UK Study on Imported Water Risk

An Anthesis Consulting Group PLC report for WWF

Final report

March 2015

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WWF UK Study on Imported Water Risk

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Executive summary

The World Economic Forum's 10th edition of the Global Risks report[1], concludes that water is the top global risk, in terms of projected impact. Forecasts put global water requirements at 40% ahead of sustainable water supplies by 2030[2].

The World Water Council has framed the problem as follows:

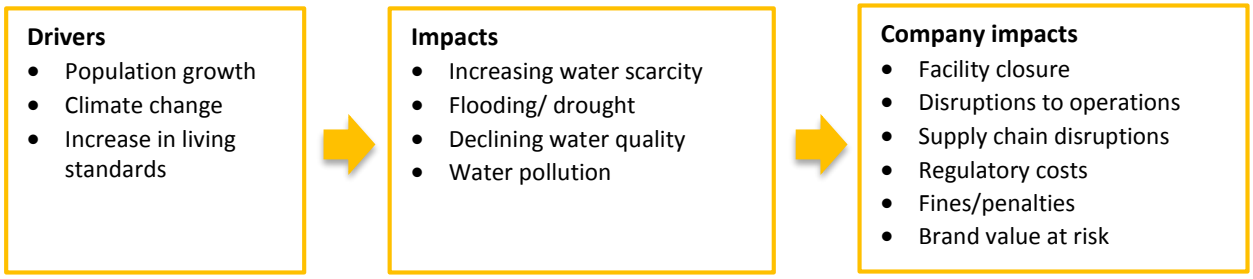
"There is a water crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people – and the environment – suffer badly." (World Water Council, 2000)

Currently, Agriculture accounts for 70% of total water use and industry for a further 25%. The World Bank states that food production will need to increase by 50% by 2030 as the global population expands and dietary habits change. However, the Intergovernmental Panel on Climate Change suggests that over the same period the impact of climate change on weather patterns and rainfall – causing either floods or droughts – could cut crop yields by up to 25%[3]. A deterioration in the quality of surface waters and groundwater – due to agricultural runoff, industrial wastewater, and poor sanitation – threaten to compound the problem. Related impacts include environmental degradation and reduced access to drinking resources, coupled with mounting health problems.

In a world of increasingly globalised supply chains, many of the countries the UK's companies source products from are countries that face these significant challenges over freshwater supplies. Yet, many businesses do not have a good enough understanding of how these resources are exposed to water risk, and how this risk is placing their activities at risk.

The degree and nature of a business' exposure to these risks differs widely, as set out in Figure 1. It depends on i) how their water footprint is distributed across the value chain, ii) how much water their supply chain partners use, iii) what pollution they contribute, and iv) if they are located in areas prone to water stress.

Figure 1: Water risk impact on business operations



Equally, armed with a clear understanding, opportunities exist for UK Plc to improve its resilience to water-related risk, and to demonstrate leadership through good water management. A key mechanism for achieving this is engaging with stakeholders and practicing good water stewardship.

[1] World Economic Forum. Global Risks 2015. Available online.
[2] 2030 Water Resources Group, Charting Out Water Future, Economic frameworks to inform decision-making, 2009.
[3] As per 1.

The approach

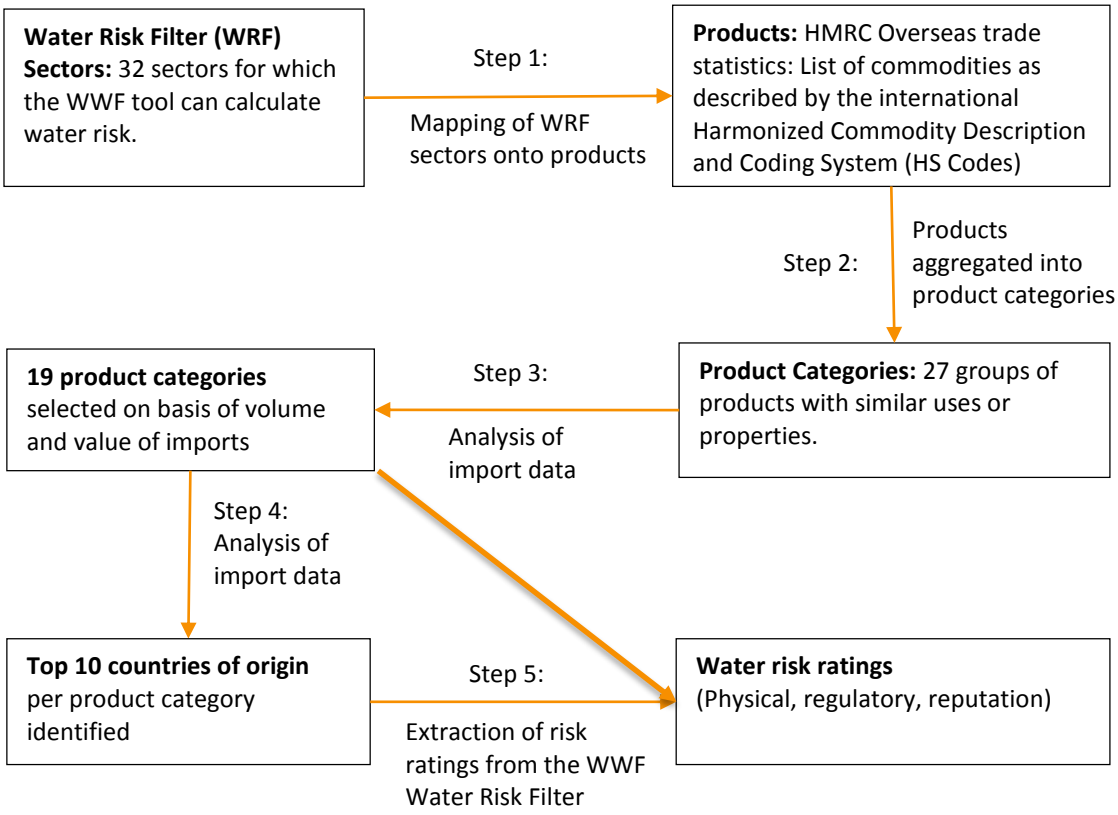
This study aims to establish the degree of water risk faced by UK businesses in connection with the UK's imports – including raw materials, semi-finished and finished products. The methodology of this study is built on that of the 2014 WWF-Germany report.

To achieve the aim of this study three elements were required:

- A list of products imported to the UK derived from the UK's HM Revenue and Customs Overseas Trade Statistics dataset;
- Identification of countries from which these products are sourced; and
- Classification of import data mapped to the WRF sector/commodity and country/basin.

Figure 2 outlines the main steps undertaken in this study as well as the terminology used.

Figure 2 methodology used as the basis for the analysis:



From the analysis of the main product categories imported to the UK, 19 were selected for further analysis.

The analysis of major agricultural (plant) based imports follows a similar methodology. HMRC import data was mapped onto the 122 agricultural (plant) based commodities listed in WRF. From these, 14 commodities were selected for further analysis based on a combination of the value and volume of imports. These include: apples, bananas, chillies and peppers, cocoa, coffee, grapes, maize, onions and shallots, palm oil, potatoes, soybeans, strawberries, tea, tomatoes and wheat.

Analysis of the main product groups imported to the UK

In 2013 UK imported 293 Mt of products with a value of £420 billion. The 19 categories account for 96% of the total imports by mass and 91% by value. The products imported to the UK are heavily consolidated – with the two product sectors covering gas and oil and coal accounting for over 50% of total imports by weight.

When examining imports by value only four sectors (e.g. extractives (oil and gas), chemicals, basic metals, and rubber and plastic products) from the classification by weight feature on this list. Technology hardware is the largest import by value, followed by extractives (oil & gas) and motor vehicles. When considered by value, apparel and pharmaceuticals are also important products for the UK.

Table 1 shows the main product groups imported in the UK (by volume and value).

Rank	Product category	Total Weight		Rank by weight	Product category	Total value	
		Mt	%			£ billion	%
1	Extractives (Oil & gas)	109	37.2	1	Extractives (Oil & gas)	52.1	12.4
2	Extractives (Coal)	46	15.7	2	Technology Hardware and Equipment, Semi-conductors	51.4	12.2
3	Agriculture (Plant)	17	5.8	3	Machinery & equipment	50.8	12.1
4	Food products	16	5.3	4	Motor vehicles, trailers and semi-trailers	42.3	10.1
5	Chemicals and chemical products	15	5.1	5	Other goods[4]	25.4	6.0
6	Extractives (Metals)	15	5.0	6	Chemicals and chemical products	23.3	5.5
7	Basic metals	12	4.0	7	Apparel	22.2	5.3
8	Wood and other plant based products	11	3.7	8	Basic metals	20.8	4.9
9	Rubber and plastic products	8	2.6	9	Pharmaceutical products	17.8	4.2
10	Other non-metallic mineral products	7	2.4	10	Rubber and plastic products	16.0	3.8

Sixty percent (60%) of imports, accounting for 177 Mt/£202 billion, are sourced from 10 countries. The main import partner by weight of goods imported is Norway, accounting for 13.5% of total import by weight (39.8 Mt), followed by Russia (9.7%, 28 Mt), the Netherlands (8.3%, 24.5 Mt), the United States (6.6%, 19.4 Mt) and Germany (5.4%, 16 Mt).

Water risk for selected product categories

Within the WWF Water Risk Filter (WRF), the water risk is scored on a 1-5 scale, where <2.25 (low / green); 2.25-3.5 (medium / orange); >3.5 (high / red). None of the product categories are rated with an overall high risk rating; 83% are rated medium risk and 17% low risk. The highest overall risk is associated with finished products, such as apparel (which scored 3.4), appliances (2.84), technology products (2.65), products made of basic metals (2.55) and machinery (2.52).

[4] Other goods includes products not accounted for under the 10 product categories of focus AND wider universe of product categories, for example toys, books and jewellery.

A clearer understanding of the water-related risk of each product category is obtained by looking at the drivers of the individual physical, regulatory and reputational risk scores. Analysis of the risk ratings at the country level helps to identify specific 'hotspots' of risk and to characterise the drivers of these vulnerabilities.

Table 2: Water risk of imported product categories sorted by overall risk

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)	Overall	Physical	Regulatory	Reputational
Apparel	2	22.2	3.4	3.23	3.49	3.83
Appliances	0.7	3.6	2.9	2.98	2.67	3.3
Technology	3.1	62.3	2.64	2.71	2.34	3.45
Basic metals	11.7	20.8	2.55	2.7	2.05	3.18
Machinery	3.1	36.3	2.52	2.68	2.01	3.49
Beverages	4.8	5.8	2.51	2.62	1.73	3.08
Pharmaceutical Products	0.2	17.8	2.42	2.56	1.98	3.27
Extractives (Coal)	46	3	2.41	2.18	3.12	3.08
Rubber and plastic products	7.6	16	2.4	2.55	1.8	3.23
Motor vehicles, trailers, semi-trailers	5.5	42.3	2.38	2.5	1.72	3.27
Other non-metallic mineral products	7.1	0.6	2.38	2.5	1.85	2.63
Agriculture (plant)	17.1	12.5	2.37	2.48	1.87	3.27
Food products	15.6	15.7	2.37	2.42	1.88	3.01
Extractives (Oil & gas)	109.1	52.1	2.31	2.28	2.38	2.5
Chemicals and chemical products	14.9	23.3	2.23	2.29	1.65	3
Extractives (Metals)	14.7	2.5	2.2	1.88	2.72	3.85
Wood and other plant based products	10.8	4.3	2.06	1.92	2.13	2.96
Paper and paper products	6.9	5.6	2.05	2.04	1.71	2.82

Our analysis shows that apparel, appliances and technology hardware are at higher risk than the other product categories, owing to a higher dependency on imports from overseas locations, such as India, Russia and China. These locations are subject to higher physical, regulatory and reputational risk, respectively.

In contrast, the remaining product categories imported to the UK are categorised with low-medium overall risk. However, the water risk associated with raw materials is also dependent on the type of commodity and the water availability/scarcity within the specific growing/sourcing region and in the case of agricultural plant based products whether the water is provided through irrigation or crops are rain-fed.

This highlights the requirement for companies to look in detail across the value chain of individual commodities, to ensure the water risk 'hotspots' are fully evaluated and addressed at source.

As a next step, sector-specific risk profiles were developed as a function of the particular product categories imported to the respective sectors of focus, including: agriculture, food and beverage manufacturing, retail, energy and transport, construction, manufacturing and financial services.

Agricultural sector

- In 2013, the agricultural sector in the UK contributed 0.6% of gross value added (GVA), £9.2 billion, and employed 476,000 people.
- 71% of the UK land area was utilised for agricultural usage (17.3 million hectares).
- 48% of the arable land is committed to wheat production; 14% for other arable crop, horticultural crops and potato production.

The water risk analysis here focuses on the principal inputs to the agricultural sector in the UK; agrochemicals, animal feed and fuel imports.

- Fuel imports are at the highest overall risk (2.4), but animal feed poses a higher physical risk.
- The UK is around 63% self-sufficient in fertiliser; phosphate and potassium have high regulatory and reputational risk. However, this is offset by the actual quantity sourced from these locations.
- Animal feed is a major input and cost to livestock farming. Imports, such as maize and soybeans, pose a reputational risk to companies sourcing from high risk-hotspots.
- The UK is reliant on energy imports and exposed to water-related risks linked to the extractives industry and these are only marginally offset by the gains from utilising renewable energy.

Food and beverage manufacturing

- The food and drink manufacturing industry is the single largest manufacturing sector in the UK.
- In 2013, it accounted for £25.7bn of gross value added (GVA), and employed 417,000 people.
- Approximately, 63% of food consumed in the UK is produced domestically; but has a growing dependency on imports.

Agricultural (plant) based products and food products imported to the UK have medium overall risk, linked to the high proportion of products imported from the EU.

- However, reputational risk is a concern for selected sourcing locations for tea and coffee and soybeans and to a lesser extent maize, potatoes and onions.
- Suppliers tend to be at higher vulnerability to water-related risk as they tend to hold higher levels of stock than the retailers.
- Companies need to be aware that product substitution may simply shift the impact from one region to another.
- This highlights the requirement for companies to look “beyond the factory fence” to ensure the water risk ‘hotspots’ are fully evaluated and addressed at source.

Retail sector

- In 2013, the UK imported est. £5 billion of retail goods; and exported £500m.
- Gross value-added was £78 billion over the same period; and employed 3m people.

From our analysis this is the sector that is most exposed to water risks from imports.

- Apparel is categorised with the highest overall risk rating (medium, bordering high risk); medium for physical and regulatory risk and high for reputation risk. However, it should be noted that if the score for China was only 0.02 higher then 60% of the UK's apparel would be at high risk. Essentially, cotton production and processing is associated with large amounts of freshwater withdrawal and, pollution through wastewater generated during growing and processing. This is particularly apparent where cotton growing is dependent on irrigation water. However, the capacity to shift sourcing locations, and to mitigate risk in the process, is limited. Thus, the

relationship between the retail sector and its suppliers will play an increasingly import role in securing the supply.

- Appliances and technology hardware are also ranked medium risk across all three parameters; the embedded supply chain impacts of mining and manufacturing operations can potentially exacerbate pre-existing stresses (pollution, community relations) – again placing countries at significant regulatory and reputational risk.

Energy (from oil, gas, coal) & transport

- Electricity is principally generated from gas (47%) and coal (28%).
- The energy industry contributed £23.8 billion in GVA in 2013 and employed 176,000 people.
- The transport and distribution sector contributed GVA of £149.6 billion.

The UK is highly dependent on imported fossil fuels. In 2012, UK coal production fell to an all-time low of 18 Mt, imports rose to 42 Mt; the UK produced 424 TWh domestically of which 109 TWh was exported. The UK is a net importer of oil. In 2013, the UK imported 150 million barrels of oil.

- Yet, imports of gas and oil are exposed to relatively low water risk. This can be linked to the dominant production method – offshore extraction – which is both less water intensive than onshore production and does not rely on freshwater sources.
- In contrast, coal production is associated with medium water-related risk, thought it may be possible to substitute sourcing of coal from developed markets which have more established water management institutions and thus lower water-related risks.

Construction sector

- Construction is one of the most important economic sectors in the UK.
- In 2013 it accounted for GVA of £92.4 billion and employed 2.06 million people.
- Almost all products (metals, plastics, mineral products and wood) are sourced within the UK.

The sector's exposure to imported water risk remains relatively low risk owing to the UK's self-sufficiency in its main materials and, where necessary, a high % of imports deriving from Europe.

- Basic metals imports are at the highest level of overall risk (2.55) linked to the activities of the extractives sector followed by other non-metallic mineral products (2.38). But this can mask potential reputational risk hotspots within particular sourcing locations
- Conversely, water scarcity may lead to increased regulation and reduced water rights. In Chile the country's third largest copper mine, Xstrata's Collahuasi operation, had to reduce its rate of water extraction by two thirds. The costs of such measures may be passed through the supply chain in the short term impacting the cost of not only raw materials, but semi-finished and finished products.
- Cement and other non-metallic mineral products are important inputs to the construction sector. The UK consumes 9.3 million tonnes of cement and is around 86% self-sufficient159 in the product. The balance is sourced from EU counterparts linked to an overall low water risk.

Manufacturing sector

- The share of the sector in the total UK economic output has been steadily declining; from 30% in the 1970's to 10% of GVA today.
- It comprises 11% of UK GVA and employs 2.6 million people.
- It is estimated that the imports into the sector account for 61% of the total supply.

The water risk analysis here focuses on the principal inputs to the manufacturing sector in the UK; metals, machinery, chemicals and rubber and plastic products.

The analysis shows that imported products to the manufacturing sector represent (overall) a low to medium water risk.

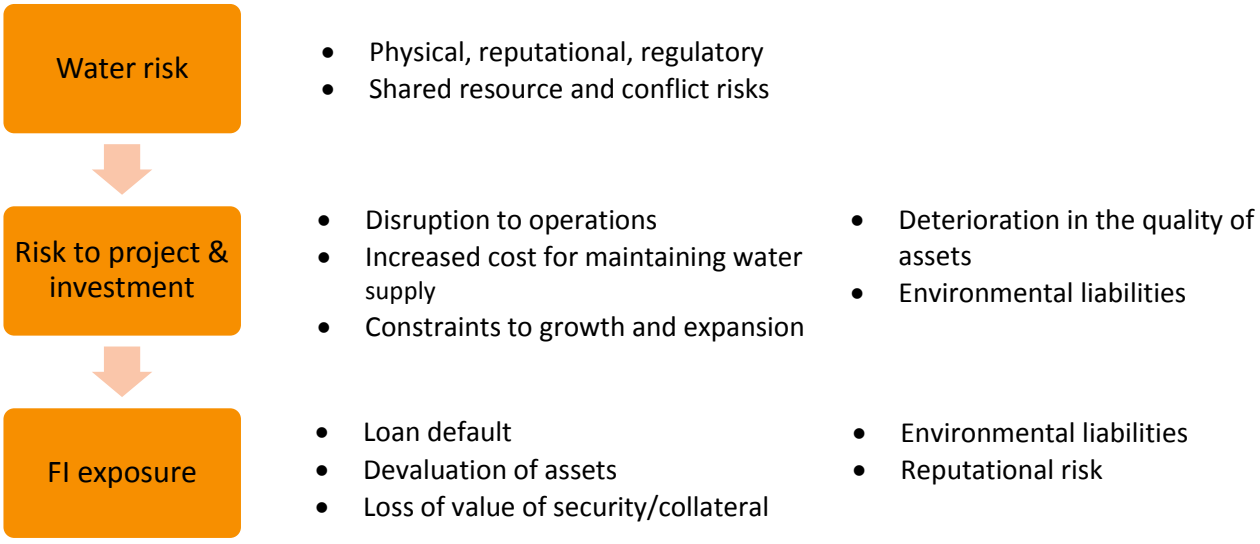
- Machinery imports are associated with the highest overall risk (2.52) followed by rubber and plastic products (2.40), motor vehicles (2.38), chemicals (2.23) and metals (2.20).
- Overall, these sectors are not exposed to significant water risk; however individual companies should be aware of the risks when sourcing from countries, such as China and Russia, characterised with higher regulatory and reputational risk.
- With multiple sourcing countries for some chemicals, there is significant opportunity to switch sources to locations that pose a lower water-related risk.

Financial institutions

- In 2011, the services of financial institutions (FIs) contributed £125.4 billion in gross value added (GVA) to the UK economy (9.4% of the UK's total).
- The sector's contribution to UK jobs is around 3.6% of total employment, around 1.1 million people.

The water risks for the financial sectors are mostly indirect since they are often connected to investments and/or in the countries they invest in (financial services sector).

Figure 3: Water risk and Financial Institutions



Source: UNEP FI (2004)[5]

Consequently, strategies to mitigate water risk have to be tailored towards the relevant and subsequent business models of the specific FI. The interaction between FIs and companies found in the real economy is essential to setting the right criteria, dealing with information requests, and ultimately reducing relevant water risks.

[5] SIWI. Risks of water scarcity. A business case for financial institutions. http://www.unepfi.org/fileadmin/events/2004/water_scarcity/water_unepfi_2004.pdf

Outcomes

While no single product category presents a 'high' risk companies should not be complacent about their exposure to the water risk. The potential for supply chain disruption remains high. Our analysis shows that there a number of products rated 'high' risk for at least one type of water-related risk, thereby posing a direct or indirect risk to business operations. Moreover, risks for individual products often diverge from national averages as they are sourced from a limited area that can have very different water risks to the country average – as highlighted through the examples for tomatoes and tea. It is therefore incumbent on companies to understand, in so far as it practicable, the specific locations where their own product imports derive from and take steps to mitigate their exposure to these risks.

Any future increase in pressure at source is likely to be reflected in the future price of the import product and hence play a more prominent role in decision making. To anticipate the water-related implications of future activities businesses need to evaluate where the hotspots exists and take the opportunity to rethink their water strategies to safeguard the resource for the future.

