantly to the country's economy through 7.2% of recorded industrial employment and 18% of total export revenues making it the second biggest export earner. With its rather complex production system, the industry poses considerable environmental impacts through its intensive resource use and waste discharges to the environment.

The welcoming speech was given by the project coordinator, Assoc. Prof. Dr. Nilgün Cılız, a lecturer at Boğaziçi University Institute of Environmental Sciences, director of the Boğaziçi University Sustainable Development and Cleaner Production Center (BU-SDCPC), a co-chair of the UNSDSN Turkey Office and coordinator of the Boğaziçi University Green Campus Programme. Then Consul General for Sweden in Istanbul, Ms. Therese Hydén gave the opening remarks with a special focus on Swedish programs and initiatives related to sustainability. After that, Ms. Anna Forslund, programme manager at SIWI, described the aims and objectives of the workshop. Mr. Rami AbdelRahman continued presenting with the STWI Turkey activities and examples of current situation of textile industry from all over the world. Finally, Assoc. Prof. Dr. Nilgün Cılız went through the *Water governance mapping report: Textile Industry Water Use in Turkey* report which has been prepared by BU-SDCPC and SIWI prior to this workshop.

Before the lunch break, Assoc. Prof. Dr. Aslıhan Kerç from Turkish Water Institute (SUEN) presented the *New Regulations and Key Implementation Challenges*; Assoc. Prof. Dr. Ahmet Baban from The Scientific and Technological Research Council of Turkey (TUBITAK) transferred *Integrated water management - CP applications in Textile industry* and finally independent consultants Mr. Mehmet Güner and Mr. Cengiz Değerli gave detailed information on *Wigglesteps Waterless Socks*.

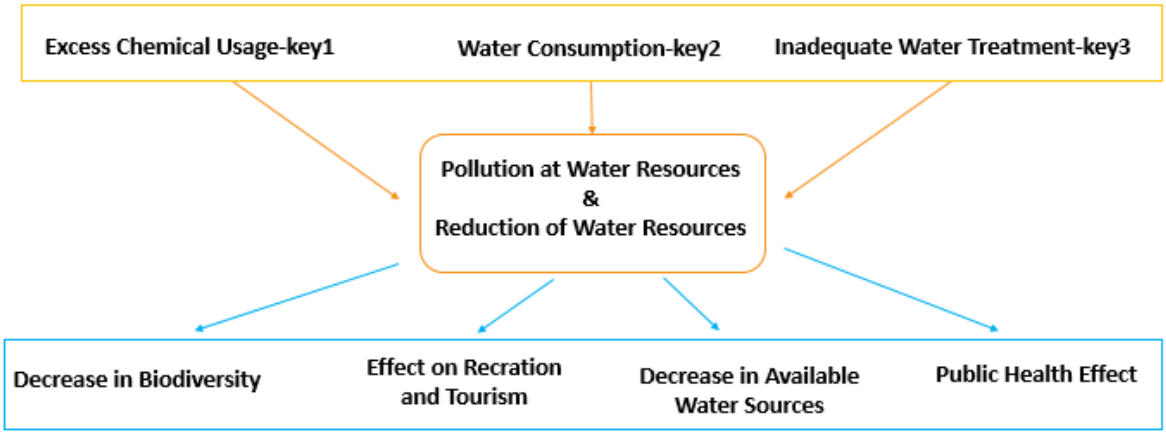
PART 2. BREAK-OUT SESSIONS



First part of the break-out sessions was a brain-storming for possible indicators. Each group tried to identify indicators and trends based on the focus of the groups. After this stage, system analysis held on considering the connections between the indicators. Third part of the session was about innovation, the group members developed prioritized set of innovations that could improve the system conditions. Afterwards, each group presented their innovation to the participants and developed a strategic diffusion and adoption plan. Each participant voted for their favorable project idea, as a result of the votes of all break-out groups, Society's project, *(ISO 70001 Water Traceability Management)* was selected as the best project to solve the water related problems. Nature, Economy and Health and Well-Being groups followed the winner, respectively. Detailed information on the group discussions are explained below.