Immediate efforts can be undertaken to invest in innovating problems 'out' of the system. Companies can partly improve their competitive position through improved operational performance and efficiency. For instance, increasing water efficiencies to a point where there is no or minimal net water usage and by decreasing wastage. Or by creating improvements e.g. restoring functionality to catchments. However, efficiency improvements will do nothing to reduce risks if no other users sharing the same resource are applying the same measures and there is an absence of a regulatory regime to limit abstractions. Indeed water efficiency may even increase risk. For example, industry may be told during a drought to drastically cut their water use. If all efficiencies have been realised there may nowhere left to make these reductions – apart from reducing production volumes. However, good water stewardship of a catchment can help conserve water for all users.

Next, by determining where and when to invest in R&D. Potential measures include leveraging insights from improved data collection e.g. from a full life cycle perspective to use less water (or no water) for production processes. For example, the retail industry has taken steps to analyse product-related risks (at the farm, factory and river basin-level) to support suppliers to practice good management, through certification and water stewardship schemes. From a material point of view, companies could explore options to substitute one input with a different one, or, to substitute a complete system eliminating the need for the product entirely.

Finally, collaborating with a wide network of water users, public and private institutions to solicit creative solutions and strengthen resilience. Engaging with local suppliers and non-governmental organisations can stimulate ideas to address risk factors at a catchment level through practicing good water stewardship schemes.

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1. Water Risks – From Global to Local

1.1 Our global water challenge

The World Economic Forum's 10th edition of the Global Risks report, concludes that water is the top global risk, in terms of projected impact. Projections put global water requirements at 40% ahead of sustainable water supplies by 2030[6]. See Box 1.

The World Water Council has framed the problem as follows:

"There is a water crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people – and the environment – suffer badly." (World Water Council, 2000)

Freshwater consumption worldwide has more than doubled since 1900, and has exceeded the population growth by a factor of two over the same period. By 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world's population could be living under water stressed conditions.

Agriculture accounts 70% of total water use and industry for a further 25%. It takes as much as 1000-3000 litres of water to produce one kilogram of rice and it takes 13000-15000 litres of water to produce one kilo of grain-fed beef (IFAD)[7].

The World Bank states that food production will need to increase by 50% by 2030 as the global population expands and dietary habits change[8]. However, the Intergovernmental Panel on Climate Change suggests that over the same period the impact of climate change on weather patterns and rainfall – causing either floods or droughts – could cut crop yields by up to 25%[9] .

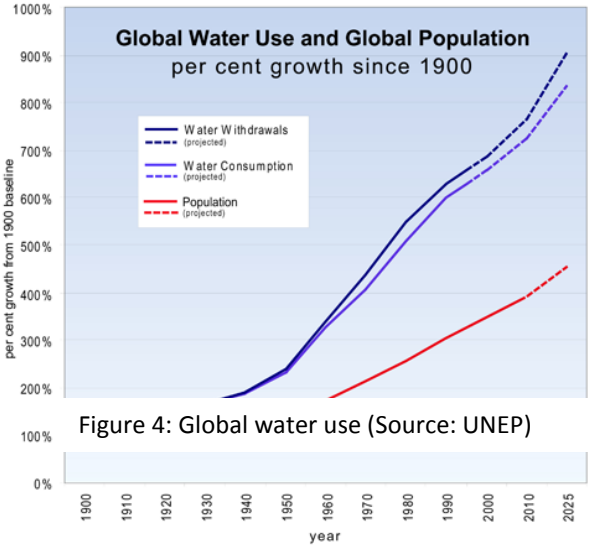
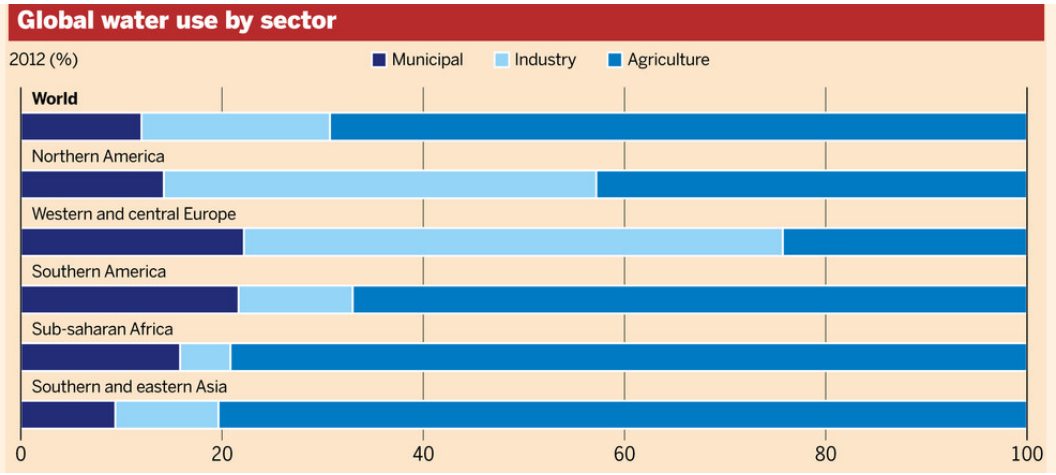


Figure 4: Global water use (Source: UNEP)

Water is also an important component of energy generation methods. The International Energy Agency further projects water consumption to meet the needs of energy generation and production to increase by 85% by 2035[10]. It is estimated that about one-fifth of the world's electricity requirement is now provided by hydropower and in some countries like Brazil and Norway the share is close to 90%.

[6] 2030 Water Resources Group, Charting Out Water Future, Economic frameworks to inform decision-making, 2009.
[7] IFAD, Water facts and figures. Available online.
[8] World Economic Forum. Global Risks 2015. Available online.
[9] As per 11.
[10] As per 11.

Figure 5: Global water use



Source: FT (2014)[11]

Box 1: Water stress facts

- Over the past 50 year the Aral Sea has dried to a 10% of its original size due to irrigation of fields for cotton and wheat production in Kazakhstan and Uzbekistan.
- Groundwater levels in many parts of Asia, such as the Indian state of Gujarat, have fallen by more than 150 meters in 25 to 30 years; thousands of wells and whole villages have been abandoned—the aquifer was developed and used up in just one generation.
- A prolonged multiyear drought in Australia (from 2002 and 2010) led to a 46% drop in wheat yield.
- California courts have limited the diversion of water for irrigation from Northern California and cities in the southern part of the state to protect endangered species in the San Joaquin-Sacramento river delta, causing a crisis for irrigated agriculture.

Source FAO, Land & Water: Drought[12]

The deterioration in the quality of surface waters and groundwater – due to agricultural runoff, industrial wastewater, and poor sanitation – compound the problem. Related impacts include:

- Environmental degradation – UNEP estimate that 300-500 Mt of heavy metals, solvents, toxic sludge, and other wastes accumulate each year from industry (UNEP FI[13]). Nitrogen leaching from intensive agriculture[14] is another driver.
- Reduced access to drinking resources and mounting health problems. WHO estimates that 3.4 million people die each year from water-related illnesses[15;] 90-95% of sewage in the developing world is discharged untreated into surface waters.

Hence water sustainability, needs to be understood, analysed and managed in specific localised contexts as well as considered as a global issue.

[11] Financial Times (2014). A World without water. Available online.
[12] FAO, Land & Water, Drought. Available online.
[13] UNEP FI, Challenges of Water Scarcity: A Business Case for Financial Insitutions
[14] Figures, C. et al. (2003). Rethinking Water Management: innovative approaches to contemporary issues. London: Earthscan Publications Ltd., p.71.
[15] Voice of America, WHO: Waterborne Disease is World's Leading Killer (2009). Available online.

1.2 Impact on business

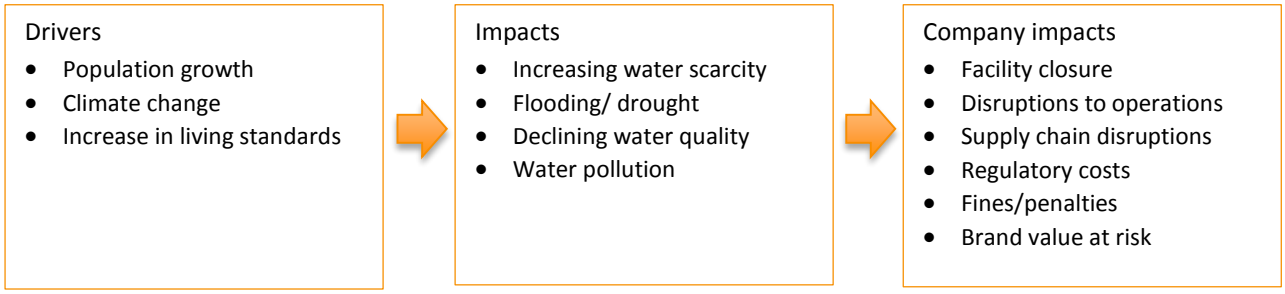
Numerous studies have demonstrated the importance of carbon embedded in imports while the awareness about water – from water scarcity to declining water quality – has not been fully understood and analysed for the economy as a whole. As a result many businesses are not sufficiently aware of how their globalised supply chains are exposed to water risk.

The implications for business of the water crisis have been set out by the CEO Water Mandate:

"Global water challenges, such as water scarcity and pollution, are having an increasingly negative impact on businesses. Now more than ever, companies need to assess their water performance and the watersheds in which they operate in order to address these challenges and ultimately stay in business." (CEO Water Mandate, 2014)

Figure 6 sets out the direct and indirect risks for companies and their supply chains, which extend to the closure of operations, disruption to supply chains, higher input costs, damage to reputation and the loss of the license to operate.

Figure 6: Water risk impact on business operations



In times of water crisis, different types of risk can conflate. For example, water scarcity not only disrupts business operations, but governments, which play an important role in allocating water rights and licensing for abstraction of water, can prioritise domestic consumption as a top priority for water allocation. According to UNEP FI[16]industry is often the last priority, which increases the business risk for companies operating in water scarce and water stressed areas. Hence a company's success depends on factoring water into their decision making and considering it a strategically important issue.

The different types of water-related risks are presented in greater detail in the following section.

1.3 Water risk

In line with the WWF Water Risk Filter (WRF), we distinguish in this report between three types of risk: physical, regulatory, and reputational.

The WRF assesses the water risk of businesses against basin- and facility-related risks. Basin-related risks depend on the origin of the product and are calculated using location-specific risk indicators within a framework of physical, regulatory, and reputational water risk categories. In order to account for sector-specific risk exposure, each sector has different weightings for the three risk categories mentioned above.[17] The facility-related risk depends on the facility's direct operations and therefore is not included in this analysis. A summary of these risks are presented in Table 3 below.

[16] UNEP FI, Challenges to water scarcity, a business case for financial institutions. Available online.
[17] Sector-specific weightings can be found on the Water Risk Filter website: www.waterriskfilter.panda.org

Table 3: Water-related risk

Category	Physical risk	Regulatory risk	Reputational risk
Basin-related risk (linked to location)	Water quantity (availability, scarcity, flooding, droughts), quality (pollution) and supply chain dependency within the river basin and the impacts this might have on companies, society, and the environment.	Strength and enforcement of water regulations and the consequences of restrictions by public institutions. Either felt through direct arbitrary or unanticipated regulatory action or from neglect, blockages, or failure. Potential for conflict or political disagreement over transboundary river basins, or national political imperatives, such as trade restrictions on food crops with embedded water.	Perceptions around water use, pollution, and behaviour that may have negative impacts on the company brand and influence purchasing decisions. Public perceptions can emerge rapidly when local aquatic systems and community access to water are affected.
Company-related risk (linked to behaviour)	Water quantity (scarcity and flooding) and quality issues related to a company's performance and its supply chain. It also relates to water quality that is unfit for use (pollution). Physical risk may mean that a company might not have sufficient amounts of appropriate quality water for their business operations and supply chains.	The potential changes in pricing of water supply and waste water discharge, water rights, quality standards and license to operate for a particular company or sector. Particularly in times of crisis (induced by physical risk) when regulatory regimes are changed unpredictably or incoherently, or they are inconsistently applied due to political expedience, incompetence or corruption	When the actions of the company are poorly executed, understood, or communicated to local stakeholders and when perceptions and brand suffer as a consequence. In a highly globalised information economy, public perceptions can emerge rapidly around business decisions that are seen to impact on aquatic ecosystems or local communities' access to clean water.

1.4 Water risk prospects for UK companies

The UK has a heritage of international trade and today many UK companies remain dependent on imported products – in the form of raw materials (e.g. metals), fossil fuels, textiles and agricultural products – to conduct their activities.

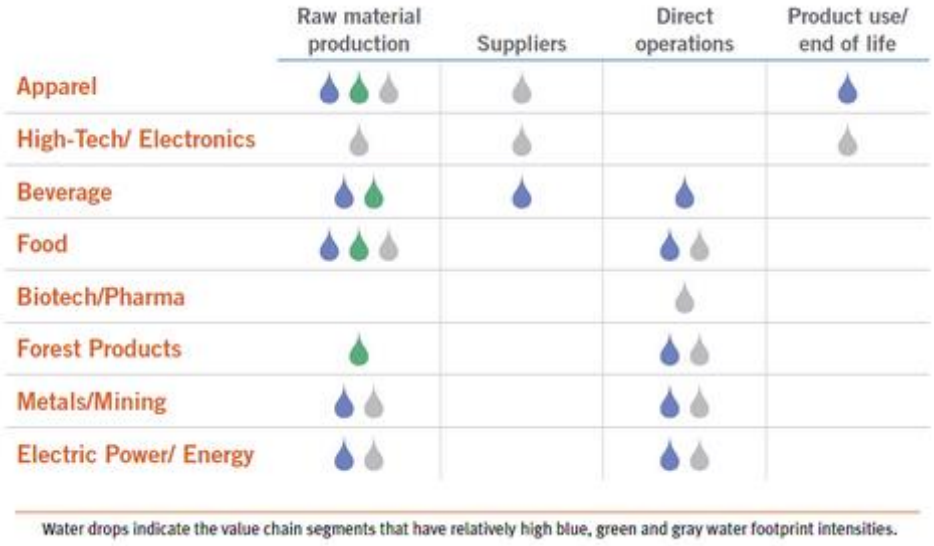
The UK food chain is a case in point. It is dependent on a variety of imports. Changing behavioural patterns or changes in tastes can affect the nature of these imports and consequently the degree to which business are exposed to water-related risk. For instance, policies developed to encourage one outcome (e.g. heathier eating) may actually have unintentional consequences on the environment in distant locations where product substitution occurs. For example, a dietary change that induces a switch from meat to pulses/nuts/fruits, means the substitute may be sourced from countries

associated with a high level of water stress, such as Spain, South Africa, and Israel[18]. Nevertheless, studies by Hess *et al (2014)* suggest that large but plausible changes in the typical diet in the UK have very little difference on overall blue water scarcity, rather it is a shift in where the impact occurs that needs to be considered.

Consequently many, UK industry sectors are exposed to imported water-related risks. The degree and nature of these risks differs based on where it is located within the value chain. For instance, how much water their supply chain partners use, the degree to which they contribute to pollution, and if they tend to be located in areas prone to water stress.

Figure 7 provides an indication of how water is used across different industry sectors.

Figure 7: Relative water footprint of various sectors.



Source: CEO Water Mandate[19]

Companies can partly mitigate water-related risk through proactive management of operations and the supply chain to increase water efficiency and build resilience. But to safeguard resources companies need to identify 'hotspots' of water-related risk and invest in the sustainable management of shared water resources and comprehensive water stewardship solutions. **Section 3** and **Section 4** identify the sources of risk, while **Section 6** details a variety of potential mitigating actions.

[18] Hess, T., Andersson, U., Mena, C., Williams, A. The impact of healthier dietary scenarios on the global blue waterscarcity footprint of food consumption in the UK, Food Policy, 2014.
[19] CEO water mandate, Risks by Industry Sector. Available online.

2. Method

This study and builds on the past work by WWF, such as the WWF Germany study on country-level water risks released in 2014,[20] and the 2008 UK water footprint report.[21] Whereas the 2008 report aimed to quantify the UK's water footprint, with particular emphasis on the quantity and origin of virtual water[22] deriving from food and fibre imports, this study aims to establish the degree of water risk faced by the UK in connection with its imports. The results of this study will enable decision-makers to better understand water risks and to take action to mitigate such exposures.

2.1 Water risk analysis and methodology

The methodology of this study is built on that of the 2014 WWF-Germany report. The analysis focuses on understanding the water risk to products imported to the UK, including raw materials, semi-finished and finished products, by using the trade data and the WWF's Water Risk Filter (WRF)[23].

The WRF assesses the water risk of businesses for 32 sectors; two sets of results are generated:

- Basin-related risk to a facility or operation that is derived from external factors. This is calculated using location-specific risk indicators within a framework of physical, regulatory, and reputational water risk categories. In order to account for sector-specific risk exposure, each sector has different weightings for the three risk categories mentioned above.[24]
- The facility-related risk depends on the particular type of business, the attributes of its operations and water management, and its water risk history. It is therefore not included in this analysis, as this study takes a product/sector/country level analysis

To achieve the aim of this study three elements were required:

- A list of products imported to the UK obtained from the analysis of the trade data from the UK's HM Revenue and Customs Overseas Trade Statistics;
- Identification of countries from which these products are sourced; and
- Classification of import data in a format and structure to match up with the WRF sector/commodity and basin/country.

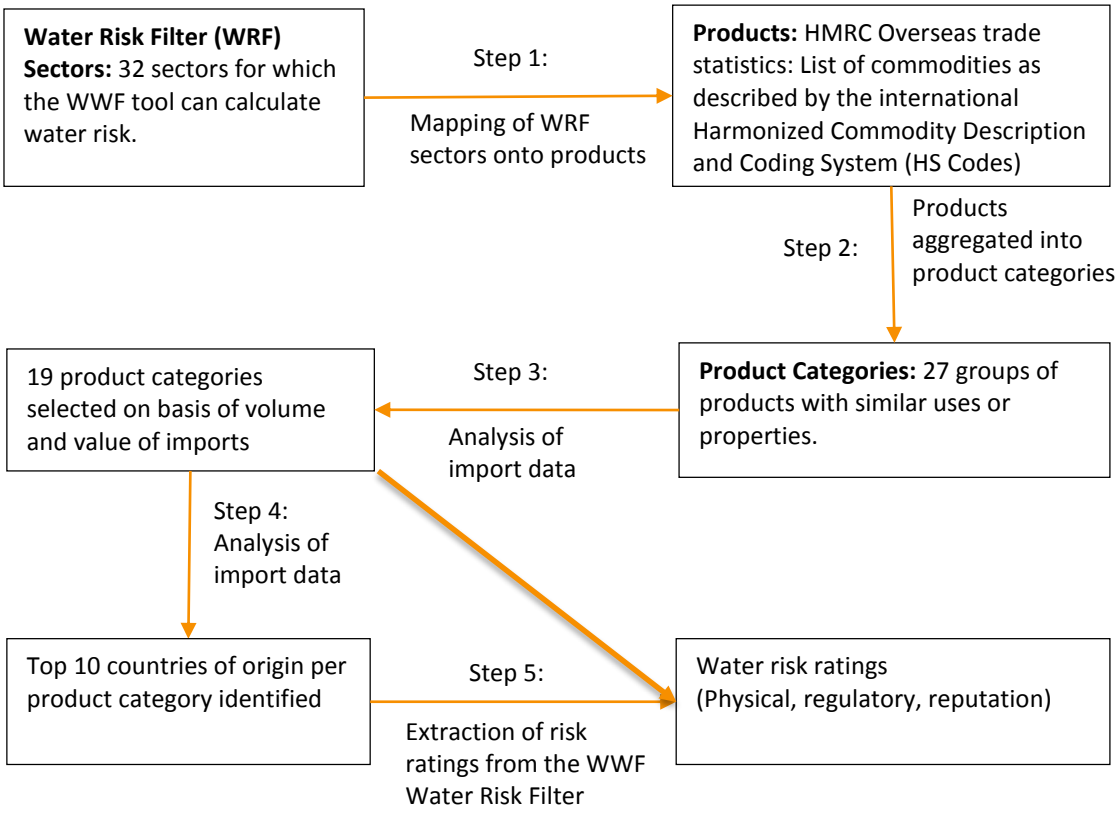
Figure 8 outlines the main steps undertaken in this study as well as the terminology used in the methodology described below.

Firstly, it was necessary to identify the type and quantity of UK imports. For the purpose of this analysis it was decided to use HMRC's Overseas Trade Statistics due to its comprehensiveness and ease of access[25]. HMRC data is arranged under the Harmonized Commodity Description and Coding System (HS Code), which is an internationally standardised coding system for classification of trade data for commodity groups at three different levels of aggregation (HS2, HS4 and HS6)[26]. For the

[20] WWF Germany (2014). The Imported Risk. Germany's Water Risks in Times of Globalisation. Available online.
[21] WWF (2008). UK Water Footprint: the impact of the UK's food and fibre consumption on global water (volume 1 and 2). Available online.
[22] 'Virtual water' refers to the water used to grow food and fibre commodities.
[23] For more information see: www.waterriskfilter.panda.org
[24] Sector-specific weightings can be found on the Water Risk Filter website: www.waterriskfilter.panda.org
[25] For more information see: www.uktradeinfo.com
[26] For more information see: World Customs Organization.

purpose of this analysis it was deemed adequate to use the most highly aggregated import data (HS2 codes).

Figure 8: Methodology outline and terminology



In the next step each HS2 product code was then mapped onto one of the 32 WRF sectors (i.e. the sector that produces that product) to enable the WRF tool to be used. At the highest level of aggregation (i.e. HS2), 99 codes exist and the analysis was simplified by further grouping imported products into 27 product categories, such as 'Agriculture (plant based)' and 'Pharmaceuticals'.[27] The trade data was then analysed to determine the volume and the value of imports of each product category for the year 2013, as this was the most recent year for which finalised data are available. Following this analysis, the 19 product categories with the highest volume and value imports to the UK were selected to determine the overall water risk.

Finally, HMRC trade data was analysed to identify the top ten sourcing countries by volume in 2013 for each of the 19 product categories analysed in detail. For each product category only the top ten importing countries (by volume) were included to keep the analysis manageable. The ten largest source countries for each product category encompassed between 63% (for agricultural (plant) based imports) to 98% (metal ores) of the total imports by volume for those categories, and therefore represent a sufficient coverage that general UK risk associated with a particular product category can be identified. The information acquired through the steps described above was used to extract the risk rating (physical, reputational and regulatory) for the top ten sourcing countries for each product category from the WRF. Where product categories spanned a number of WRF sectors, weighted averages were taken to find the overall product category rating e.g. Extractives (Metals) is linked to WRF sectors Extractives 2 (Coal, Uranium, Crude Oil except tar sands, Zinc, Lead, Iron ore)

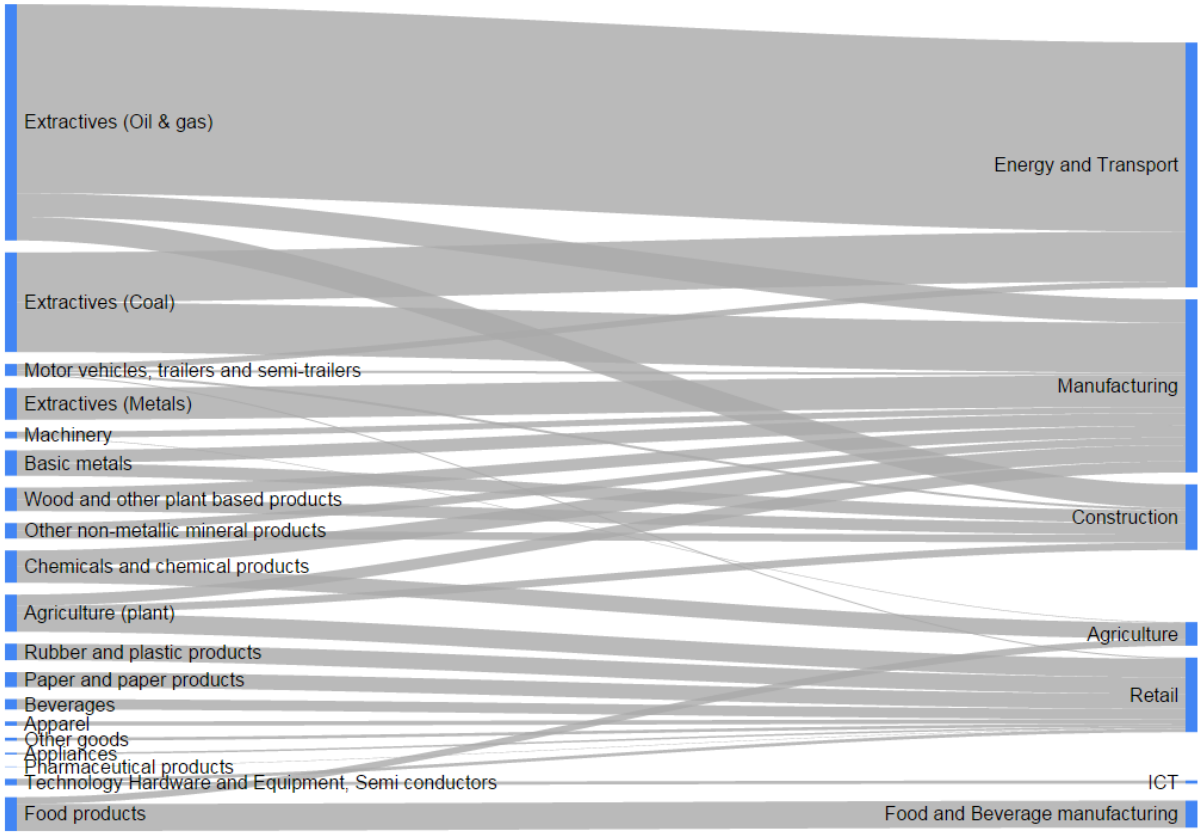
[27] See Appendix I for list of product categories.

and Extractives 1 (Low grade ore, Precious metals, Diamonds, Copper, Nickel, Tar sands).[28] See Appendix 1 (Table 40) for illustrative sector mapping between HMRC data and WRF classification.

The results of this analysis are presented in **Section 4**. The implications of the water risk of these products to seven main economic industry sectors are analysed in **Section 5**. These include:

- Agriculture
- Food and beverage manufacturing
- Retail
- Energy and transport
- Manufacturing; and
- Financial services.

Figure 9: A Sankey diagram to visualise how product categories map onto industrial sectors



**Note: Figure 9 does not show the share of imports being utilised by each sector. It is a pictoral representation of the sectors for which these products are of importance. Analysis of import data at HS4/ HS6 levels, and of the destination sectors of imported products would be required for greater accuracys.*

Given the focus on the Top 10 countries, some 'high risk' countries may have been omitted from the analysis. We feel this omission is not material to the overall water risk experienced by the UK for a particular import category, but the reader should keep this in mind. The financial sector was included in the analysis given its importance to the UK economy and the indirect water-related risk posed.

2.2 Major agriculture imports and water risk

The WRF tool also provides commodity level risk data for 122 plant based agricultural (plant) based products, including fruit and vegetables, cereals and fibre products.

[28] Water risk is assessed on a scale 1 to 5 with 1 being low risk and 5 high water risk.

This data provides an insight into those products that tend to require large amounts of water for growing.

The analysis follows a similar methodology to that outlined in Section 2**.** To start, HMRC HS codes were mapped on the 122 agricultural (plant) based commodities. HS6 data represented the best match to the products being analysed. Next, the HMRC import data was analysed to find the import values and volumes for each agricultural (plant) based commodity from 2013. 14 commodities were selected for further analysis based on a hybrid approach that uses both the value and the volume of imports to identify key agricultural produce/commodity imports to the UK (i.e. it captures both high value products that may be imported in low volumes, and products for which the UK relies on large volumes but which are not necessarily high value).

To calculate the related water risk using the WRF the top ten sourcing countries for each agriculture commodity were identified, using the HMRC data.

Re-imports relate to products that were previously imported by another country in the same state[29] (i.e. originate from a third country but are recorded as being sourced from the country of shipment before they arrive to the UK). For instance, a large number of products transit through the port of Rotterdam on arrival to the EU. According to HMRC data these products will originate from the Netherlands, rather than the country from which they were produced. However, the water risk of agricultural (plant) based commodities depends on the growing stage of such products. It is therefore necessary to identify the country of origin rather that from which a product is being exported.

HMRC trade data does not extend to information on re-imports. FAOSTAT production data was compared to that of imports. Imports from countries with no or little production of a specific commodity were labelled as re-imports; for example, bananas imported from the Netherlands (though a small amount of growing is now taking place) or Ireland. Imports labelled as re-imports were redistributed to UK sourcing countries proportionately. This means each country was assigned a share of re-imports proportionate to its imports (see Box 2). Finally, the WRF was used to extract risk values for all commodities and related countries of origin.

Total re-import quantity $= x$
Total import quantity from top 10 countries $= y$
Adjusted country import quantity $= Country\ import \times \left(1 + \frac{x}{y}\right)$

Box 2: Re-import redistribution methodology

In order to gain a better understanding of the water risk to agricultural commodities a commodity-related risk was also calculated. This risk rating relates specifically to the commodity as distinct from the basin level risk. The commodity-related risk depends on a number of criteria specific to the crop, the attributes of its production and its water management. Within the WRF, the commodity related risk is calculated on the basis of answers to a questionnaire, which could not be done in this case given the large number of crops and locations being assessed. However, three parameters relating to the water footprint of each commodity are automatically calculated in the WRF from global datasets and can be used to calculate a partial commodity-related water risk rating. These are: green water footprint, blue water footprint[30] and water sensitivity of the crop to water shortages. These figures depend both on the specific crop and the area in which this is cultivated.

[29] United Nations Trade Statistics Knowledgebase (n.d.). Distinction between Exports and Re-exports/Imports and Re-imports.

[30] Green water footprint is defined as the volume of rainwater consumed during the production of a good; the blue water footprint of a product is the volume of surface or groundwater consumed to produce a good that does not return to the catchment from which it was withdrawn.

3. Overview of UK's imports

3.1 An overview

This section provides an analysis of the UK trade data obtained from HMRC and the ratings from the WRF. It provides a general overview of the products imported to the UK, in addition to detailing the main import countries and their associated water risk. This is aimed at helping help decision-makers to understand water risks and to develop plans for risk mitigation.

The UK is the 7th leading importer and the 12th leading exporter in the world[31] and is the 6th largest world economy. As an open economy UK businesses trade with 181 countries worldwide. In 2013, the total value of products imported stood at £420 billion – equivalent to 32% of the total UK GDP[32]. The total weight of imports stood at 293.6 Mt of products.

Imports have been increasing over the last 10 years (see Figure 10). The dip in 2008/09 reflects the recent global recession that impacted on UK industries which imported less as a result of suppressed demand.

Figure 10: UK imports

Source: Trading economics [33]

3.2 Main import groups

The 18 categories account for 96% of total exports by mass and 91% by value. The products imported to the UK are heavily consolidated – with the two product sectors covering gas and oil and coal accounting for over 50% of total imports by weight, but only represent 12% of total imports by value. Oil and gas imports are valued at £59 billion with 68% of imports deriving from Norway, Russia, Qatar, Algeria and Nigeria.

Coal is the second largest import product category by weight (45 Mt). However, the value accounts for less than 1% of total imports (£3 billion). By weight 39% of coal imports derive from Russia,

[31] Economy watch. http://www.economywatch.com/world_economy/united-kingdom/export-import.html
[32] World Bank. http://data.worldbank.org/indicator/NE.IMP.GNFS.ZS/countries
[33] For more info see: http://www.tradingeconomics.com/united-kingdom/imports

followed by the US (26%) and Columbia (19%). Other countries including Australia account for less than 3% each.

Table 4: Main product groups imported into the UK (by weight)

Rank	Product sector	Total Weight		Total Value	Intensity of imports	Main imports by weight (Mt)
		Mt	%	£ billion	£/tonne	
1	Extractives (Oil & gas)	109	37	52	477	Norway (36.6), Netherlands (12.0), Russia (7.6), Qatar (6.7), Algeria (6.1), Nigeria (5.7)
2	Extractives (Coal)	46	16	3	66	Russia (17.9), United States (12.1), Colombia (8.6), Australia (1.6)
3	Agriculture (Plant)	17	6	13	730	France (2.2), Netherlands (2.0), Spain (1.8), Germany (1.4)
4	Food products*	16	5	16	1007	Netherlands (2.7), Argentina (1.3), France (1.3), Belgium (1.3), Germany (1.2), Ireland (1.2)
5	Chemicals and chemical products	15	5	23	1567	Netherlands (2.7), Germany (2.5), Belgium (1.5), France (1.4), Norway (1.1)
6	Extractives (Metals)	15	5	3	169	Brazil (6.7), Russia (2.0), Sweden (1.7), Canada (1.3), South Africa (1.2)
7	Basic metals	12	4	21	1778	Germany (1.7), China (1.1), Spain (1.0)
8	Wood and other plant based products	11	4	4	396	US (1.9), Sweden (1.6), Canada (1.4)
9	Rubber and plastic products	8	3	16	2089	Germany (1.6), Belgium (1.0)
10	Other non-metallic mineral products	7	2	1	85	Spain (1.8), Norway (1.4)
	Total	**294**		**420**		

Note: the total refers to the total imports and not the imports of the top 10 products.
*Includes preparation of meat and fish, sugars and sugar confectionary, cereals, flour, preparation of fruits and vegetables and residues from food industries, such as animal feed.

Extractives (metals) and basic metals represent the third largest import product group at 9% by weight. Brazil, Russia, Sweden, Canada, South Africa, China and EU are the principal sources. However, these imports represent less than 1% of the total value of imports, valued at £2 billion.

Food products are the fourth largest import category by weight. In 2013, 16 Mt (valued at £16 billion) were imported; Netherlands (17%), Argentina (8%), France and Belgium (8% each), Germany and Ireland (7% each).

Chemicals and chemical products are the fifth largest import group (15 Mt and valued at £23.3 billion). The majority of products were imported from the Netherlands (18%), Germany (17%), Belgium (10%) and France (9%).

Table 5 lists the largest imported product categories by value. Only four sectors (e.g. extractives (oil and gas), chemicals, basic metals, and rubber and plastic products) from the classification by weight feature on this list. Technology hardware is the largest import by value, followed by extractives (oil & gas) and motor vehicles. When considered by value, apparel and pharmaceuticals are also important products for the UK.

Table 5: Main product groups imported into the UK (by value)

Rank	Product sector	Total value	
		£ billion	%
1	Technology Hardware and Equipment, Semi-conductors	62	15
2	Extractives (Oil & gas)	52	12
3	Motor vehicles, trailers and semi-trailers	42	10
4	Miscellaneous goods[34]	37	9
5	Machinery	36	9
6	Chemicals and chemical products	23	6
7	Apparel	22	5
8	Basic metals	21	5
9	Pharmaceutical products	18	4
10	Rubber and plastic products	16	4
	Total	**420**	79

3.3 Main import countries

By volume the UK imports 60% (177 Mt) from a total of 293 Mt of products from 10 countries. The volume is equivalent to half of the total imports by value (£202 billion). The main import partner for the UK is Norway, accounting for 13.5% of total import by weight (39.8 Mt), followed by Russia (9.7%, 28 Mt), the Netherlands (8.3%, 24.5 Mt), the US (6.6%, 19.4 Mt) and Germany (5.4%, 16 Mt). See Figure 11 for schematic presentation of the main import countries by weight while Table 6 below provides information in more detail.

Table 6: The main import countries (by weight)

Rank	Country	Total Weight		Total Value	Intensity of import	Main imports by weight (Mt)
		Mt	%	£ billion	£/tonne	
1	Norway	40	14	17	421	Gas (35.6), Chemicals (1.1), Other non-metallic (1.4)
2	Russia	29	10	7	243	Coal (17), Oil & gas (7.5), Metals (2)
3	Netherlands	25	8	34	1394	Oil & gas (12), Agriculture (plant)(2.0), Food products (2.4), Chemicals (2.7)
4	United States	19	7	32	1652	Coal (12.1), Wood (1.9)
5	Germany	16	6	56	3492	Chemicals (2.5), Motor vehicles (1.9), Basic metals (1.7), Rubber & plastic products (1.6)
6	Belgium	12	4	20	1688	Oil & gas (4.3), Chemicals (1.5), Food products (1.2)
7	France	11	4	25	2230	Agriculture (2.2), Chemicals (1.4), Food products (1.3)
8	Colombia	9	3	1	87	Coal (8.6)
9	Sweden	9	3	7	842	Oil & gas (3.2), Metals (1.7), Wood (1.6), Paper (1.1)
10	Brazil	9	3	3	347	Metals (6.7)
	Total	**294**		**420**	**1430**	

Note: the total refers to the total imports and not the imports from the top 10 import countries.

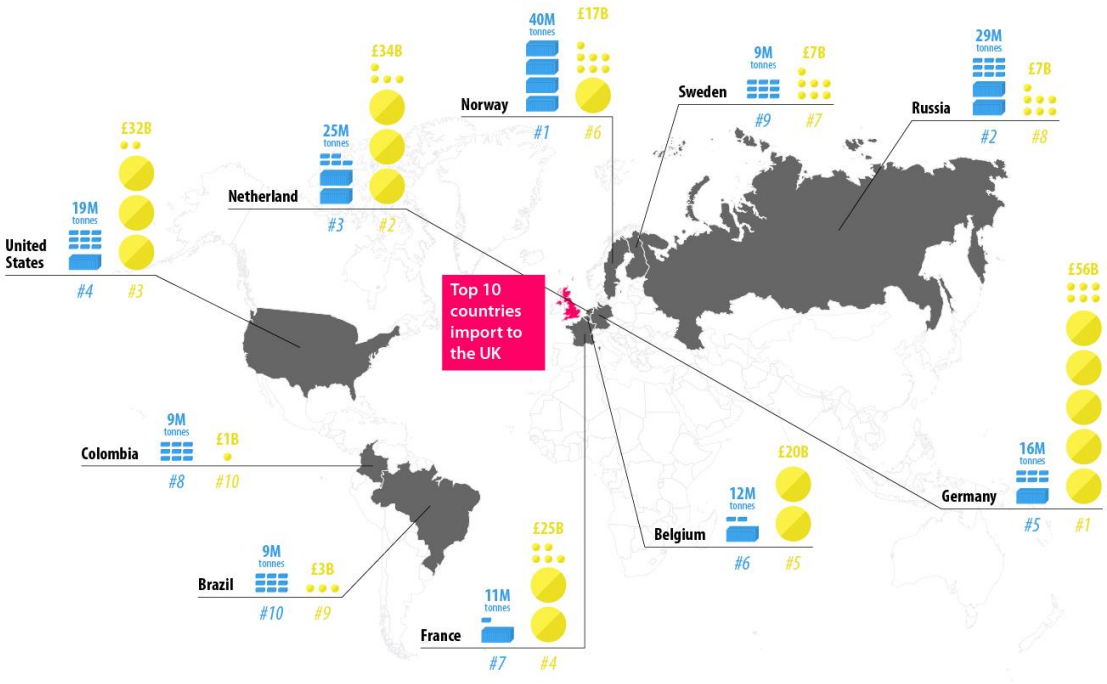
[34] Miscellaneous goods includes products not accounted for under the 10 product categories of focus AND the other product categories excluded from the analysis; for example toys, books and jewellery.

Table 7 presents the ranking by value. Germany is ranked first, followed by the Netherlands, the US and China. The latter does not feature on the list of the top importers by weight reflecting the fact that many of the imports to the UK from China are manufactured goods with a high value/weight ratio. In this ranking Italy, Spain and Brazil replace Colombia, Sweden and Brazil from the last three places.

Table 7: The main import countries (by value)

Rank	Country	Total Value		Overall
		£ billion	%	risk score
1	Germany	56	13	2.1
2	Netherlands	34	8	2.1
3	United States	32	8	2.5
4	China	32	8	3.4
5	France	25	6	2.6
6	Belgium	20	5	2.3
7	Norway	17	4	1.5
8	Italy	15	4	2.9
9	Spain	13	3	3.0
10	Irish Republic	12	3	1.5
	Total	**420**	62	

Figure 11: Map of the top 10 import countries. The bar charts denote the value and weight of imports.



The following section, **Section 4**, explores the water risk associated to main products imported to the UK.

4. Water Risk by product category

4.1 Sector overview

Within the WRF, the water risk is scored on a 1-5 scale, where <2.25 (low / green); 2.25-3.5 (medium / orange); >3.5 (high / red).

None of the imported product categories are exposed to high overall water risk; 83% are rated medium and 17% low risk (see Table 8). The highest overall risk is associated with finished products, such as apparel (3.4), appliances (2.84) technological products (2.65), products made of basic metals (2.55) and machinery (2.52). Low overall water risk is associated with some raw materials, such as metals and wood.

Table 8: Water risk of imported product categories sorted by overall risk

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)	Overall	Physical	Regulatory	Reputational
Apparel	2	22.2	3.4	3.23	3.49	3.83
Appliances	0.7	3.6	2.9	2.98	2.67	3.3
Miscellaneous goods[35]	1.4	36.6	2.76	2.71	2.69	3.51
Technology Hardware and Equipment, Semi conductors	3.1	62.3	2.64	2.71	2.34	3.45
Basic metals	11.7	20.8	2.55	2.7	2.05	3.18
Machinery	3.1	36.3	2.52	2.68	2.01	3.49
Beverages	4.8	5.8	2.51	2.62	1.73	3.08
Pharmaceutical Products	0.2	17.8	2.42	2.56	1.98	3.27
Extractives (Coal)	46	3	2.41	2.18	3.12	3.08
Rubber and plastic products	7.6	16	2.4	2.55	1.8	3.23
Motor vehicles, trailers and semi-trailers	5.5	42.3	2.38	2.5	1.72	3.27
Other non-metallic mineral products	7.1	0.6	2.38	2.5	1.85	2.63
Agriculture (plant)	17.1	12.5	2.37	2.48	1.87	3.27
Food products	15.6	15.7	2.37	2.42	1.88	3.01
Extractives (Oil & gas)	109.1	52.1	2.31	2.28	2.38	2.5
Chemicals and chemical products	14.9	23.3	2.23	2.29	1.65	3
Extractives (Metals)	14.7	2.5	2.2	1.88	2.72	3.85
Wood and other plant based products	10.8	4.3	2.06	1.92	2.13	2.96
Paper and paper products	6.9	5.6	2.05	2.04	1.71	2.82

Raw materials, such as metals and wood, present a low **physical** risk; i.e. water is present in sufficient quantity at source (e.g. forest land in Canada, Finland, and mining sites in Sweden, Canada and Brazil). Medium to high risk ratings are characteristic of apparel and appliances.

[35] Miscellaneous goods includes products not accounted for under the 10 product categories of focus AND the other product categories excluded from the analysis; for example toys, books and jewellery..

The majority of products have low **regulatory** risk. The exception being apparel, extractives (coal, oil & gas, metals) which are rated medium risk.

All product categories are rated medium risk from a **reputational** perspective. High risk hotspots are identified with imports of apparel and metals.

The drivers of risk are explored further in the sub-sections 4.2-4.19.

4.2 Agricultural (plant) based products

In 2013, the UK imported over 17 Mt of Agricultural (plant) based products, valued at £12 billion. In comparison, the UK exported nearly 4 Mt of such products for a total value of around £2 billion, making the UK a net importer of plant based agricultural products. Plant based agricultural products are imported from 165 countries to the UK.

Cereals are by far the largest import by weight in the UK with a volume of about 6 Mt and value of nearly £1.5 billion (see Table 9). These are followed by fruits and nuts, and vegetables which account for a lower share by volume but represent higher value imports with totals of £3.7 billion and £2.9 billion, respectively.

Table 9: Main product imports for the agricultural sector

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
10	Cereals	5,957	1,518
08	Edible fruit and nuts; peel of citrus fruits or melons	3,884	3,702
07	Edible vegetables and certain roots and tubers	3,665	2,901
15	Animal[1] or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	1,623	1,420
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medical plants; straw and fodder	1,188	789
09	Coffee, tea, mate and spices	392	913
06	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage	360	1,091
13	Lacs; gums, resins and other vegetable saps and extracts	28	145
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included	19	12

[1] The data includes animal fats although this is not a plant based product as the analysis was undertaken at HS2 level. Vegetable fats and oils represent a larger proportion of imports therefore it was decided to include HS code 15 in this section.

The leading foreign suppliers for plant based agricultural products by weight were France (13%), the Netherlands (12%), Spain (11%), Germany (8%) and Ireland (4%). The European Union is the most important trade partner for such products, sourcing 62% of total imports by weight.