Nature (N): Environmental quality, resource use, habitat scenic beauty, built environment, indoor environment.

There have been four components of compass of sustainability, such as society, well-being, economics and nature. In ''Nature'' group, the focuses of the discussion were pollution at water resources and reduction of water resources according to this problem different kinds of indicators were started to weighed. Identified indicators were water consumption, decrease in biodiversity, decrease in available water sources, public health effect, effect on recreation and tourism, inadequate water treatment systems, and excess chemical usage. These indicators were classified as reasons, problem and results. According to this systematic approach, there has been three key indicators were graded in reason class such as **excess chemical usage-key1, water consumption-key2, inadequate water treatment-key3** and there has been four main effects revealed as shown in figure below.



After examining the problem and identifying the indicators, possible alternatives for solution were discussed. Main focus points were innovation, enzyme dyeing, reduction of water consumption in washing stage in textile industry, encouragement of technical modifications in water treatment systems, alteration between current chemicals and environmental friendly chemicals, **real time monitoring of waste water discharges,** utilization of *Information Technologies* for discharge monitoring, making sustainability analysis of the sector, sectorial water allocations. The most important and effective solution alternative selected was "*real time monitoring of waste water discharges and inspection of this system properly"*. Lack of enforcement and inadequate regulation, makes current monitoring and inspection of waste water discharge inefficient therefore "*monitoring and inspection"* was selected by the group as the most important issue to address

Economy (E): Business, infrastructure, production of goods and services, value creation, finances and budget, work and jobs.

Water rights is a fundamental issue. Water has an economic value but there is still a lack of knowledge of the exact cost.

In terms of valuing the true cost the following performance indicators needs to be taking into account

- Health cost (affected by water pollution)
- Agriculture industry (decrease)
- Fisheries industry
- Social effect (decreasing life quality because of polluted water)
- We need to improve our industry zones regarding environmental criteria
- Several rules and taxes are applied as sanctions based on regulations

The use of ground water, includes the use of more efficient pumps for reaching cleaner water. It will require more energy and will have higher economic costs. Also the water quality will decrease depending on the depth of the water supply.

The "Economy" working group offered following actions in order to prevent water related problems:

- Rehabilitation of industrial zones
- Designing integrated wastewater treatment plant
- Selling four types of water according to their pollution levels
- Regarding fashion support, avoiding dark colored clothes that need more dyeing
- Performing more research to decrease desalinization cost
- Reusing water for different purposes

"Designing integrated wastewater treatment plant" was selected as the top choice by the economy group. In terms of reaching these goals, the government support is very important for producers. Otherwise, even if the producers respect environmental demand, the strategy needs to be negotiated. Government regulations integrated wastewater treatment plants and reforming industrial zones will therefore be key.

Society (S): Community or group cohesion, social development, social and cultural institutions, management systems, social equity.

Within the scope of workshop, different issues were discussed by different groups. The focus of the discussion were possible society problems challenges in terms of , how the challenges could be identified and quantified and possible precautions to prevent such problems . The society group firstly listed the effects of water scarcity and the water quality on the population. They listed lots of indicators related to water quality and quantity which can be listed as:

- The risk of epidemic diseases may increase as water resources are reduced or polluted.
- Hunger may arise because of agricultural problems.
- Populations may increase around water resources, migration problems may arise.
- Hunger, education and health problems may be observed in the non-immigrant part.
- Infrastructure problems may occur.
- The prices of products may increase.
- Social unrest may occur.
- Water prices may increase.

The group offered **"ISO 70001 Water Traceability Management"** system to preclude those problems. The targets of the proposed project can be listed as follows:

- Awareness raising among consumers and employees,
- Productions with zero discharge or 100% recyclable water influent,
- Auditing collected data with third parties to be more transparent,
- Designing water label and inform all consumers about water footprints of the products,
- Using brine water with solar power,
- Constituting R&D departments among all facilities,
- Investing in digital fabrics,
- Enhancing purchasing methods such as sustainable purchasing both for chemicals and machines,
- Recuperating the manufacturing systems and processes and integrating water management systems,
- Providing 100% incentives by governments on water reduction projects,
- Awarding with water certificates,
- Reporting on which sources of water are being used and the amounts of influents and effluents.