Unlike other product categories, imports of agricultural products are less concentrated, with the top ten countries of origin only accounting for 63% of all imports. This is compared to Extractives (metals), where 98% of all imports to the UK derive from the top ten sourcing countries.

Water risk assessment

The risk ratings for Agriculture (physical, regulatory and reputational) are based on an average rating for all commodities and the entire geography of a single country (see Appendix I). Therefore, the

aggregate figures provide an indication of water risk to all agricultural products originating from a specific country.

Our analysis shows that plant based agricultural products imported to the UK have medium overall, physical and reputational water risk. The regulatory risk is low, linked to the high proportion of products imported from EU countries.

However, the water risk associated with agricultural products is also dependent on the type of commodity and the water availability/scarcity within the specific growing region and whether the water is provided through irrigation or crops are rain-fed.

This highlights the requirement for companies to look in detail across the supply chain of individual commodities, to ensure the water risk 'hotspots' are fully evaluated and addressed at source. Further analysis of individual commodities and associated supply chain risks follows below. First, by looking at individual raw materials and second, through an analysis of specific growing regions.

Wheat

Wheat is the largest single agricultural commodity imported to the UK. In 2013 2.4 Mt of wheat with a value of £500 million was imported. This contrasts with UK production volumes of 13 Mt.[36] Imports are linked to demands for varieties that can be difficult to cultivate in the UK. For crops like wheat year-to-year variations in sourcing can be large, linked to e.g. changing weather patterns.

Germany (35%) is the largest source country followed by France (19%) and Canada (15%). These three countries alone account for nearly 70% of all imports by weight.

In total, 29% of imports from the Top 10 source countries are rated medium risk; 19% of imports sourced from Canada and Bulgaria are assessed as being at a high reputational risk.

On average, wheat requires 1,827 m^3 of water per tonne of product;[37] the crop is rain-fed in temperate climates such as the UK. This is consistent with commodity related risks for this commodity that show low risk for all countries expect the US which is assessed to have medium risk. Here, irrigation is used in a number of states making cultivation more susceptible to water scarcity issues. For example, the blue water footprint for wheat in Idaho is 864 litres per tonne of product compared to zero in countries where wheat agriculture only depends on rainwater.[38]

Maize

Maize is the second largest agricultural commodity import to the UK – 2 Mt were imported in 2013, worth almost £400 million.

The largest exporters of maize to the UK are France (33%) followed by Ukraine (21%) and Bulgaria (13%). The top ten countries accounting for over 90% of imports; 59% derives from EU sources and the remainder from countries in Eastern Europe and Latin America.

As for wheat, none of the sourcing countries have an overall high water risk score, although 83% of the top 10 importing countries are rated medium risk rating. Maize is grown in a number of southerly European and non-EU countries. 31% of imports derive from Ukraine, Argentina and Russia. These

[36] FAOSTAT data.

[37] Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. Available at: http://www.waterfootprint.org/Reports/Report47-WaterFootprintCrops-Vol1.pdf

[38] As above.

countries are assessed as being at high regulatory risk, and 18% of imports are sourced from countries, such as Bulgaria, Canada and Brazil which are characterised with a high reputational risk.

Maize requires on average 1,220 m^3 of water per tonne of product. The water footprint varies between different countries, for example maize grown in the US has an average water footprint of 760 m^3 of water per tonne compared to 1,900 m^3 of water per tonne of Russian crops; of this, the blue water footprints for the US and Russia are 63 m^3/tonne and 572 m^3/tonne respectively.[39]

Ukraine is associated with high regulatory risk consistent with an evolving regulatory system and partial implementation of reforms (e.g. tariff reform, establishment of a national regulator)[40]. Also, political pressure and lobbying often take precedence over rules[41]and hence provide an uncertain institutional framework. Similar constraints are present for businesses in Russia, where companies face a number of regulatory issues, as well as lack of transparency and high levels of corruption. The political and economic situation in Argentina is unstable causing high regulatory risk.

Bananas

Bananas are the most imported fruit commodity. In 2013, the UK imported over 1 Mt of bananas for a value of £500 million. Bananas are sourced from Central and Latin America, and from Africa. Colombia (25%) is the largest exporter of this fruit followed by the Dominican Republic (19%), Costa Rica (16%) and Ecuador (14%). Again, imports are very concentrated and the top ten countries provide 97% of all imports.[42]

Colombia, the largest exporter, is rated as having a high reputational risk, whereas the Dominican Republic, Ivory Coast and Cameroon (32% combined) are all rated as high risk from a regulatory perspective.

The water footprint of bananas is on average is 790 litres per kilogram of crop;[43] 99% of water use in the production of bananas occurs during the growing stage.[44] This can be both rain-fed and supplied through irrigation. None of the top ten importing countries have a high overall commodity risk; however, 72% of imports out of these countries are at medium water risk.

Colombia faces high reputational risks due to increasing competition for water between different industry sectors, such as mining.[45]

The Dominican Republic suffers from a high concentration of power by one political party which combined with corruption and favouritism results in an unfavourable regulatory framework for businesses. Poor water management is also thought to be the cause for water pollution and scarcity

[39] Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. Available at: http://www.waterfootprint.org/Reports/Report47-WaterFootprintCrops-Vol1.pdf

[40] OECD, 2011. Guidelines for performance-based contracts between water utilities and municipalities. Lessons learnt from Eastern Europe, Caucasus and Central Asia: http://www.oecd.org/env/resources/49092291.pdf

[41] As per 42.

[42] It should be noted that some import data for bananas from countries that have been deemed to be re-exporters, such as the Netherlands, has been reassigned proportionately to remaining top ten countries.

[43] Water Footprint Network.

[44] Sikirica, N., (2011). Water Footprint Assessment Bananas and Pineapples Dole Food Company

[45] OECD Water Forum. October 2011. Colombia: Managing water conflicts in an emerging economy. Available online. http://www.oecd.org/env/resources/49012603.pdf

in the country.[46] Political stability has improved in both the Ivory Coast and Cameroon but these are still subject to a lack of enforcement of environmental regulations.

Soybeans

The UK is dependent on imports. The principal use for this commodity is animal feed. In 2013, 600,000 tonnes of soybean were imported for a total value of £200 million. Production and imports to the UK are dominated by North and South American countries, although some production is present in Europe. Brazil dominates exports and alone provides 51% of UK imports. This is followed by Argentina (20%), Canada (16%) and the United States (12%). Together these four countries account for 99% of imports.[47]

Soybean requires 2,145 m^3 of water per tonne of product.[48] FAO reports that this crop is mostly cultivated under rain-fed conditions but irrigation is becoming more common.[49] China and India have overall high risks; however, these account together for only 1% of imports. In China the water footprint for growing soybean in this country is slightly over 3,000 m^3/tonne and 8% of this is associated with blue water. France has a lower overall footprint of 2,250 m^3/tonne however, 24% of which is associated with blue water.[50]

Three of the top four importing countries – Brazil, Argentina and the US comprising (83% by weight) have overall medium risk; Canada is rated low risk. Of these four, Brazil and Canada have high reputational risk and Argentina has high regulatory risk.

Regulatory water risk in Argentina is a result of the division of water resources management functions across multiple institutions operating at different levels (e.g. the national, provincial, and river basin level) with a variety of functions and jurisdictions. This has led to conflicts between competing uses (i.e. irrigation, hydropower and environment), poor planning and budget programming, and limited technical capacity and knowledge exchange.

Soybean production requires large areas of land, this has led to increasing deforestation of tropical forests particularly in Brazil, but also in other South American countries. Deforestation is also thought to be one of the major drivers for recent droughts in the country.[51]

Potatoes

The UK produced 5.6 million potatoes in 2013, with a slight declining trend since 2010.[52] In the same year 600,000 tonnes were imported to the UK, a very small amount compared to domestic production.

The top exporter to the UK of this product is France (33%) followed by the Netherlands (13%), Israel (13%), Belgium (11%) and Germany (10%). These countries alone represent over 80% of total

[46] WWF Water Risk Filter. http://waterriskfilter.panda.org/en/CountryProfiles#25/profile
[47] It should be noted that some import data for soybean from countries that have been deemed to be re-exporters, such as the Netherlands, has been reassigned proportionately to remaining top ten countries.
[48] Water Footprint Network.
[49] FAO Water (n.d.), Crop Water Information: Soybean.
[50] Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. Available at: http://www.waterfootprint.org/Reports/Report47-WaterFootprintCrops-Vol1.pdf
[51] World Resources Institute. 3 Maps Help Explain São Paulo, Brazil's Water Crisis, 2014. Available online: http://www.wri.org/blog/2014/11/3-maps-help-explain-s%C3%A3o-paulo-brazil%E2%80%99s-water-crisis
[52] FAOSTAT data.

imports. European countries are the main trading partners with the UK for potatoes. Eight EU countries are present in the top ten list accounting for 81% of potato imports.

The water footprint of potatoes is 290 litres per kilogram. Water consumption by irrigation can be significant depending on the region. For example, the water footprint of potatoes grow in the UK is 102 litres per kg compared to those grown in Egypt for which 428 litres per kg are required. For potatoes grown in Egypt, 68% of water footprint is caused by blue water use.[53] High dependence on irrigation for this crop in a country with severe water stress means that Egypt has the highest physical water risk.

None of the major countries of origins are assessed as having high overall water risk; however, 83% of imports arise from countries with medium risk. Two countries – Israel and Egypt totalling 18% – have been assigned high reputational risk.

The high reputational risk rating in Israel is consistent with the water risks associated with the ongoing conflict with Palestine and the restrictive water management policies deployed in the West Bank. [54]

In Egypt, ongoing issues over water management in the Nile river basin cause uncertainty over water supply.[55] Whilst the unstable political environment and societal unrest contribute to low investment confidence for businesses.

Apples

Although the UK is a large producer of apples, only around a third of apples consumed in the UK are from domestic production. The UK produced 203,000 tonnes of apples in 2012, compared to nearly 500,000 tonnes of imports for a value of almost £400 million. Apples are only in season in autumn in the Northern hemisphere. Therefore, large amounts of apples are imported from countries like South Africa and New Zealand in the spring and summer periods.

France (28%) is the largest exporter of apples to the UK followed by South Africa (21%) and New Zealand (9%). The top ten countries represent 89% of total imports. Of the top 10 countries, around 50% of imports derive from Europe; the remainder from countries located in the southern hemisphere, in the off season.

The water footprint of apples is 822 litres per kilogram of product.[56] According to water footprint studies, over 99% of water in apple production is used on farm mainly for irrigation purposes. Other uses include cooling, application of pesticides and frost control.[57]

None of the top ten sources are assessed as having an overall high risk. But 74% have a medium risk. Brazil is the only country with a high reputational risk. Its rating can be linked to the high levels of deforestation associated principally to with a decline in water quality. However, the majority of

[53] Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. Available at: http://www.waterfootprint.org/Reports/Report47-WaterFootprintCrops-Vol1.pdf

[54] Human Rights Watch. 2010. Separate and Unequal
Israel's Discriminatory Treatment of Palestinians in the Occupied Palestinian Territories. Available online.

[55] AfricaRenewal: Africa Watch (2013). Ethiopia plans Africa's biggest dam.
http://www.un.org/africarenewal/magazine/august-2013/africa-watch

[56] As per 57

[57] Williams et al, (2007). Comparative life-cycle assessment of food commodities procured for UK consumption through a diversity of supply chains.

apple orchards in Brazil are located in high altitude areas in Southern Brazil and unlikely to impact freshwater sources.

Onions and Shallots

The 7th largest agricultural (plant) imports by weight to the UK are onions and shallots. These are the second largest fresh vegetable product consumed in the UK after potatoes. Domestic production in 2012 amounted to around 400 thousand tonnes,[58] 2013 imports accounted for a similar amount and were valued at £160 million. The largest source of onions and shallots is the Netherlands (43%) followed by Spain (31%). These two countries alone are the source of 70% of onions and shallots imported to the UK. However, it should be noted that those products which originate from the Netherlands, may be re-exports.

The global average water footprint for onions and shallots is 272 m³/tonne, this is low compared to other commodities assessed in this analysis.[59] However, two countries – Egypt and India, representing 7% of imports – have an overall high risk; these countries also have physical and reputational risk. An additional 44% are sourced from medium risk countries.

Egypt has high physical and reputational risk relating to water. In Egypt the annual water withdrawals exceed the amount of renewable water available.[60] Egypt is already experiencing internal and cross-border tensions due to limited availability and dependence on Blue Nile of water resources. The Egyptian government has threatened legal action against countries failing to respect the long-standing agreement on the use of the Nile[61]. Irrigation requirements for onion cultivation are likely to contribute to such problems.

India scores high risk on all three types of water risk. The country is affected periodically by both severe droughts and floods. Water quality is also a problem. Lack of sewage treatment causes pollution of surface water, whereas groundwater is polluted by municipal, industrial and agricultural activities. Excessive withdrawals of groundwater also cause saline intrusion.[62] Poor governance is considered one the main causes for such problems.[63]

Tomatoes

Most of the tomatoes consumed in the UK are imported. In 2012, the UK produced around 84,000 tonnes of tomatoes and imported 420,000 tonnes, worth £420 million representing the fourth largest agricultural import in terms of value.

The largest exporter of tomatoes to the UK is the Netherlands (42%), although some of this may represent re-exports, this is followed by Spain (34%). The top two countries alone account for 76% of imports. Tomato imports are strongly dominated by European countries. These account for 89% of imports from the top ten countries of origin. There are no countries assessed as having high risk overall or in any of the three risk areas.

[58] FAOSTAT data

[59] Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. Available at: http://www.waterfootprint.org/Reports/Report47-WaterFootprintCrops-Vol1.pdf

[60] WWF Water Risk Filter. http://waterriskfilter.panda.org/en/CountryProfiles#27/profile

[61] International Water Management Institute (2012). The Nile River Basin, Water, Agriculture, Governance and Livelihoods.

[62] WWF Water Risk Filter. http://waterriskfilter.panda.org/en/CountryProfiles#37/profile

[63] Water Governance Facility (2013) Groundwater Governance in India: Stumbling Blocks for Law and Compliance. WGF Report No. 3, SIWI, Stockholm.

The average global water footprint of tomatoes is 214 litres/kg[64]. This occurs during the cultivation stages. Most UK production, as well as in the Netherlands and out of season production in countries like Spain and Italy is carried out in greenhouses. These cultivations therefore cannot be rain-fed and require water for irrigation.

Palm oil

Palm oil, like soybeans, requires tropical climatic conditions for cultivation and therefore it is not produced in the UK. Palm oil is used in a large number of food products including chocolate, margarine and cream cheese. Its popularity is owed to its low cost. It is also used in cosmetic products and increasingly to produce biofuels.

The UK imported 300,000 tonnes of palm oil in 2013 for a total value of £170 million. The countries of import include the locations where oil palm is cultivated, principally countries in South East Asia and Central and Latin America. The major exporting country to the UK was Papua New Guinea (58%), followed by Malaysia (14%).[65]

The majority of sourcing countries have an overall medium water risk (87%). Malaysia, Indonesia and Thailand (19%) are assessed as having high regulatory risk and Indonesia (4%) as having high reputational risk.

Indonesian regulations on palm oil have been changing over the past couple of years. In 2013, the introduction of a new law limiting the ownership of land for new plantations was reported.[66] There remains however potential for conflict or political disagreement over transboundary river basins and access to water for indigenous communities.

Malaysia is also characterised by a high regulatory risk. Although the country aims to increase investment by improving infrastructure and creating a positive environment for businesses, regulatory risks are still present due to corruption and political involvement in the judiciary system. Water management is controlled by a large number of agencies leading to conflicts over water management. In addition, legislation changes have resulted in some progress towards improved water management but the scope of these revisions is still considered to be limited.[67]

In Thailand, rated with a high regulatory risk, there are no clear policies to control overexploitation of groundwater resources. These are increasingly polluted because of agricultural run-off and wastewater pollution.[68]

Grapes

The UK is fully reliant on imports of fresh grapes. In 2013 it imported 250,000 tonnes worth £400 million. Grapes are the third highest import of agricultural commodities by weight. South Africa

[64] Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. Available at: http://www.waterfootprint.org/Reports/Report47-WaterFootprintCrops-Vol1.pdf

[65] It should be noted that some import data for oil palm from countries that have been deemed to be re-exporters has been reassigned proportionately to remaining top ten countries.

[66] CDP, July 22 2014. Palm oil politics. http://blog.cdp.net/palm-oil-politics/

[67] WWF Malysia (n.d.), Managing water resources well for sustainability. Available at: http://www.wwf.org.my/about_wwf/what_we_do/freshwater_main/freshwater_sustainable_water_use/projects_sustainability_of_malaysia_s_water_resources_utilisation/smwru_issues/

[68] The Water Project: http://thewaterproject.org/water-in-crisis-thailand

(24%) is the largest exporter of grapes to the UK followed by Chile (17%) and Spain (14%). The top ten countries account for 92% of total imports, only 28% of imports are from EU countries.[69]

Two top importing countries, South Africa and Chile, have been assessed as having a high overall water risk, while the remaining countries have medium risk score.

The water footprint of grapes is 600 litres per kilogram of crop. On average, the blue water footprint accounts for 16%.[70] Countries with medium commodity-related risk account for 61% of imports.

Egypt and India are both rated at high physical risk and along with Brazil, which is characterised with high reputational risk (14%); 10% of imports originate from countries with high regulatory risk, such as India and Peru.

Egypt has high physical and reputational risk. In Egypt the annual water withdrawals exceed the amount of renewable water available.[71] Irrigation requirements for onion cultivation are likely to contribute to such problems. India scores high risk on all three water risk parameters for the reasons cited previously.

Peru has been trying to improve its business environment to encourage investment since the election of the new government in 2011; however, this has not been an easy task. Although the regulatory framework has been improving this is still not considered to be sufficient to effectively manage water resources and reduce conflict around water use.[72]

Coffee

All coffee consumed in the UK is imported. In 2013, 145,000 tonnes of this commodity were imported at a value of nearly £300 million. Note that extracts, essences and concentrates, of coffee, are included within the food products category. This includes instant coffee.

All coffee imports arise from Asia, Central and South America, and Africa.[73] The major exporter of coffee to the UK is Vietnam (27%), followed by Brazil (23%), Colombia (15%) and Indonesia (12%). The top ten countries account for 92% of total imports.

Coffee requires huge amounts of water for cultivation, its water footprint is 15,897 m^3 per tonne; however, only 1% of this is accounted for by the blue water footprint.[74] This means most countries have medium water risk. Only one country, Ethiopia (3%), has high overall water risk.

[69] It should be noted that some import data for grapes from countries that have been deemed to be re-exporters has been reassigned proportionately to remaining top ten countries.
[70] Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. Available at: http://www.waterfootprint.org/Reports/Report47-WaterFootprintCrops-Vol1.pdf
[71] WWF Water Risk Filter. http://waterriskfilter.panda.org/en/CountryProfiles#27/profile
[72] Global Water Intelligence. http://www.globalwaterintel.com/client_media/uploaded/20130220_GWM2014_Peru_sample_chapter.pdf
[73] It should be noted that some import data for coffee from countries that have been deemed to be re-exporters has been reassigned proportionately to remaining top ten countries.
[74] Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. Available at: http://www.waterfootprint.org/Reports/Report47-WaterFootprintCrops-Vol1.pdf

Vietnam and Indonesia are assessed as having high regulatory risk along with Peru, Ethiopia, Nicaragua and El Salvador. These top four countries account for 77% of imports and all have a high reputational risk rating.

Ethiopia has been affected by droughts in over 50% of the country over the past 12 months resulting in severe problems for agriculture. Although Ethiopia has large water resources these are not well developed.[75] Ethiopia is also characterised by lack of transparency, high levels of corruption and high power concentration.

In Vietnam, the extensive use of pesticides and fertilisers on coffee plantations, as well as waste produced during the processing of coffee beans, contaminates waterways and causes serious environmental threats. Deforestation, depletion, and contamination of water resources pose a high reputational risk for companies involved in Vietnam's coffee production and trade[76].

Chillies and Peppers

The UK imported nearly 190,000 tonnes of chillies and peppers in 2013, worth over £270 million. This is compared to a domestic production of approximately 18,000 tonnes. Over half of chillies and peppers imported to the UK originate from the Netherlands (55%), although this figure is likely to include re-exports. Spain also accounts for a large proportion of imports (29%). The majority of the top ten countries are members of the EU from which 90% of these products are imported.

The water footprint of chillies and peppers is 379 litres per kilogram of crop.[77] This is a very low volume compared to most commodities analysed in this section and is consistent with all but two countries having low commodity related water risk.

India scores high risk on all three parameters for the reasons cited previously.[78] The high reputational risk rating in Israel can be linked to the ongoing conflict with Palestine and the restrictive water management policies deployed in the West Bank. [79] Turkey is also rated high risk in respect of all three parameters. Challenges are particularly acute regarding water supply, waste water treatment and waste management. This can be linked to rising demand for both domestic and industrial water supply, but a diminishing supply of easily exploitable fresh water. The government has responded by introducing new principles, including the Regulation on Water Pollution Control. However, the level of enforcement is weak. Often the responsibility for industrial waste water analysis is left to the industries that apply for the permits. This is particularly evident at the local / municipal levels.

Tea

Tea is one of the most popular drinks in the UK. In 2013, the UK imported nearly 140,000 tonnes of green and black tea for the value of £270 million. The principal exporter of tea to the UK is Kenya, which accounts for 56% of imports alone. India (16%) is the second largest exporter.[80]

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[75] WWF Water Risk Filter. http://waterriskfilter.panda.org/en/CountryProfiles#28/profile

[76] WWF 2014, The Imported Water Risk: Germany's water risks in times of globalisation

[77] Mekonnen, M.M. and Hoekstra, A.Y. (2010) The green, blue and grey water footprint of crops and derived crop products, Value of Water Research Report Series No. 47, UNESCO-IHE, Delft, the Netherlands. Available at: http://www.waterfootprint.org/Reports/Report47-WaterFootprintCrops-Vol1.pdf

[78] Water Governance Facility (2013) Groundwater Governance in India: Stumbling Blocks for Law and Compliance. WGF Report No. 3, SIWI, Stockholm.

[79] Human Rights Watch. 2010. Separate and Unequal
Israel's Discriminatory Treatment of Palestinians in the Occupied Palestinian Territories.
http://www.hrw.org/sites/default/files/reports/iopt1210webwcover_0.pdf

[80] It should be noted that some import data for coffee from countries that have been deemed to be re-exporters has been reassigned proportionately to remaining top ten countries.

Three (76%) of the exporting countries – Kenya, India and China – are assessed as having overall high water risk. Kenya and India have high risks for all risk categories. The remaining 18% have medium risk. Over 80% of imports are sourced from countries with high regulatory risk and high reputational risk respectively.

Kenya has high physical, regulatory and reputational risks. The water management framework is considered to be inadequate, particularly for use in farming. The only existing legislation controlling water use for irrigation dates to 1966. However, the government is working on establishing a new regulatory framework and in the meantime has issued guidance on this issue.[81]

It should be noted that although both India and Kenya have been assessed as having high physical risks, these figures represent national averages. Tea is mostly grown in highland areas where rainfall is generally sufficient to sustain agricultural production without the requirement for irrigation. The water issues related to these areas are likely to arise because of changing rainfall patterns with heavier rainfall in some seasons and longer dry spells.

China has worked on improving its water management framework and now has a comprehensive set of regulations. Water problems arise due to the lack of enforcement of such regulations and compliance was reported to be as low as 10% in 2009. This is due little control of regional authorities from the national government, lack of transparency and corruption. Poor enforcement of these laws is one of the major drivers for pollution incidents in China.[82]

Argentina's rating of high regulatory risk is consistent with an inadequate regulatory and institutional framework, inter-sectoral conflict, limited capacity in water management at the central and provincial levels, and high risk for flooding in urban and rural areas[83].

Cocoa

Cocoa is grown in tropical regions. Cocoa is imported mainly from African countries as well as from South East Asia and Central and Latin America. In 2013, the UK imported 140,000 tonnes of cocoa worth £302 million. The major exporting countries were the Ivory Coast (46%) and Ghana (32%). Imports of cocoa are highly concentrated with the top ten countries representing nearly 100% of imports.[84]

None of the importing countries are assessed as having high overall or physical water risk ratings. The water footprint of cocoa beans is 19,928 litres per kilogram of crop.[85] This is derived from rain water use. Of the top 10 countries 99% are rated medium risk; 66% at high regulatory risk and only 4% with a high reputational risk rating relating to water issues (4%).

The countries with high regulatory risk are the Ivory Coast, Nigeria, Malaysia, Indonesia, Peru and Cameroon. These are all known to be affected by a number of issues, such as corruption, political influence in the judiciary and administrative systems, unstable political environment, low quality infrastructure, and poor regulatory frameworks controlling the use of water.

[81] WWF Water Risk Filter. http://waterriskfilter.panda.org/en/CountryProfiles#40/profile
[82] China Water Risk. Regulations. Available online: http://chinawaterrisk.org/regulations/enforcement/
[83] WWF. 2011. Big Cities, Big Water. Big Challenges. See: http://www.wwf.se/source.php/1390895/Big%20Cities_Big%20Water_Big%20Challenges_2011.pdf
[84] It should be noted that some import data for coffee from countries that have been deemed to be re-exporters has been reassigned proportionately to remaining top ten countries.
[85] Mekonnen, M. M. and Hoekstra, A.Y. (2010). The green, blue and grey water footprint of crops and derived crop products. Volume 1: Main Report.

Brazil and Indonesia face high reputational risk due to the destruction of tropical forests to expand agricultural land – explored above. In Colombia, a legacy of poor water use, pollution, and behaviour that may have negative impacts on the surrounding communities threatens to impact companies from a reputational standing.

4.3 Agricultural (plant) based products water risk 'hotspots'

The preceding analysis has highlighted how the water-related risks differ by commodity across different countries at the country-average level. Where the water risks associated with different crops obviously diverge from the national average, as a result of crops being sourced from well-defined areas (e.g. as for the discussion of tea), these interdependencies between the growing conditions required for individual crops and the water availability/scarcity within specific growing regions at the subnational level have been flagged.

In many cases, concentrations of growing areas for particular crops, and their associated local water risks, are not obvious from the global data sources. To establish these risks would require a detailed assessment of each crop that is beyond the scope of this study. This highlights the need for companies to evaluate the sourcing locations for their individual supply chains, and the associated water risks, at basin or sub-basin level, to ensure the water risk 'hotspots' are identified in full.

For example, Table 10 shows the average risk ratings relating to the cultivation of strawberries in Spain against the Donana River Basin in Andalusia[86]. The Donana River Basin is located in a semi-arid region, afflicted with prolonged periods of drought[87]. Low water availability in the region combined with high demand from agriculture results in a high physical risk in this area. This contrasts with the medium risk rating allocated at the country level.

Table 10: National and regional water risk for strawberries grown in Spain

Commodity	Country	Area	Overall Risk	Physical Risk	Regulatory Risk	Reputational Risk
Strawberries	Spain	Country	3.0	3.2	2.3	2.9
Strawberries	Spain	Donana	3.4	3.8	2.3	2.9

A similar pattern is replicated for oranges and apples grown in South Africa, Table 11. The Doring River Basin experiences water scarcity during seven months of the year because of water withdrawals for use in agriculture, resulting in high physical and overall water risks.

Table 11: National and regional water risk for apples and oranges grown in South Africa

Commodity	Country	Area	Overall Risk	Physical Risk	Regulatory Risk	Reputational Risk
Apples	South Africa	Country	3.2	3.3	2.9	3.5
Apples	South Africa	Ceres	3.8	4.1	2.9	3.5
Oranges	South Africa	Country	3.2	3.3	2.9	3.5
Oranges	South Africa	Citrusdal	3.7	4.1	2.9	3.5

[86] Sources: LIFE+ IRRIMAN (n.d.), Implementation of efficient irrigation management for a sustainable agriculture; Dumont, A. et al. The water footprint of a river basin with a special focus on groundwater: The case of Guadalquivir basin (Spain). Water Resources and Industry 1–2 (2013) 60–76; Aldaya (2009), Incorporating the Water Footprint and Environmental Water Requirements into policy: Reflections from Doñana National Park (Spain); Hoekstra, A.Y., Mekonnen, M.M. (2011), Global water scarcity: The monthly blue water footprint compared to blue water availability for the world's major river basins.

[87] http://environ.chemeng.ntua.gr/wsm/Newsletters/Issue3/Spain.htm

Despite these highlighted issues we are confident in the overall water risk results presented in the study. The results are averaged for countries and product groups and therefore provide good approximation of overall water risk related to imported products and commodities.

In summary, when considering water risk for the agriculture sector, it is crucial for UK manufacturers and retailers to review the entire value chain and identify indirect water risks. UK companies could face significant water-related risks along their supply chains where agricultural raw materials are imported from regions experiencing water problems.

4.4 Food products

Unlike agricultural commodities, the products described in this section refer to processed goods. As such these products face water risks related to processing/production operations, as well as supply chain water risks for the agricultural raw materials.

Imports of all food products to the UK in 2013 amounted to almost £10 billion (11 billion tonnes). The primary imports are comprised of preparations of meat, fish and vegetables, fruits and nuts, sugar; cocoa and preparations of cereals, flour, starch or milk; and animal feeds.

Residues from the food industry (destined for animal feed) and processed animal feed represent the largest import group in this category with a volume of 6 Mt and a value of £2 billion. This compares to UK animal feed production of 11Mt for the year 2014.[88] Over 50% by volume of the food products imported to the UK are going to feed animals. Preparations of vegetables, fruits, nuts account for 2.7 Mt (£2.4 billion) followed sugars and sugar confectionery and preparations of cereals. The former account for 2.6 Mt (£1.3 billion) and the latter for 1.5 Mt (£2.6 billion). Edible preparations of meat, fish and crustaceans represent one of the largest value import groups with a value of £3 billion and a weight of 900 kt.

The leading foreign suppliers among the Top 10 sourcing countries are the Netherlands (15%), Argentina, France, Belgium, Germany and Ireland (8% each).

However, it should be noted that while the majority of the UK's imports are sourced from European countries, in some cases these are acting as transit points for non-European production for onward distribution to Europe. For instance, 4.8 Mt of soy bean cake was imported to the UK in 2013 from the Netherlands. The products may be in the processing stage of the value chain or routed via companies that import and then re-export raw materials. Consequently, the actual risk may be higher than that reported if traced to the source countries. To definitively trace the source countries for all the UK's imports would be a significant undertaking and unlikely to change the aggregated risk profile of the UK's imported water risk.

Table 12: Main product imports for the food products sector *(Source: HMRC, 2013)*

HS code	Product (HS description)	Total Weight (kt)	Total Value (£million)
23	Residues and waste from the food industries going to animal feed; prepared animal fodder	5,597	2,075
20	Preparations of vegetables, fruit, nuts or other parts of plants	2,732	2,400
17	Sugars and sugar confectionery	2,576	1,316
19	Preparations of cereals, flour, starch or milk; pastry cooks' products	1,470	2,636

[88] Defra, 2015. Animal Feed Statistics for Great Britain - November 2014

HS code	Product (HS description)	Total Weight (kt)	Total Value (£million)
21	Miscellaneous edible preparations	1,148	2,338
16	Preparations of meat, fish or crustaceans, molluscs	915	3,053
11	Products of the milling industry; malt; starches; wheat gluten	627	336
18	Cocoa and cocoa preparations	539	1,557

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)	Overall	Physical	Regulatory	Reputational
Food products	15.6	15.7	2.37	2.42	1.88	3.01

Our analysis has shown that 41% of the total imports in the food products category are rated medium risk, with a further 31% rated low risk. Of the top 10 importing countries, seven are members of the EU. These countries have similar regulatory frameworks with the UK and high levels of environmental protection resulting in low to medium water risk. High regulatory risks are associated with 8% of food imports derived from Argentina and Brazil and 3% with a high reputational risk from Brazil.

Argentina's rating of high regulatory risk is linked to an inadequate regulatory and institutional framework, inter-sectoral conflict, limited capacity in water management at the central and provincial levels, and high risk for flooding in urban and rural areas.

The food production industry may also be associated with high reputation risk due to pollution arising from poor business practices. Equally, from exploitation of the tropical rainforest for crops for animal feed leading to further degradation of the environment.

4.5 Beverages

Beverages are one of the most significant imports to the UK alongside food products. In 2013, the UK imported over 4 Mt with a value of nearly £6 billion. Products include wine, beer, bottle water (still, sparkling and with flavours and sweeteners) and fruit juices. Imports of wine, beer and water total over 3 Mt and are valued at £4.3 billion, of which bottled water comprise 38% of the total value. Fruit juices total £700m and 900 kt by weight. Note that fruit juices are categorised the product category HS20 which is mapped to food products imports as opposed to beverages.

Seven of the top 10 importing nations are European. France (18%) is the largest exporter followed by the Netherlands (16%), Italy (10%) and Ireland (10%) and Belgium (9%). Again, imports are very concentrated and the top seven (European) countries provide 75% of all imports.

Table 13: Main imports for beverage products *(Source: HMRC, 2013)*

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
2204	Wine of fresh grapes, incl. fortified wines	1,393	3,172
2203	Beer made from malt	914	434
2202	Waters, incl. mineral / aerated, containing sugar / sweetening / flavours, non-alcoholic beverages (excl. fruit, veg. juices & milk)	850	690
2207	Undenatured ethyl alcohol >= 80%; denatured, any strength	680	461
2201	As per 2202 not containing added sugar / sweetening / flavours	547	105

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)	Overall	Physical	Regulatory	Reputational
Beverages	4.8	5.8	2.51	2.62	1.73	3.08

None of the top ten importing countries are assessed as having a high overall risk; however, 53% of imports out of these countries are at medium water risk.

Spain, the seventh largest exporter, is rated at high physical risk and Chile (2% of exports by weight) at high regulatory risk. Australia is rated high risk from a reputational standpoint – a recent UNESCO funded study confirmed that Australia, the world's driest inhabited continent, was the largest net exporter of virtual water in the world[89].

Bottling plays a significant role in the production of beverages. Bottling operations can also significantly impact communities when the companies extract large quantities of water placing communities at risk of facing depleted resources – posing a reputation risk.

4.6 Apparel

The imports to this product category comprise of articles of apparel and clothing; plus footwear and knitted or crocheted fabrics. In 2013, the UK imported over 1.2 Mt with a value of nearly £16 billion.

In 2013, the FAO reported that the global apparel fibre consumption was split 60:40 in favour of synthetic (non cellulosic) fibres; 33% was attributed to cotton fibres[90].

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)	Overall	Physical	Regulatory	Reputational
Apparel	2.0	22.2	3.40	3.23	3.49	3.83

Water-related risks are significant in textiles and apparel production and this product category faces the highest water risks of those assessed for this study. There are strong links to agriculture and the petrochemical industry, both of which are big water users and polluters. Processing in the textiles industry (bleaching, dyeing and printing) can generate large volumes of polluted wastewater if the industry is unregulated or regulation poorly enforced. For instance, mills may discharge wastewater containing toxic chemicals, such as formaldehyde, chlorine, and heavy metals, like lead and mercury. Many of these chemicals cannot be filtered or removed and cause both environmental damage and human disease. This poses a significant reputational risk to retail companies involved in sourcing products directly or indirectly.

Our analysis has shown that 21% of the total imports of apparel are rated high risk, with a further 53% rated medium risk. UK imports of apparel are rated as 'medium' for physical risk; medium for regulatory risk; and 'high' for reputation risk. It should be noted that if the score for China was only 0.02 higher then 60% of the UK's apparel would be at high risk. High physical risks are linked to India,

[89] GHD. Thinking about virtual water. Available online: http://www.ghd.com/global/markets/water/thinking-about-virtual-water/

[90] FAO and International Cotton Advisory Committee. 2013. World Apparel Fiber Consumption Survey. https://www.icac.org/cotton_info/publications/statistics/world-apparel-survey/FAO-ICAC-Survey-2013-Update-and-2011-Text.pdf

Pakistan and Turkey (18% of total imports). China is rated high risk on regulatory and reputational parameters along with Bangladesh.

Table 14: The main apparel exporting countries (to the UK).

Country		Total Import Weight (kt)	Total Import Value (£billion)	Basin-related Risk Overall	Physical	Regulatory	Reputational
China	39%	0.77	5.9	3.49	3.31	3.55	4.00
Bangladesh	8%	0.16	1.6	3.66	3.06	4.30	4.60
India	7%	0.13	1.4	3.84	3.82	3.30	5.00
Pakistan	6%	0.11	0.6	3.79	3.97	3.85	3.00
Turkey	5%	0.091	1.5	3.43	3.75	3.25	2.60
Hong Kong	4%	0.078	1.1	2.14	1.28	3.50	2.60
Viet Nam	3%	0.054	0.6	3.05	2.63	3.35	4.00
Italy	3%	0.050	1.3	2.99	3.30	2.20	3.45
Sri Lanka	3%	0.050	0.6	2.92	2.70	3.25	3.05
Belgium	2%	0.047	0.5	2.17	2.45	1.45	2.60

Given the low/medium risk in some sourcing countries it could be assumed that companies can switch sources to mitigate the risk. However, the capacity to shift sourcing locations, and to mitigate water risk in the process, is limited.

Cotton is a key raw material and 65 % of global production (Total production in 2013 amounted to 47,076,688 tonnes) is at high risk. Table 15 shows the water risk associated with cotton cultivation in the world's top ten producing countries. China and India, which together accounted for 56% of global production in 2013, both have high water risks across all risk categories. Thus, the relationship between the retail sector and its suppliers will play an increasingly import role in securing the supply.

China is not only the biggest producer of cotton but also the main supplier of apparel to the UK (39%). Other important supplier countries of apparel that also produce cotton are Bangladesh (8% of the 2013 imports, in terms of quantity), India (7%) and Pakistan (6%).

Where the origin of the yarn or fabric is unknown, this should be determined to understand the water-related risks. For instance, Egypt was determined to be the main country of origin for processed cotton supplied to Italy, and Uzbekistan for Bangladesh. In turn, this will help to clarify the environmental conditions relating to its production. For instance, the amount of freshwater withdrawn for the cultivation of cotton and processing in the textile industry; or the quantities of polluted wastewater generated in cotton growing (fertilisers, pesticides) and/or in the processing (bleaching, dyeing and printing).

Cotton production is the most water-intense segment of the value chain for the textiles and apparel sector and is also the segment most vulnerable to climate-induced physical water risks. On a global average, 3,600 cubic metres of water are required for every tonne of harvested raw cotton and 8,500 cubic metres per tonne for cotton fibre. This is sourced through a combination of precipitation and irrigation but these differ by climatic conditions. In India, for example, there is a higher dependency on rainwater for cotton growing, whereas Pakistan depends mainly on irrigation water and Egypt does so exclusively[91]. The use of irrigation for cotton growing can creates considerable

[91] DESTATIS. See: https://www.destatis.de/EN/Publications/STATmagazin/Environment/2013_06/UGR2013_06.html

pressure on water resources. Irrigation water creates considerable pressure in cotton-growing countries. The withdrawal reduces biodiversity, leads to salinisation and/or lowers the groundwater table.

The consequences are particularly pronounced in Uzbekistan where significant water withdrawal from tributaries to the Aral Sea – formerly the world's fourth largest inland body of water – have led to the drying of the Eastern portion and conversion into the Aralkum desert.

Table 15: Cotton production (2013) and associated water risk

Country	Production (tonnes)	Overall Risk	Physical Risk	Regulatory Risk	Reputational Risk
China	12,620,000	3.6	3.5	3.6	3.9
India	12,293,100	3.7	3.5	3.6	5.0
Pakistan	4,030,000	3.5	3.4	4.1	3.2
United States	3,164,000	2.6	2.5	2.6	3.5
Brazil	2,144,712	2.8	2.5	3.0	5.0
Uzbekistan	1,899,000	3.7	3.5	4.6	3.3
Australia	1,522,033	3.0	3.2	1.8	4.5
Turkey	1,287,000	3.2	3.3	3.1	2.6
Greece	475,000	2.7	2.8	2.6	2.6
Turkmenistan	376,200	2.9	2.9	3.5	2.1

Source: FAOSTAT and water risk filter.

4.7 Wood and other plant based products

The majority of imports in this product category are wood and articles of wood (88%). These product imports amount to 10 Mt for a value of £3.7 billion. Other products include pulp of wood, straw products and cork (see Table 16). According to data from the Forestry Commission, the UK is a net importer of wood and wood products. In 2013, 3.6 million cubic metres of sawn wood were produced in the UK whereas imports amounted to 5.5 million cubic metres.[92]

The US (18%) is the largest exporter of wood products to the UK, followed by Sweden (15%) and Canada (13%). Sourcing of wood is associated with low and medium overall water risk. There are few water risk hotspots accounting for 28% of imports to the UK.

Table 16: Main imports of wood and other plant based products

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
44	Wood & articles of wood, wood charcoal	9,522	3,692
47	Pulp of wood, waste & scrap of paper	1,292	522
46	Manufactures of straw, esparto, or other plaiting materials, basketware and wickerwork	21	55
45	Cork & articles of cork	4	24

Source: HMRC, 2013

[92] Forestry Commission, 2014. UK Wood Production and Trade: 2013 provisional figures.

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)	Overall	Physical	Regulatory	Reputational
Wood and other plant based products	10.8	4.3	2.06	1.92	2.13	2.96

None of the exporting countries have high overall water risk. 11% of the total imports sourced from the top 10 countries of import are assessed as being at high regulatory and 21% reputational risk.

Forest land management plays an important role in regulating water quantity and has a critical impact on the timing of surface water flows, water quality, groundwater recharge, and floodplain maintenance[93]. The main forest management activities that can affect water resources include construction of access roads, harvesting, re-planting, and pesticide application. Forest management activities use limited quantities of water, they can, and do, have a significant effect on the water quality within catchments.

Wood and wood products sourced from Canada, China and Brazil show high reputational risk. The timber industry has on occasion, been associated with the destruction of pristine rainforest, resulting in adverse impacts on the surrounding ecosystems and quality of water resources. The timber industry is also subject to illegal sourcing, owing to a complex and non-transparent supply chain which prevents traceability and easy identification of the source of forestry products. Imports are also subject to uncertainty around future regulation as citizens demand cleaner water resources and more transparent sourcing controls.

4.8 Paper and paper products

Paper is the largest single plant-based commodity imported to the UK. In 2013 5.5 billion tonnes of paper were imported to the UK worth over £600 million. The Forestry Commission reported that the UK produced 4.6 Mt of paper and paperboard in 2013.[94]

Germany (35%) is the largest sourcing country followed by Sweden (19%) and Finland (15%). These three countries alone account for 50% of all imports.

Table 17: Main imports for paper and paperboard products[95]

HS code	Product (HS description)	Total Weight (kt)	Total Value (£million)
4810	Paper and paperboard, coated on one or both sides	2,015	1,297
4802	Uncoated paper and paperboard, of a kind used for writing	1,478	935
4805	Other paper and paperboard, uncoated, in rolls	660	275
4804	Uncoated craft paper and paperboard, in rolls	587	282
4801	Newsprint	510	204

Source: HMRC, 2013

[93] National Round Table on the Environment and the Economy, Changing Currents, Water sustainability and the Future of Canada's Natural Resource Sectors, 2010. Available online: http://www.blue-economy.ca/sites/default/files/reports/resource/changing-currents-water-report-eng-1.pdf

[94] Forestry Commission, 2013. UK Wood Production and Trade 2012 Provisional Figures.

[95] Note that books are included under the product category 'other goods'.

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)	Overall	Physical	Regulatory	Reputational
Paper and paper products	6.9	5.6	2.05	2.04	1.71	2.82

None of the exporting countries have high overall water risk. 3% of the total imports sourced from the top 10 countries of import are assessed as being at high regulatory and 6% reputational risk.

Paper contains substantial amounts of virtual 'freshwater' as well as generating a significant quantity of waste water during the production processes. Moreover, water is not only consumed directly but also indirectly. For instance, necessary inputs to paper production are wood, chemicals, electricity and water (direct consumption). The production processes of each of these inputs also rely heavily on water (indirect consumption)[96].