Health & Well-being (W): Individual health, development, working conditions, satisfaction and fulfillment, happiness and perceived quality of life.

Within the scope of workshop, different issues based on the case study were discussed by different groups. One of the issues which may arise from the projected water problems that Turkey may face was Health and Well-Being. The focuses of the discussion were, possible challenges in terms of health and well-being and how the challenges can be identified and quantified and what the possible precautions to prevent such problems are.

The Health and well-being group firstly identified possible impacts on human well-being on the decrease in water quality and quantity. Human health and well-being is affected by water related diseases, decrease in amount of food, change in recreational activities, changing migration rates and routes based on water resources. Then they focused on the indicators impacted by the decrease in water quantity and quality the indicators were grouped in order of priority.

- Percentage of water related diseases distribution in population
- Measurement of water quality parameters (COD, BOD, pH, turbidity and so on)

- Measurement of water amount (m^3/capita/year; m^3/m^2/min)
- Number of water intense industries
- Migration rates
- Variation in agricultural products dependent on irrigation
- Species diversity index
- Bio concentration factor
- Rate of recreational activities
- Water recycling percentage
- Cost of residences per m^2 area
- Amount of fish catch per year
- Period of accommodation in hotels

The group identified **improved regulation** as key to address the above listed problems. To protect the water amount and quality; strict regulations should be put into force; regular monitoring and auditing should be made.

APPENDIX C.1: AGENDA

08.30 – 09.15	**Registration**
09.15 – 09.25	**Welcoming** Assoc. Prof. Dr. Nilgün Cılız, Sustainable Development and Cleaner Production Center, Boğaziçi University
09.25 – 09.40	**Opening remarks** Therese Hydén, Consul General For Sweden in Istanbul
09.40 – 10.00	**Aim and objectives of the workshop** Anna Forslund, SIWI
10.00 – 10.20	**STWI Turkey** Rami AbdelRahman, SIWI and Mehmet Şerbetçi, Escarus
10.20 – 10.40	**Water governance mapping report: Textile Industry Water Use in Turkey** Assoc. Prof. Dr. Nilgün Cılız, Sustainable Development and Cleaner Production Center, Boğaziçi University
10.40 – 11.00	**Coffee Break**
11.00 – 11.20	**New Regulations and Key Implementation Challenges** Assoc. Prof. Dr. Aslıhan Kerç, Burcu Yazıcı, Turkish Water Institute (SUEN)
11.20 – 11.40	**Integrated water management - CP applications in Textile industry** Assoc. Prof. Dr. Ahmet Baban, The Scientific and Technological Research Council of Turkey (TUBITAK)
11.40 – 12:00	**Wigglesteps Socks** Mehmet Güner, Cengiz Değerli
12.00 – 12.45	Questions and answers, discussion
12.45 – 13:30	**Lunch**
13:30 – 14:00	**Managing Business Water risks – Key challenges and opportunities** Anna Forslund, SIWI
14.00 – 15.30	**Break-out groups** Main Barriers for Managing Water Risks: Sustainable Development Pyramid
15.30 – 16.00	**Reporting back from Break-out groups**
15.30 – 16.00	**Coffee break**
16.00 – 16.50	**Continue to Break-out groups and Panel discussion: identifying priority solutions to improve institutional capacities in managing water risks and capturing opportunities** Moderator: Assoc. Prof. Dr. Nilgün Cılız, Sustainable Development and Cleaner Production Center, Boğaziçi University
16.50 – 17.00	**Summary and closing** Anna Forslund SIWI

APPENDIX C.2: PARTICIPANTS

Name Surname	Institution	E-mail Adress
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