China is rated high risk on both regulatory and reputational parameters. The discharge of pollution to surface flows from pollution-intensive production sectors (e.g. paper, chemicals and textiles) has led to many major rivers in North China no longer support any type of usage due to the low water quality levels[97]. Austria is also flagged at high risk. Industry accounts for almost two thirds of demand[98]. The paper industry accounts for 15.6% of total industrial consumption and has the potential to be linked to negative perceptions around water use, pollution and behaviour that may have negative impacts on the brand.

4.9 Extractives (Metals)

Iron ore dominates the imports in the extractives (metals) product group. These account for 96% of imports by weight (14 Mt) and 46% by value (£1.1 billion). Other important products are ashes and residues (31% of total value). These contain concentrated contents of minor metals and therefore can be used to produce valuable raw materials such as gallium or indium. Precious metals ores and concentrates account for 9% of total value of imports.

46% of imports for this product category originate from Brazil. This is followed by Russia (13%), Sweden (12%) and Canada (9%).

Table 18: Main imports for metals

HS code	Product (HS description)	Total Weight (kt)	Total Value (£million)
2601	Iron ores & concentrates, including roast pyrites	14,137	1,133
2618	Granulated slag from iron or steel manufacture	208	4
2614	Titanium ores and concentrates	104	38
2620	Slag, ash and residues containing metals, arsenic or their compounds (excl. those from the manufacture of iron or steel)	71	761
2615	Niobium, tantalum, vanadium or zirconium ores and concentrates	47	43

Source: HMRC, 2013

[96] Dabo, G. and Hubacek, K. (2007) Assessment of regional trade and virtual water flows in China. Ecological Economics, Volume 61 (1), 159-170. Version available online: http://eprints.whiterose.ac.uk/4802/1/hubacekk3.pdf

[97] Dong, F. (2000). Urban and Industry Water Conservation Theory. Beijing, Chinese Architecture & Building Press.

[98] WWF Water Risk Filter. Available online: http://waterriskfilter.panda.org/en/CountryProfiles#7/profile

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)	Overall	Physical	Regulatory	Reputational
Extractives (Metals)	14.7	2.5	2.20	1.88	2.72	3.85

Overall this product category is associated with a small overall water risk – only 1% is affected by high water risk. However, there are countries from which sourcing metals can be considered to bear considerable water risk from reputational or regulatory risk perspective. If this is taken into account then at least 69% of imports are considered high risk from at least one category of risk. Reputational risk is the most significant covering over half of imports.

The extraction of metals is associated with high levels of water use. Mining requires significant volumes of water, especially in the extraction and processing phases. Most water at the mine site is used to grind and separate minerals from host rocks, to wash and transport materials, to control dust, and to cool drilling machinery. Water consumption varies greatly depending on a range of factors including climate conditions, ore mineralogy, mine management and practices, and the commodity being mined (WRI). The most serious water issues in mining occur in conjunction with toxic waste disposal and as a result of water consumption at the extraction and processing phases (e.g. separating and washing of minerals, cooling of processes, environmental control, effluent dilution and as a use as a feedstock[99]. As a result the mining industry can have significant impacts on the quality of local water resources. Mining operations can impact local communities and ecosystems by affecting water supplies[100]. While the mining industry is a relatively small water user compared to agriculture, or other industries it may be the largest water user within a particular catchment. It can therefore affect the availability of water for other uses and purposes.

Consequently, mining locations may also be subject to increased regulation and reduced water rights in the future. In Chile (not in the top 10 countries) the authorities allocate fresh-water rights to companies and closely monitor the usage of water. As a result the country's third largest copper mine, Xstrata's Collahuasi operation, has had to reduce its rate of water extraction by two thirds. However, such reductions in water allocations may lead to investments in water efficiency and supply measures and/or manifest in production cuts[101].

Brazil, from where 46% of metals are imported. The high reputational risk WRF score in Brazil is because the high level of (national and global) media attention on water issues and the cultural importance of water. Russia (which accounts for 13% of imports) is associated with high regulatory risk due to poorly enforced regulation[102]. Products sourced from Saudi Arabia are associated with high physical and regulatory risk. However, they only account for 1% of metal imports to the UK.

4.10 Base metals

The base metals category consists of common metals such as iron, steel and aluminium, and articles primarily composed of those metals. The imports are dominated by iron and steel, and articles thereof (78%), accounting for a total of 9 Mt worth £11 billion in 2013 (see Table 19). UK iron and

[99] UNEP Finance Initiative. 2007. Half full or half empty. Available online.
[100] WRI, Mine the gap: Connecting Water Risk and Disclosure in the mining sector.
[101] As per 101.
[102] OECD. 2006. Environmental Policy and Regulation in RUSSIA. Available online:

steel production in 2012 amounted to 17 Mt[103]. The UK does not have available iron ore resources therefore iron and steel production depend on imports of this commodity (see section 4.8).[104]

Import origins of base metals are less concentrated compared to other product categories analysed in this report. The top ten countries account for 69% of total imports by weight. Germany (15%) is the major source country, followed by China (9%) and Spain (9%). Germany and Spain are not major producers of metal ores and re-import them from other major metal producers, such as Australia, Brazil, India, Russia, Ukraine, South Africa, US, Canada, Iran, or alternatively process the ores into iron and steel products[105].

Table 19: Main base metal imports

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
72	Iron & steel	5,983	4,801
73	Articles of iron or steel	3,115	5,831
76	Aluminium & articles thereof	1,323	3,170
83	Miscellaneous articles of base metal	337	1,543
74	Copper & articles thereof	296	1,866

Source: HMRC, 2013

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)	Overall	Physical	Regulatory	Reputational
Basic metals	11.7	20.8	2.55	2.70	2.05	3.18

Basic metals are rated medium risk on average. Yet, 16% of products are imported from countries that are rated high risk from a regulatory, reputational and/or physical risk perspective at various stages of the value chain. This extends to the extraction of the raw material (*see also* Extractives (Metals)), and processing and manufacturing of the finished products.

China and India are ranked among the top three largest sources. Both contain large regions that are at physical risk, i.e. considered to be water stressed, and face demographic and economic trends that will intensify competition for water resources (WRI, 2010)[106].

4.11 Technology Hardware and Equipment, Semi-conductors

The primary imports to the Technology Hardware and Equipment product category comprise of insulated wires, coaxial cables, electrical apparatus for switching or protecting circuits, monitors and projectors and sound or signalling apparatus. Insulated wires and optical fibre cables (400 kt; £9.2 billion) represented the largest imports by weight. Other important products are monitors and projectors (120 kt; £2.9 billion) and electrical switches (130 kt; £1.7 billion). See Table 20. Other important products include computers, laptops etc (HS8471)

Our analysis has shown that the 73% of total imports are sourced from 10 countries.

[103] USGS, 2014. 2012 Minerals Yearbook Iron and Steel.
[104] USGS, 2014. 2012 Minerals Yearbook Iron Ore and Steel.
[105] USGS: http://minerals.usgs.gov/minerals/pubs/commodity/iron_ore/mcs-2014-feore.pdf
[106] WRI, Mine the gap: Connecting Water Risk and Disclosure in the mining sector. Available online.

Table 20: Main product imports for the Technology Hardware and Equipment sector

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
8544	Insulated wire, cable and other insulated electric conductors, optical fibre cables	384	9,212
8471	Automatic data-processing machines and units thereof	108	9,211
8516	Electric instantaneous or storage/immersion heaters; electric space- and soil-heating apparatus; hairdressing apparatus	292	1,615
8507	Electric accumulators	203	656
8536	Electrical apparatus for connections to or in electrical circuits	130	1,709
8502	Electric generating sets and rotary converters	203	656

Source: HMRC, 2013

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)	Overall	Physical	Regulatory	Reputational
Technology Hardware and Equipment, Semi-conductors	3.1	62.3	2.64	2.71	2.34	3.45

The analysis reveals that 6% of the total imports featured under the technology hardware product category are rated high risk, 32% medium risk and 34% low risk, based on analysis of the Top 10 countries. Only 6% of the imports sourced from the top 10 countries of import are assessed as being at high physical risk. However, 23% of imports are sourced from countries with a high regulatory risk and 20% from countries with a high reputational risk.

China manufactures more than half of all the computers produced worldwide. The country is rated medium risk overall – with both the regulatory and reputational parameters flagged as high risk. Hazardous substances have the potential to create environmental hazards within the manufacturing facilities or to be discharged into the environment and surrounding communities as a result of waste water produced during manufacturing. This poses a significant risk to communities.

Turkey is also rated high risk in respect of the regulatory environment. Challenges are particularly acute regarding water supply, waste water treatment and waste management. This can be linked to rising demand for both domestic and industrial water supply, but a diminishing supply of easily exploitable fresh water. The government has responded by introducing new principles, including the Regulation on Water Pollution Control. However, the level of enforcement is weak. Often the responsibility for industrial waste water analysis is left to the industries that apply for the permits. This is particularly evident at the local / municipal levels.

However, it should be noted that whilst 44% of the UK's imports are sourced from European countries (e.g. 17% are imported from Germany) the products may be routed via countries that process raw materials or even composites. For instance, copper originating from Chile may pass through a smelter in Sweden. Tantalum, the metal used to make capacitors, is likely to originate in a Coltan mine in Democratic Republic of Congo, before heading to China for processing. The hard drive could be manufactured in Singapore, but the semiconductor could derive from Ireland. Consequently, the actual risk may be higher than that reported if traced to the raw material by source.

4.12 Chemicals and chemical products

The UK imported 15 Mt of chemicals in 2013, worth over £23 billion. Chemicals are fifth largest product category by weight and sixth by value. Table 21 shows the top five chemical products imports. Organic chemicals (31%) represented the largest imported product by weight followed by fertilizers (24%) and inorganic chemicals (16%). Although fertilisers are the second largest import by weight, these only represent 3% of imports by value. In contrast, oils and resinoids, perfumery, cosmetic or toilet preparations account for 5% of imports by weight but 17% by value.

The Netherlands (19%) is the largest source of chemical products, followed by Germany (17%) and Belgium (10%). Overall imports to the UK are dominated by European countries, which contribute over 70% of total imports.

Table 21: Main imports for chemicals and chemical products

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
29	Organic chemicals	4,584	8,331
31	Fertilizers	3,498	807
28	Inorganic chemicals, org/inorganic compounds of precious metals, isotopes	2,365	2,619
38	Miscellaneous chemical products	1,723	3,636
34	Soaps, waxes, scouring products, candles, modelling pastes, dental waxes	1,043	1,575

Source: HMRC, 2013

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)		Product Category	Weight (Mt)	Value (£billion)
Chemicals and chemical products	14.9	23.3	2.23	2.29	1.65	3.00

Water is an important input to chemicals production. It is used as raw material (e.g. as a solvent) and for multiple process activities, such as cleaning, heating/cooling, safety related activities and in materials re-use processes.

The overall risk associated with the import of chemicals to the UK is considered to be low. A high risk is associated with 6% of imports coming from developing or emerging countries. The rest of the imports from the top 10 countries are low risk as they come from the developed world with stable institutions and functioning regulatory system, though this does not exclude developed countries from high physical risk. The main reputational and regulatory risks associated with the chemicals industry derive from water pollution during the processing stage[107]. This is exacerbated in countries, such as China and Russia with weak regulatory frameworks, where enforcement within the industry is poor. From a reputational risk perspective China is also considered to be a high risk due to the perception of the production methods employed there.

[107] Blacksmith Institute and Green Cross Switzerland. Top Ten Toxic Polluting Problems. #9 Chemical manufacturing, http://www.worstpolluted.org/projects_reports/display/104

4.13 Pharmaceutical products

Medications for therapeutic or prophylactic use dominate imports of pharmaceutical products (171 kt; £11 billion). All other products account for significantly lower volumes (see Table 22). Although imports of human and animal blood products only amounted to 6,000 tonnes, these had a value of nearly £5 billion.

France and Germany (18% respectively), Ireland (15%) and Italy (10%) are the principle countries of export. This represents 61% of total supply to the UK.

Table 22: Main imports for pharmaceutical products

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
3004	Medicaments consisting of mixed or unmixed products for therapeutic or prophylactic uses; two or more constituents mixed together for therapeutic or prophylactic uses and or pharmaceutical preparations / products 3006.10.10 to 3006.60.90	186	12,508
3005	Wadding, gauze, bandages and the like	26	273
3002	Human blood; animal blood prepared for therapeutic, prophylactic or diagnostic uses; etc.	6	4,878
3001	Dried glands and other organs for organo-therapeutic uses	1	72

Source: HMRC, 2013

Water risk assessment

Product Category	Total Import Weight (Mt)	Total Import Value (£billion)		Basin-related Risk Product Category	Basin-related Risk Weight (Mt)	Basin-related Risk Value (£billion)
Pharmaceutical Products	0.2	17.8	2.42	2.56	1.98	3.27

The pharmaceutical sector requires water for many different processes and at differing level of purity; including potable water (for cleaning), purified water (in manufacturing, cleaning, preparation of bulk chemicals), and water acting as solvents or carriers for injections and inhalations.

The overall water risk to pharmaceuticals is medium. However, almost 10% of the total imports sourced from the top 10 countries of import are assessed as being at high risk. India is rated high risk on the physical and regulatory parameters, with China rated high risk for regulatory and reputational water risks. Risk arises around the discharge of active pharmaceutical compounds and biological agents from manufacturing plants where enforcement is weak. In India the risk is specifically linked to high physical water stress, in manufacturing locations.

4.14 Rubber and plastic products

In 2013, nearly 8 Mt of rubber and plastic products were imported for a total value of £16 billion. Plastic and plastic products (6.5 Mt; £12 billion) accounted for the majority of these imports, with tyres being the major rubber-based import (0.6 Mt, £2.0 billion).

Polymers of ethylene, such as PET, represent the largest import of plastic and rubber by volume (1.2 Mt; £1.4 billion). Polyethylene is the most common kind of plastic and this is reflected in import volumes of plastic to the UK. The top four import product for this category are plastics of different forms, shapes and at different stages of production (see Table 23).

Around 25 million tonnes of rubber is produced each year, of which 42% is natural rubber; 70% of which is used in tyres. The remainder is synthetic rubber derived from petrochemical sources – water is an important input to the manufacturing process. High value latex products include products surgeons' gloves and balloons.

Germany alone provides 21% of UK imports. This is followed by Belgium (13%), the Netherlands (11%) and France (8%). Together these 3 countries account for 45% of imports.

Table 23: Main imports for rubber and plastic products

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
3901	Polymers of ethylene, in primary forms	1,264	1,431
3923	Articles for the conveyance or packaging of goods, of plastics; stoppers, lids, caps and other closures, of plastics	922	1,546
3920	Plates, sheets, film, foil and strip, of non-cellular plastics, not reinforced, laminated, supported etc.	605	1,414
3902	Polymers of propylene or of other olefins, in primary forms	582	715
4011	New pneumatic tyres, of rubber	557	1,967

Source: HMRC, 2013

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)		Product Category	Weight (Mt)	Value (£billion)
Rubber and plastic products	7.6	16.0	2.40	2.55	1.80	3.23

Natural rubber processing consumes large volumes of water and energy and uses large amount of chemicals – which can be discharged in wastewater.

In the plastics sector the water is used for cooling and steam production. Water is also a major raw material to make plastic products, as polyethylene terephthalate (PET) is produced from fossil fuels – typically natural gas and petroleum and incurs cumulative impacts at the extraction, refining and recovery phases, in addition to processing and manufacturing phases.

On average, water risk for rubber and plastic products is medium. China (8%) is rated high risk on regulatory and reputational parameters. Saudi Arabia (representing 3% of imports) is rated overall high risk; based on high physical and regulatory risk ratings. The main regulatory and reputational risks are associated with water pollution during the processing stage[108]. This is exacerbated in countries, such as China and Saudi Arabia with weak regulatory frameworks, where enforcement within the industry is poor. From a physical risk perspective Saudi Arabia is also considered to be a high risk due to water scarcity issues.

4.15 Extractives (Coal, coke, peat)

The main imports in this product category are very concentrated. Coal (45 Mt; £2.9 billion) accounts for 98% of all imports in this category. UK production of coal in 2013 was 13 Mt, the lowest value on record. Both UK production and consumption of coal has been declining since the 1970s; imports have been experiencing the opposite trend with an increase in imports since the mid-90s.[109]

[108] Blacksmith Institute and Green Cross Switzerland. Top Ten Toxic Polluting Problems. #9 Chemical manufacturing, http://www.worstpolluted.org/projects_reports/display/104
[109] DECC (2014), Special feature - Coal in 2013.

Russia accounts for 39% of all coal imports, followed by the US (26%) and Colombia (19%). Together these top three countries contribute nearly 85% of imports making imports of this product very concentrated. Other countries in the top ten list account for less 11% cumulatively.

Table 24: Main imports for coal

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
2701	Coal; briquettes and similar solid fuels manufactured from coal	44,906	2,879
2704	Coke and semi-coke of coal, of lignite or of peat, whether or not agglomerated; retort carbon	629	111
2703	Peat[1], incl. peat litter, whether or not agglomerated	451	33
2702	Lignite, whether or not agglomerated (excl. jet)	2	1

[1] Although peat is not a coal product it is included here given its use and extractive nature. Source: HMRC, 2013

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)		Product Category	Weight (Mt)	Value (£billion)
Extractives (Coal)	46.0	3.0	2.41	2.18	3.12	3.08

90% of coal imported to the UK is associated with medium overall water risk. None of the top 10 import countries are considered to have high overall risk. However, 24% of imports coming from countries such as Columbia, Australia and Canada have high reputational water risk. UK imports about 39% of coal from Russia which is classified as a country with high regulatory risk. *(See also Extractives (Metals), for further details on the related risks).*

4.16 Extractives (Oil & gas)

The main imports in this product category are very concentrated with the top three products accounting for nearly 99% of the imports by weight. The main imports, as shown in Table 25, are crude oil (48 Mt; £25.2 billion), followed by petroleum gases (30 Mt; £8.6 billion) and oil (29 Mt; £17.7 billion). In contrast the UK crude oil production was 38 Mt in 2013.[110]

The top 10 countries sourcing oil and gas products account for 79% of all imports. Norway is the largest importer to the UK (33%), followed by the Netherlands and Russia. These three countries alone account for over half the total imports. It must be noted that some imports arising from the Netherlands may be re-imports.

Table 25: Main product imports for the Extractives (Oil & gas) product category

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
2709	Petroleum oils and oils obtained from bituminous minerals, crude	48,381	25,294
2711	Petroleum gas and other gaseous hydrocarbons	30,422	8,604
2710	As per 2709 (excl. crude)	28,885	17,662
2713	Petroleum coke, petroleum bitumen and other residues	1,062	271
2707	Oils and other products of the distillation of coal tar	208	131

Source: HMRC, 2013

[110] DECC (2015), Oil and gas: field data.

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)		Product Category	Weight (Mt)	Value (£billion)
Extractives (Oil & gas)	109.1	52.1	2.31	2.28	2.38	2.50

Water consumption in oil production varies substantially by geography, geology, recovery technique and reservoir depletion[111]. Water in oil extraction is mainly used for enhanced oil recovery, where a reservoir is flooded with water or steam to displace or increase the flow of oil to the surface. Oil extraction also generates large volumes of waste. Almost all the stages and operations involved in surveying and extracting petroleum entail liquid and solid waste. These volumes may be as high as 5000 m^3 for every well sunk[112], comprising of geological material, drilling fluids and sludge. An additional source of discharge is the 'produced water' originating as a by-product of oil and gas recovery from extraction wells. On average close to seven times the volume of oil produced[113]. Oil spills and other accidents can further aggravate risk to water resources.

A third of total oil and gas imported to the UK are given an overall low risk rating. This is attributed to imports sourced from Norway. However, 16% of oil and gas imported to the UK comes from countries classified as having high overall water risk, including Qatar, Algeria, Saudi Arabia and Kuwait.

These countries not only have large resource base, but are also facing water scarcity pressures. As a result these countries, have turned to alternative sources, including desalinated seawater and brackish water, for oil recovery[114] . Moreover, the amount of freshwater used is very low because the majority of produced water is re-injected and the wells are relatively immature (i.e. non-depleted)[115] thereby reducing the pressure on freshwater resources. Therefore overall water risk to oil and gas production is likely to be lower than that suggested by the country-average water risk scores from the WRF. Over the years the water consumption has been reduced with a change in recovery techniques, such as horizontal production wells[116]. It is estimated that in Saudi Arabia water consumption associated with oil extraction range from between 10 and 33 gal/MMBtu[117]. Moreover, many projects are offshore. Gulf fields are exploited by Saudi Arabia, Qatar, Iran and the UAE. Saudi Arabia is the biggest offshore oil producer, while Qatar and Iran are the largest in the gas sector.

The recent expansion of the unconventional (i.e. shale) gas market in the US has transformed and disrupted the conventional natural gas sector and has also focused attention on the water-energy nexus. The water consumed in the production of shale gas appears to be lower (0.6 to 1.8 gal/MMBtu) than for other fossil fuels (1 to 8 gal/MMBtu for coal mining and washing, and 1 to 62 gal/MMBtu for US onshore oil production)[118]. Due to potential water contamination issues[119], which may result for example from poor well construction, this approach to gas extraction can be subject to reputational risk.

[111] Mielke E., Diaz Anadon, L., Narayanmurti V., Water consumption of energy resource extraction, processing and conversion, Energy Technology Innovation Policy Research Group, Harvard Kennedy Scholl, Belfer Center for Science and International Affairs, 2010
[112] Bellona Foundation.
http://bellona.no/assets/fil_Chapter_3._Environmental_risks_when_extracting_and_exporting_oil_and_gas.pdf
[113] As per 120
[114] As per 120
[115] http://www.bp.com/content/dam/bp/pdf/sustainability/group-reports/BP-ESC-water-handbook.pdf
[116] As per 120
[117] As per 120
[118] As per 120
[119] Texas tribune, Report: Water availability a risk for gas drillers.

4.17 Other non-metallic mineral products

The major import within this product category is cement (2.1Mt; £138 million), followed by granite and other monumental or building stone and salts (see Table 26). 25% of these imports originated from Spain, followed by Norway (20%), Ireland (12%), and Denmark (6%). All but one country from the top ten sources are European countries. These products are low value products imported in large amounts meaning long distance travel is not economically feasible. The cement in industry in the UK produces around ten million tonnes of Portland cement a year, representing about 90% of the cement sold in the UK[120].

Table 26: Main imports for other non-metallic mineral products

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
2523	Cement, incl. cement clinkers, whether or not coloured	2,099	138
2516	Granite, porphyry, basalt, sandstone and building stone	1,526	113
2501	Salts, incl. table salt and denatured salt, and pure sodium chloride, whether or not in aqueous solution or containing added anti-caking or free-flowing agents; sea water	739	54
2517	Pebbles, gravel, broken or crushed stone, for concrete aggregates, for road metalling or for railway ballast, shingle and flint	653	27
2505	Natural sands of all kinds, whether or not coloured (excl. gold- and platinum-bearing sands, zircon, rutile and ilmenite sands, monazite sands, and tar or asphalt sands)	415	19

Source: HMRC, 2013

Water risk assessment

Product Category	Total Import Weight (Mt)	Total Import Value (£billion)		Basin-related Risk Product Category	Basin-related Risk Weight (Mt)	Basin-related Risk Value (£billion)
Other non-metallic mineral	7.1	0.6	2.38	2.50	1.85	2.63

The overall water risk for non-metallic minerals is medium. 8% of non-metallic mineral products are imported to the UK from India and are associated with high water risk.

Cement activities can have significant impacts on the natural environment and local communities in proximity of their operations. Cement production requires water for cooling heavy equipment and exhaust gases, in emission control systems such as wet scrubbers, as well as for preparing slurry in wet process kilns[121].

The impact of aggregates and stones is limited to quarrying which can have an impact on the river basin depending on the point of discharge. The aggregates business also requires significant quantities of water for processing purposes. The indirect impact on water consumption arising through mining/quarrying operations is covered in Extractives (Metals).

4.18 Motor vehicles, trailers and semi-trailers

Passenger cars (2.8Mt; £25 billion) are by the largest import within this product category both by weight (51%) and value (59%). Other significant imports in this product category are parts and accessories, trailers and semi-trailers and bicycles (see Table 27).

[120] Mineral Products Association Cement website

[121] This process is progressively being phased out and replaced by modern, more efficient dry processes, which require less water.

Germany (35%) is the principal exporter of vehicles to the UK as can be expected given its dominance in the global market for cars. This is followed by Spain (9%), France (9%), Belgium (8%) and Italy (4%).

Table 27: Main import for motor vehicles, trailers and semi-trailers

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
8703	Motor cars and other motor vehicles principally designed for the transport of persons	2,804	24,785
8708	Parts and accessories for tractors, motor vehicles for 10+ persons	1,605	9,839
8716	Trailers and semi-trailers; other vehicles, not mechanically propelled (excl. railway and tramway vehicles); parts thereof, n.e.s.	198	493
8701	Tractors (other than tractors of heading 8709)	146	1,091
8712	Bicycles and other cycles, incl. delivery tricycles, not motorised	44	376

Source: HMRC, 2013

Water risk assessment

Product Category	Total Import Weight (Mt)	Total Import Value (£billion)		Basin-related Risk Product Category	Basin-related Risk Weight (Mt)	Basin-related Risk Value (£billion)
Motor vehicles, trailers and semi-trailers	5.5	42.3	2.38	2.50	1.72	3.27

Water is a critical input to vehicle production as it is used extensively in a number of manufacturing stages, including vehicle painting. Water is also used at various stages of the supply chain. For example, car manufacturing uses a large quantity steel and aluminium, the processing of which uses large amounts of water. Overall, the manufacture of a passenger vehicle can use up to 170 m^3 of water embedded in materials[122], with the metals alone being responsible for around 75% of water used. Manufacturing is responsible for up to 18 m^3.[123]

Overall the water risk for the transport sector is medium. The regulatory risk is low for the top 10 importing countries apart from China which is considered a hotspot both from a regulatory and reputational risk perspective. Regulatory risk is driven by authorities responding to the demands of their citizens demanding access to clean water. Hence companies operating in China should be prepared for stricter regulation that will increase the cost of doing business in the country. Reputational risk is attributed to the fact that businesses pollute and use excessive amounts of water which is causing Chinese automotive brands to be perceived negatively in the eyes of Western buyers.

4.19 Machinery

In 2013, the UK imported over 3 Mt of machinery equipment worth over £36 billion. The major imports by weight were parts suitable for excavation machinery and for combustion machinery (see Table 28). Germany (22%) is the major source of machinery products followed by China (13%) and Italy (8%). European countries in the top ten list of exporters account for half of total imports to the UK.

[122] These figures do not include recycling rates. If these are taken into account water consumption can 30 times smaller.

[123] SAE International. 2012. Quantifying the Life Cycle Water Consumption of a Passenger Vehicle http://www.manufacturing.gatech.edu/sites/default/files/uploads/pdf/2012-01-0646.pdf

Table 28: Main imports of machinery products

Product		Total weight (kt)	Total Value (£million)
8431	Parts suitable for use solely or principally with the machinery of heading 8425 to 8430, n.e.s.	343	1,357
8409	Parts suitable for use solely or principally with internal combustion piston engine of heading 8407 or 8408	338	2,442
8408	Compression-ignition internal combustion piston engine "diesel or semi-diesel engine"	194	1,841
8429	Self-propelled bulldozers, angledozers, graders, levellers, scrapers, mechanical shovels, excavators, shovel loaders, tamping machines and roadrollers	166	712
8483	Transmission shafts, incl. camshafts and crankshafts, and cranks; bearing housings and plain shaft bearings for machines; gears and gearing; ball or roller screws, gear boxes and other speed changers	164	1,105

Source: HMRC, 2013

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)		Product Category	Weight (Mt)	Value (£billion)
Machinery	3.1	36.3	2.52	2.68	2.01	3.49

As with motor vehicle production water is a critical input as it is used extensively in a number of manufacturing stages and across the supply chain.

Machinery product imports are characterised as an overall medium risk. Only 3% of machinery imported into the UK is associated with high water risk. These are principally related to products originating from India which are associated with high physical and reputational water-related risks and China, associated with high regulatory and reputational risks. In both instances, the ratings arise from manufacturing practices which affect the water quality[124]. However, successive incidents have triggered a major revision of China's Water Pollution Control Law. The new regulations impose greater penalties and eliminate loopholes from previous statutory controls.

4.20 Appliances

In 2013, 700,000 tonnes of appliances worth £4 billion were imported to the UK. Although these mostly represent mostly represent household appliances, some machinery for industrial use is included due to grouping of HS codes. grouping of HS codes.

Table 29 shows that the largest import for this product category were refrigerators and freezers (270kt; £1 billion), followed by household washing machines.

Turkey (22%) is the largest exporter of such products to the UK, followed by China (20%), Poland (17%) and Italy (12%). European countries from the top ten list of importers represent 43% of imports.

[124] CERNA. Maria, A. The Costs of Water Pollution in India. Available online.

Table 29: Main imports for appliances

HS code	Product (HS description)	Total weight (kt)	Total Value (£million)
8418	Refrigerators, freezers and other refrigerating or freezing equipment, electric or other; heat pumps	267	1,067
8450	Household or laundry-type washing machines, incl. machines which both wash and dry; parts thereof	225	562
8422	Dishwashing machines; machinery for cleaning or drying bottles or other containers; machinery for filling, closing, sealing or labelling bottles, cans, boxes, bags or other containers; machinery for capsuling bottles, etc.	69	674
8415	Air conditioning machines comprising a motor-driven fan and elements for changing the temperature and humidity, incl. those machines in which the humidity cannot be separately regulated; parts thereof	58	623
8451	Machinery (excl. of heading 8450) for washing, cleaning, wringing, drying, ironing, pressing incl. fusing presses, bleaching, dyeing, dressing, finishing, coating or impregnating textile yarns, etc.	26	134

Source: HMRC, 2013

Water risk assessment

Product Category	Total Import		Basin-related Risk			
	Weight (Mt)	Value (£billion)		Product Category	Weight (Mt)	Value (£billion)
Appliances	0.7	3.6	2.90	2.98	2.67	3.30

Imports from Turkey are rated as being at high risk – driven by high physical risk. Wide variations in rainfall occurring from year-to-year lead to droughts and fluctuations in available water resources. It is likely that many regions will effectively become water scarce due to sustained population growth.[125] China is linked to high regulatory and reputational risk. Endemic corruption and limited enforcement are some of the regulatory risks associated with South Korea.[126]

[125] Climate Adaptation (n.d.), Fresh water resources Turkey. Available at: http://www.climateadaptation.eu/
[126] The Heritage Foundation. 2015 Index of Economic Freedom. Available online: http://www.heritage.org/index/country/southkorea

5. Water risk exposure of the main economic sectors of focus

Based on the information presented in the preceding chapter we have identified the main economic sectors to which the imports are directed. This selection is based on the trade data, the water risk assessment and the importance of the sectors to WWF and their stakeholders, and includes:

- Agriculture
- Food and Beverage manufacturing
- Energy & transport
- Construction
- Manufacturing
- Information communications technology
- Retail
- Financial services

For each of the sectors, the implications of the water risks (physical, regulatory, and reputational) to key imports are presented.

Definition of Gross Value Added (GVA)[127]

One way to measure a company's, industry sector's or economy's value is to determine its size in terms or output or turnover (total sales). Another key measure is the contribution made, often defined as the 'Gross Value Added'. This is the difference between the value of the goods and services produced and the cost of inputs, such as raw materials and energy consumed.

The Gross Value Added (or GVA) generated by all sectors adds up, with some adjustments (e.g., for taxes and subsidies), to a country's Gross Domestic Product (GDP). On these pages we use 'GVA' and 'contribution to GDP' interchangeably.

5.1 Agriculture

In the UK, agriculture contributed 0.6% of value added in 2013 (£9.2 billion) and employed 476,000 people. In terms of land take, in June 2013, up to 71% of the UK land area was utilised for agricultural usage (17.3 million hectares). The majority of arable land in the UK is dedicated to wheat production (48%) whereas 14% is used for other arable crops, horticultural crops and potato production.[128] The activities covered by the sector include cultivation of livestock, such as poultry, and the cultivation of plants and mushrooms for use in food, fibres and biofuels. Food commodities can be supplied directly to retail outlets, to the food processing and manufacturing industry, or can be used to feed livestock.

Water risk assessment

The water risk analysis here focuses on the principal imported inputs to the agricultural sector in the UK; agrochemicals, animal feed and fuel imports. All of which have a requirement for water at some stage of the value chain.

[127] Ernst and Young, 2013.
[128] Defra, 2014. Agriculture in the United Kingdom 2013

Table 30: Water risk for inputs to agriculture

	Overall	Physical risk	Regulatory risk	Reputational risk
Extractives (Oil & gas)	2.41	2.18	3.12	3.08
Food products	2.37	2.42	1.88	3.01
Chemicals and chemical products	2.23	2.29	1.65	3.00

Fuel imports are at the highest level of overall risk (2.4) linked to the activities of the extractives sector. However, they pose a lower physical risk when compared to the production of food products – of which animal feed is the principal import – which are rated medium risk (2.42). Fertilisers are subject to relatively low risk, but are at medium reputational risk (3.01) in line with the other product import categories.

Fertilisers are an import material input to the agricultural sector. The UK is around 63% self-sufficient in fertiliser[129]. The balance is provided through imports mainly derived from low risk European countries with stable institutions and functioning regulatory systems. Nevertheless, China and Canada are the principal sources of phosphate and potassium in fertiliser production.[130] While Canada has low water risk for other non-metallic mineral products, it has high reputational risk due to environmental issues linked to its extractives sector. China has high regulatory and reputational risk due its weak regulatory and enforcement frameworks, as well as water pollution caused by its extractives industry. In conclusion, whilst the industry is highly exposed to water risks related to fertiliser imports, this is offset by the actual quantity sourced from these locations.

Animal feed is the major input to livestock farming and a large cost centre for the industry. For example, more than 50% of input costs in the poultry industry are spent on feed.[131] Whilst some inputs are derived from the UK e.g. wheat and barley (16kt and 7kt respectively) in 2014, commodities such as maize and soybeans cannot be cultivated in the UK because of climatic conditions and therefore must be imported. Both of which have an overall medium risk, but high reputational risk. This poses a risk to individual companies where sourcing from high risk-hotspots.

There is significant energy use in the agricultural sector. At the same time energy supplies in the UK are becomingly increasingly dependent on imported gas and oil from Europe and beyond[132]. Electricity and petroleum products, particularly diesel and propane/LPG (liquid petroleum gas), which are imported account for the bulk of agriculture's fuel use (60% and 23% respectively). Natural gas and renewables and waste which can be sourced within the UK comprise 12% and 5% respectively. As a consequence, the sector is highly exposed to water-related risks linked to sourcing locations and the extractives industry and these are only marginally offset by the gains from utilising renewable energy.

5.2 Food and Beverage manufacturing

The food and drink manufacturing industry is the single largest manufacturing sector in the UK. In 2013, it accounted for 18.3% of the total manufacturing sector by turnover (£95.4bn) and £25.7bn of gross value added (GVA). The industry employed 417,000 people, approximately 17% of the overall manufacturing workforce in the UK.

[129] Making government work better Food Matters. Towards a Strategy for the 21st Century. The Strategy Unit. July 2008. Available online.
[130] USGS, 2014. Phosphate rock; USGS (2014), Potash
[131] Oxford Economics, 2014. Economic Impact Assessment: the British Poultry Industry 2013
[132] Defra. 2007. Direct energy use in agriculture: opportunities for reducing fossil fuel inputs

The food and drink manufacturing sector is very diverse. The Food and Drinks Federation reports that there are 6,705 food and soft drinks manufacturers in the UK (7,835 including alcoholic drinks). 60% of employees in the UK work for companies with 500 or more employees.

Changing consumer needs coupled with the complex dietary, lifestyle and health challenges facing society have led to the evolution of a wide range of convenience products. These include chilled prepared meals, washed and cut vegetables and fruit, and 'on-the-go' products. The principal raw materials utilised in food and beverage manufacturing are agricultural commodities, such as cereals, fruit and vegetables, and processed or semi-processed foods such as sugar or flour.

Water risk assessment

In 2012, 63% of food consumed in the UK was produced domestically. However, a high production to supply ratio does not necessarily insulate a country against many possible disruptions to its supply chain. For example, in 2012, poor weather had a heavy impact on the UK wheat crop leading to increased imports of milling quality wheat and a 10% decrease in the value of UK production. Moreover, the self-sufficiency ratio of domestic production to consumption has been in decline over the last decade and there is an increasing dependency on imports.

For example, even in the peak growing season the UK still imports over 30,000 tonnes each of onions, tomatoes and apples every month. In May 2014 last year Britain imported nearly 20,000 tonnes of cauliflower and broccoli, while in April over 50,000 tonnes of potatoes were derived from overseas. The UK has a self-sufficiency ratio for fresh fruit and vegetables of just 12% and 58% respectively, and imported £8bn of fruit and vegetables in 2012[133].

Table 31: Water risk for inputs to food manufacturing sector

	Overall	Physical risk	Regulatory risk	Reputational risk
Agriculture (plant)	2.37	2.48	1.87	3.27
Food products	2.37	2.42	1.88	3.01

Our analysis shows that agricultural (plant) based products and food products imported to the UK have medium overall risk. The regulatory risk is low, which can be linked to the high proportion of products imported from EU countries.

Nevertheless, policies developed to encourage substitution (e.g. soya milk for dairy) may have unintentional consequences on the environment in locations where the production takes place, i.e. localities associated with an already high level of risk.

Companies with a dependency on soybeans, onions and shallots and grapes are potentially subject to high overall water-related risk. This can be linked in part to physical water scarcity, i.e. the water availability/scarcity within the specific growing region and whether the water is provided through irrigation or crops are rain-fed. High regulatory risk is a factor in sourcing maize, soybean, palm oil, coffee, tea and cocoa where again there is a high dependency on imports. Whilst reputational risk is a concern for selected sourcing locations for tea and coffee and soybeans and to a lesser extent maize, potatoes and onions.

[133] DEFRA. Foods statistics pocketbook 2013: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/315418/foodpocketbook-2013update-29may14.pdf and The Independent: http://www.independent.co.uk/news/uk/politics/britains-food-selfsufficiency-at-risk-from-reliance-on-overseas-imports-of-fruit-and-vegetables-that-could-be-produced-at-home-9574238.html

In parallel, with the increase in dependency on imports, the industry has largely reduced warehouse stock levels over the last 5 years. The majority of retail supply chains have between one and four weeks of stock, with suppliers tending to hold higher levels of stock than retailers. This places suppliers at higher vulnerability to imports and water-related risks.

Consequently, this highlights the requirement for companies to look "beyond the factory fence" to examine how the ingredients for their products are grown and to ensure the water risk 'hotspots' are fully evaluated and addressed at source.

5.3 Retail

Total retail sales in the UK account for 8% of GDP (£358 billion in 2013). GVA was £78 billion over the same period. The sector employs 3m people in the UK, representing 10.5% of total employment.[134] However, while retail is the largest private-sector employer, 92% of enterprises have fewer than ten employees[135]. 0.25% of retail enterprises with 250 or more employees employ two-thirds of those working in the sector.

The British Retail Consortium reports that about 14% of all UK investment made by firms outside the financial sector is derived from retailers. Retailers purchase about £180bn worth of goods for resale annually and pay out £4bn every year in dividends to shareholders, about 5% of the UK total.

In 2013, the UK imported over £5 billion worth of retail goods. In comparison, the UK exported retail goods totalling a value of around £500 million[136]. The UK's 228,000 online retailers export more than the rest of Europe's e-retailers put together while UK consumers spend more online per head than any other country.

For the purpose of the analysis presented here it is assumed the following imports flow directly or indirectly to the retail sector:

- Food and beverages – fresh produce, processed foods, wine, beer and bottled water
- Non-food – clothing and footwear, household goods (appliances), pharmaceuticals, other specialised goods. It excludes automotive fuel.

The ONS reports that in 2014, UK household consumption on clothing and footwear totalled £59 billion; an average of GBP £22 per week per household against £58 for food and non-alcoholic drinks[137]. Recreation and culture amounted to £63.90 per week (this category includes spending on TVs, computers, newspapers, books, leisure activities and package holidays). Household goods (including appliances) equals £33.10 per week.

[134] ONS. UK Non-financial business economy, 2013 provisional results (annual business survey).
[135] BIS Economics Paper No.17: UK trade performance across markets and sectors.
[136] Retail 2014. Retail Week Reports. Available online.
[137] ONS see: http://www.ons.gov.uk/ons/rel/family-spending/family-spending/2014-edition/sty-the-headlines.html

Water risk assessment

Table 32: Main product categories retail sector and their associated water risk

Product Category	Overall	Physical	Regulatory risk	Reputational risk
Apparel	3.4	3.23	3.49	3.83
Appliances	2.9	2.98	2.67	3.3
Technology Hardware	2.64	2.71	2.34	3.45
Beverages	2.51	2.62	1.73	3.08
Pharmaceutical Products	2.42	2.56	1.98	3.27
Food products	2.37	2.42	1.88	3.01
Agriculture (plant)	2.37	2.48	1.87	3.27

Domestic production of clothing and apparel accounts for 29% of total supply and 45% of pharmaceuticals are manufactured in the UK. In contrast 69% of all beverages are sourced from the UK and 77% of food products. In contrast up to 52% of technology hardware is imported.

From our analysis this is the sector that is most exposed to water risks from imports. The analysis shows that imported products to the retail sector represent (overall) a medium water risk. Of the relevant imports apparel is categorised with the highest overall risk rating (medium, bordering high risk). It is also subject to high reputational risk. Appliances and technology hardware are also ranked medium risk across all three parameters – physical, regulatory and reputational, whilst the remaining categories, beverages, food products, agricultural (plant) based products and pharmaceuticals pose a low regulatory risk.

The water risks for the retail sector are mostly indirect since retailers rarely own the farms and processing plants that are supplying them. Depending on the nature of the input simply substituting inputs or shifting to an alternative sourcing location if water risks interrupt supplies might not be an option. Thus, the relationship between the retail sector and its suppliers will play an increasingly import role in securing the supply and mitigating water risks.

5.4 Energy (from oil, gas, coal) & transport

The sector covers activities related to electricity generation, gas supply and commercial transport (inclusive of passenger transport). The energy industry contributed 3.5% of GDP in 2011[138] and employed directly 7% of the UK workforce (176,000 people), while the transport and distribution sector accounts for 10.1% of employment and 10.9% of GVA, or £149.6 billion.[139].

The UK electricity network is connected to systems in France and Ireland through cables to import or export electricity. In total, the UK exported 4,481 GWh of electricity in 2010 and imported 7,144 GWh, which accounted for less than 1% of the electricity supplied.[140]

Electricity is principally generated from gas (47%) and coal (28%). In 2012 UK coal production fell to an all-time low of 18 Mt, imports rose to 42 Mt. The UK is also heavily dependent on gas imports. In

[138]DECC, UK Energy in Brief 2103. Available online.
[139] BIS Economics Paper No.18. Industrial Strategy: UK Sector Analysis. Available online.
[140] Energy UK. Electricity generation. Available online: http://www.energy-uk.org.uk/energy-industry/electricity-generation.html

2012, the UK produced 424 TWh[141] domestically of which 109 TWh was exported. The principal gas imports were derived from Norway and LNG from Qatar.[142] The balance of demand was met by imports amounting to 532 TWh derived from a mix of gas from Norway and LNG from Qatar.[143]
The UK is a net importer of oil. In 2013 the UK produced 290 million barrels and to meet demand another 150 million barrels of oil were imported[144].

The transport sector accounts for 30% of total primary energy use by fuel. It covers freight logistics, passenger transport and transport planning and traffic management. Passenger transport is split into: aviation, bus and coach, rail and light rail services, taxi and private hire and water transport.

Water risk assessment
The water risk analysis in this section focuses on the principal inputs to the energy and transport sector in the UK; oil, gas and coal.

Product Category	Overall	Physical	Regulatory risk	Reputational risk
Extractives (Coal)	2.41	2.18	3.12	3.08
Extractives (Oil & gas)	2.31	2.28	2.38	2.5

The UK is highly dependent on imported fossil fuels. However, under the existing sourcing arrangements imports of oil and gas are exposed to relatively low water risk. This can be linked to the dominant production method – offshore extraction – which is both less water intensive than onshore production and does not rely on freshwater sources. In Saudi Arabia, for example, seawater is utilised in onshore and offshore extraction. As a result actual water risk is lower than is suggested from the water risk scores.

Coal production is associated with medium water-related risk, with imports accounting for 83% of total consumption. The majority of coal is used in power stations and is often sourced from countries associated with high regulatory and reputational risks. It may be possible to substitute sourcing of coal from developed world countries which have a more established institutional and thus lower water-related risks.

While there is a trend towards renewables and improvements in energy efficiency which can reduce reliance on fossil fuels, future risk related to water might emerge if imports of unconventional sources become more significant for gas and oil.

5.5 Construction

The output of the sector in 2013 was estimated at 6.7% of GVA, employing 6.5% of workforce (2 million people). The activities covered include construction of buildings (e.g. commercial and residential), civil engineering (e.g. roads, tunnels, bridges, utilities); services (architectural & quantity surveying activities), wholesale, renting and leasing of construction equipment; as well the manufacture of construction products and material.

[141] UK government. Natural Gas: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/337623/chapter_4.pdf
[142] Energy trends section 4: gas - Gov.UK, Dec. 2014 Available online.
[143] Energy trends section 4: gas - Gov.UK, Dec. 2014 Available online.
[144] IEA. Energy Supply Security 2014. Part 2. Chapter 4. Available online. https://www.iea.org/media/freepublications/security/EnergySupplySecurity2014_UK.pdf

The construction industry has a large supply chain –- accounting for around £124 billion of intermediate consumption in 2010. Construction imports less than 8% of its supply, meaning investment in construction is retained in the UK[145]. Nearly 50% of these supplies are sourced from within the construction industry itself. It is also a purchaser of metals, plastics, mineral products and wood.

Water risk assessment

The water risk analysis here focuses on the principal inputs to the construction sector in the UK that are imported, such as basic metals, other non-metallic mineral products and wood and other plant based products.

Table 33: The main product categories used by the construction sector

Product Category	Overall risk	Physical risk	Regulatory risk	Reputational risk
Basic metals	2.55	2.70	2.05	3.18
Other non-metallic mineral products	2.38	2.50	1.85	2.63
Wood and other plant based products	2.06	1.92	2.13	2.96

The imports to the sectors are considered low and medium risk across the risk categories. Basic metals imports are at the highest level of overall risk (2.55) linked to the activities of the extractives sector followed by other non-metallic mineral products (2.38). Wood products have a low overall water risk (2.08).

The UK is a major importer of a wide range of basic metals[146]. In 2014, 60% of the UK demand for steel was serviced via imports[147]. Basic metals are imported predominantly from EU countries – with relatively low water dependency. However, a proportion of imports are also derived from countries with higher regulatory and reputational water risks. So while overall risk is low relative to the proportion of imports, the sector is exposed to 'hotspots' of risk where imports are derived from these location.

Cement and other non-metallic mineral products are important inputs to the construction sector. The UK consumes 9.3 million tonnes of cement and is around 86% self-sufficient[148] in the product. The balance is sourced from EU counterparts linked to an overall low water risk.

Imports of non-metallic mineral products from further afield are at high physical and reputational risk due weaker regulation and enforcement frameworks. However, the quantities imported are relatively small (5% of total non-mineral imports) posing a low water-related risk to industry. About 80% of softwood used in construction is imported[149]. Sourcing of wood products is associated with low overall risk apart from products sourced from China and Brazil which poses a risk to individual companies from reputational and regulatory perspective.

The sector's exposure to imported water risk remains relatively low risk owing to the UK's self-sustainability in its main materials and, where necessary, a high % of imports deriving from Europe.

[145] UKGC, Useful facts. Available online.
[146] Metals, Mineral Planning Factsheet. Available online.
[147] Iron and Steel Statistics Bureau, crude steel production. Available online.
[148] British Geological Survey, Mineral Planning Factsheet, Cement. Available online.
[149] The structural engineer, Viewpoint, 2013. Available online.

5.6 Manufacturing

The share of the sector in the total UK economic output has been steadily declining; in the early 1970s it accounted for more than 30% of the GVA. By 2013 this had dropped to 10%. This decline reflects changes to the structure of the UK economy. Since 1997, manufacturing output has fallen by only 5% in real terms[150], but the service sector's output has risen by 54% over the past 15 years.

The sector today employs 2.6 million people (7.8% of the workforce) while 30 years ago the manufacturing workforce covered more than 5.6 million workers (21.5% of the workforce).

Various sub-sectors make up the manufacturing sector, with output from these sectors varying widely. The manufacturing sector in this report comprises the following industries: metals, transport, aerospace, automotive, chemical, defence and electronics, while the above figures also include the manufacture of food products (covered under a separate section).

The water risk analysis here focuses on the principal inputs to the manufacturing sector in the UK:

- Metals (covering intermediary inputs and raw materials, as well as products made of iron, steel, copper, aluminium and other metals);
- Machinery (extending to finished products, such as, engines, construction equipment as well as intermediary products, such as engine parts);
- Automotive components.
- Chemicals (including organic chemicals, fertilizers, inorganic chemicals that are either intermediary products or finished products.
- Rubber and plastic products.

Water risk assessment

The water risk analysis here focuses on the principal inputs to the manufacturing sector in the UK. All these products require water at some stage across the value chain

Table 34: Main product categories used in the manufacturing sector and their associated water risk

Product Category	Overall	Physical	Regulatory risk	Reputational risk
Chemicals and chemical products	2.23	2.29	1.65	3.00
Extractives (Metals)	2.20	1.88	2.72	3.85
Machinery	2.52	2.68	2.01	3.49
Rubber and plastic products	2.40	2.55	1.80	3.23
Motor vehicles, trailers and semi-trailers	2.38	2.50	1.72	3.27

The imports to the sectors are considered low and medium risk across the risk categories. Machinery imports are associated with the highest overall risk (2.52) followed by rubber and plastic products (2.40), motor vehicles (2.38), chemicals (2.23) and metals (2.20). Wood products have a low overall water risk (2.08).

The UK Plastics industry is one of the top five processors of plastics in the EU with some 4.8 million tonnes of materials processed. In contrast, globally UK is a considered a small producer[151] –

[150] House of Commons, Manufacturing: statistics and policy, 2014. Available online.
[151] Plastics Europe, Plastics – the facts 2012, An analysis of European plastics production, demand and waste data for 2011.

domestically the sector produces 2.5 million tonnes of plastics[152]. The sector relies heavily on imports to bridge the gap between production and consumption. Overall, the sector is not exposed dramatically to water risk; however individual companies should be aware of the risks when sourcing from countries, such as China (8%) characterised with higher regulatory and reputational risk.
The UK trade in motor vehicles is extensive. The UK has the third largest automotive industry in Europe, with total sales of around £9 billion and accounting for 11% of the UK's total exports[153]. In 2014, the UK produced 1.6 million vehicles, 77% of which were exported. In contrast, sector imported 1.9 million vehicles[154]. Machinery imports comprise predominantly of engine parts (in 2014, 2.5 million engines were built in the UK[155]). As with plastics, the majority of imports come from EU countries associated with low water risks, with China accounting for the balance of vehicle imports (4%) and engines (13%). Again, despite a large volume of imports the water-related risk for the sector is not very high.

The UK is one of the top producers of chemicals with the sales worth £36 billion[156]. The sector imports about £29 billion of chemicals (not including pharmaceutical products)[157]. Many chemicals are sourced from EU countries and are exposed to low risk. In contrast, chemical imports from China (3%) and Russia (3%) are associated with high reputational and regulatory risk. With multiple sourcing countries for some chemicals, there is significant opportunity to switch sources to locations that pose a lower water-related risk.

The UK produces 11.9 million tonnes of steel[158] and imports 14 million tonnes of iron ore and imports 5.4 million tonnes of steel mill products. This means that the sector relies heavily on imports of iron ore. Brazil provides 46% of total imports to UK and Russia 13%. Both of which are linked to high reputational and regulatory risk.

5.7 Financial institutions

In 2011, the services of financial institutions (FIs) contributed £125.4 billion in gross value added (GVA) to the UK economy (9.4% of the UK's total). The sector's contribution to UK jobs is around 3.6% of total employment, around 1.1 million people. [159].

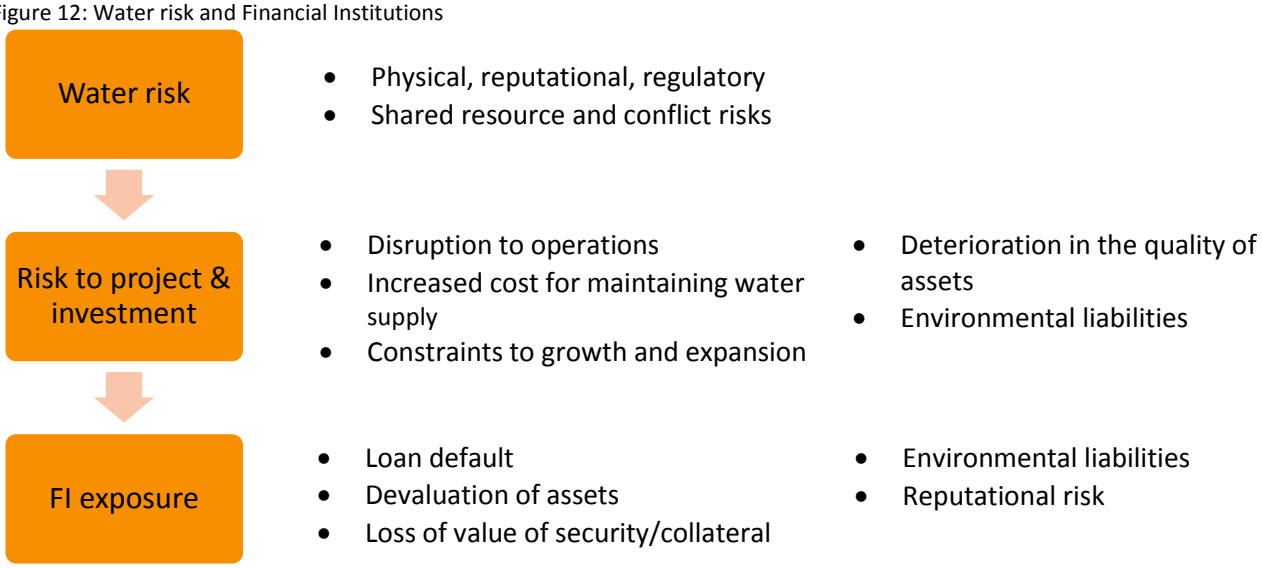
FIs cover commercial and investment banks, building societies, brokerages and insurance companies. In this respect FIs can exercise influence over the investment and management decisions of their client's through the terms and conditions tied to their investment and loans. This extends to a company's environmental, social and governance performance, including its contribution to reduce water-related risks.

The water risks for the financial sectors are mostly indirect since they are often connected to investments and/or in the countries they invest in (financial services sector). However, the business performance of FIs can also be affected by water risk directly (UNEP FI, 2006)[160].

[152] UK Plastics Industry, Capability Guide, 2012. Available online.
[153] PWC, The future of UK manufacturing: Reports of its death are greatly, 2009. Available online.
[154] SMMT, Motor industry facts 2014. Available online.
[155] SMMT, Motor industry fact, 2014. Available online.
[156] Tyndall Manchester. The chemical industry in the UK – market and climate change challenges, 2013. Available online.
[157] Chemical Industries Association, UK Chemical and Pharmaceutical Industry Facts and Figures, 2014. Available online.
[158] UK steel, Steel facts. Available online.
[159] House of Commons Library. Financial Services: contribution to the UK economy. Available online:
[160] UNEP, 2007. Half full, half empty. http://www.unepfi.org/fileadmin/documents/half_full_half_empty.pdf

It can impact on their portfolios, financing and investment activities owing to a depreciation in the value of assets and investments and / or potentially lead to defaults. For example, in times of what scarcity, poor management of water resource in times of scarcity impacting production and/or the operating environment. The reputation and the market standing of the FIs can also be affected by the public and market perception of its own corporate governance and how it with the risks affecting its clients, as well as its involvement in sensitive and problematic loans. This has led to an increase in the number of environmental and social policy resolutions filed by investors in recent years[161]. Figure 12 provides an outline of the principal water risks and the related implications for FIs.

Figure 12: Water risk and Financial Institutions



Source: UNEP FI (2004)[162]

In order to provide a view on how FIs allocate their funds amongst sectors a breakdown of the portfolio allocation of the Norwegian pension fund – the largest sovereign wealth fund in the world – is detailed below. It should be noted that this is only indicative of the type of sectors that FIs may invest their resources in. The spread may be more heavily weighted to different sectors based on the type of fund, e.g. equities, bonds and real estate. Nevertheless it provides an indication of the sectors and by extension the types of water-related risk the FIs may indirectly be exposed.

Table 35: Allocation of funds across sector

Sector	Share of equity investment (%)
Financial	23.8
Industrials	14.4
Consumer goods[163]	14
Consumer services	10.2
Healthcare	8.7
Oil and gas	8.4
Technology	7.5
Basic metals	6.4
Telecommunications	3.9
Utilities	3.5

Note: number may not add up to 100% as cash and derivatives are not included.

[161] UNEP FI. 2006. Financing water: Risks and Opportunities, An Issues Paper.
[162] SIWI. Risks of water scarcity. A business case for financial institutions. http://www.unepfi.org/fileadmin/events/2004/water_scarcity/water_unepfi_2004.pdf
[163] Consumer goods includes companies involved with food production, packaged goods, clothing, beverages, automobiles and electronics.

Consequently, strategies to mitigate water risk have to be tailored towards the relevant and subsequent business models of the specific FI. The interaction between FIs and companies found in the real economy is essential to setting the right criteria, dealing with information requests, and ultimately reducing relevant water risks.

Table 36 (below) provides several examples of some of the most important branches of the FI sector and examples of associated water risks.

Financial services sector	General business model	Example of processes relevant to water risks
Commercial and universal banks	Lend money directly to customers / companies.	Risk of default and credit risk deterioration if companies / debtors are affected by water risks (e.g. water scarcity threatens agribusiness profits leading to default).
Investment banks and corporate finance	Help businesses raise money from other firms in the form of bonds (debt) or stock (equity).	Water risks related to commodity trading (e.g. palm oil, cereals) impact the business directly, as well as future prices on commodity markets (see also agricultural section). This can impact the ability to pay interest or repay debt.
Development banks and other government-sponsored enterprises	Government-sponsored organisations (e.g. World Bank, KfW) invest in and provide credit to companies and infrastructure in developing countries.	Similar to retail and universal banks, but with even greater reputational pressure for sustainable financing.
Private equity investments	Closed-end funds, which usually take controlling equity stakes in businesses that are either private or taken private once acquired.	Poorly handled water risks will reduce returns and repayment of capital or options for public offerings.
Asset management	Offer a conglomerate of financial services from more than one sector; mostly manage third party funding.	The value of investments made in asset management processes (buying of shares, property, etc.) can significantly decrease due to water risks connected to the asset. Investors also bear a high reputational risk as the real or perceived impacts of a company's operations on communities and environmental habitats may negatively impact the investing company's reputation.
Insurance companies	Provide cover for selected risks and transfer those risks to capital markets in other forms.	Underestimating water-related risks caused by hydrological changes in water basins, regulation, and reputation can cause additional risks for clients and lead to an increased number of claims.
Re-insurance companies	Take primary insurance cover policies and restructure them to market to other investors or insurance companies, allowing primary insurers to reduce their risks and protect themselves from very large losses.	Claims are caused because of business interruption due to natural disasters like droughts or flooding or regulatory changes. House/property insurance (damage of flooding, fire) and liability/ indemnity (claims of reduction in water quality/quantity through pollution/over abstraction) are particularly affected.

Source UNEP FI[164]

[164] UNEP FI, 2004. Challenges of Water Scarcity, A Business Case for Financial Institutions.

In order to address these risks it is recommended that each branch of the financial services sector develops its own understanding of what type of water risks are emerging – physical, regulatory and reputational. Moreover, FIs should identify those which are materially relevant to their portfolio and/or investment's performance and integrate them in their processes.

6 Mitigation strategies

For certain commodities traditional approaches to water management – locating alternative sources or shifting supply chains — are proving ever more challenging or are simply not an option. Increased water scarcity, poor or declining water quality and increased competition for access to existing water resources in many jurisdictions calls for companies to adopt a different approach. Furthermore, consumers are becoming increasingly conscious of the social and environmental costs associated with the products they buy, including those for water.

Armed with a strong understanding of the risks posed at each stage of the value chain, companies can optimise business systems to respond to the specific risks and opportunities posed. Three quarters of companies in the Carbon Disclosure Programme's Global Water Report 2014[165] state that good water management offers 'operational, strategic or market opportunities', such as cost savings or increased revenues. BASF, the chemicals company, estimates that water saving, recycling, reuse and drinking water treatment products offer the company potential sales of $1bn up to 2020. It also provides a platform for demonstrating leadership through successful water stewardship.

Immediate efforts can be undertaken to invest in innovating problems 'out' of the system. For instance, increasing water efficiencies to a point where there is no or minimal net water usage and by decreasing wastage or by creating improvements e.g. restoring functionality to watersheds. However, if one company can increase efficiency but the savings are used by another company that does not do much for water risks, impacts on ecosystems, or water scarcity.

Next, by determining where and when to invest in R&D. Potential measures include leveraging insights from improved data collection e.g. from a full life cycle perspective to use less water (or no water) for production processes. For example, the retail industry has taken steps to analyse product-related risks (at the farm, factory and river basin-level) to support suppliers to practice good management, through certification and water stewardship schemes. From a material point of view, companies could explore options to substitute one input with a different one, or, to substitute a complete system eliminating the need for the product entirely.

It is also helpful to establish a team to examine current and future risks, and perhaps to categories inputs by criticality. This guards against being too dependent on just one supplier. For critical inputs, it may be reasonable to move downstream in the supply chain to establish stronger relationships. In either instance, integrating good water management into a code of conduct is advisable, and ensuring that all suppliers act within the legal framework.

Finally, collaborating with a wide network of water users, public and private institutions to solicit creative solutions and strengthen resilience.

Data-based land and water management models can help engage and inform stakeholders on the best course of action to take. For instance, the RIOS (Resource Investment Optimization System) developed by the Natural Capital Project, used to inform natural capital investments for TNC water funds in Colombia has improved return on investment (ROI) by up to 600% over previous approaches to watershed investment[166].

[165] https://www.cdp.net/en-US/Pages/events/2014/cdp-water-report.aspx
[166] SustainAbility. 2014. Evaporating Asset: Water Scarcity and Innovations for the Future. Available online.

Engaging with local suppliers and non-governmental organisations can stimulate ideas to address risk factors at a watershed level and to discover other sourcing opportunities. Bayer Crop Sciences, for example, is developing plant strains that can thrive in water-stressed areas.

Several organizations have published useful databases of water management solutions including the Water Resources Group, Coca-Cola's Replenish Watershed Protection Projects, CEO Water Mandate's Water Action Hub, and IUCN's water dialogues. IUCN, IWMI, CGIAR. The Nature Conservancy, WWF, and WRI are also driving new solutions involving partnerships across sectors[167].

The following section focuses on mitigations aligned to the three pillars of physical, regulatory and reputation risks – all of which are linked to specific case studies.

[167] SustainAbility. 2014. Evaporating Asset: Water Scarcity and Innovations for the Future. Available online.

Physical risks

Risk type	Mitigation Strategy / Action	Company
Water stress / scarcity	Data collection • Gather primary data from suppliers to characterise specific processes and their water risk 'hotspots'. • Assess new sites for the sustainability of water resources. Reduce water intensity / water withdrawals • Improve the efficiency of irrigation e.g. satellite controlled smart irrigation systems[168]. • Implement onsite water conservation awareness programmes. • Minimise leakage using more durable service pipes, control overflows, and repair promptly. Increase investment in new technologies: • Upgrade cooling towers, improve water treatment and use low-flow fixtures. • Zero water factories – ensure water 'neutral' process operations are achieved through the return of water, post process, to the local ecosystem[169]. Reduce consumption • Monitor consumption, install submeters to record water use in different areas or for different uses. • Introduce practices that don't require a water intensive wash.	• **Sugar beet production**: In the UK over 60% of all the water used in production processes comes from the sugar beet itself[170]. Water used in sugar production from sugar beet is then treated on site and either reused for agriculture or discharged into local water sources. • **PepsiCo** have pledged to take their UK factories off the water grid by 2018 and are aiming to reduce the water impact of crops grown in water-stressed areas by 50%[171]. • **Colgate-Palmolive Company's sustainability strategy include** water management pillar: 'Making Every Drop of Water Count'. Colgate expects sites to allocate 1%+ of capital investments towards water reduction project each year via the '5% for the planet' capital funding initiative.
Flooding / Drought	Extend protective measures. • Ensure drainage and sumps run-off capacity is constantly monitored for containment in extreme flood events. • Determine what the capacity is to withstand a 1-in-100 year flood event to prevent flooding related work stoppages.	• Brazilian mining firm **Vale** has invested US$8 million in monitoring systems to track changes in precipitation patterns, allowing it to take any preventive measures necessary. • **Coca Cola** holds inventories of social, environmental and political risks to the water sources supplying facilities and connected communities are evaluated to identify current water stress and drought; the potential for natural disasters and security issues that might pose a threat to the source water.

[169] IChemE's - Water Management in the Food and Drink Industry. [Online] Available online: http://www.icheme.org/media_centre/technical_strategy/green%20papers.aspx.
[170] NFU Sugar and British Sugar UK, "UK Beet Sugar Industry: Sustainability Report 2011," 2011.
[171] PepsiCo, "Water," PepsiCo UK, 22 September 2014. [Online]. Available online: http://www.pepsico.co.uk/purpose environmental-sustainability/water.
S. Casani and S. Knochel, "Application of HACCP to water reuse in the food industry," Food Control vol. 13, pp. 315 327, 2002.

Risk type	Mitigation Strategy / Action	Company
Water quality	Improve water quality • Implement greater due diligence. Follow plans and projects to prevent leakages and foster pollution control. • Regulate fertiliser usage to reduce grey water production. • Remediate watersheds through habitat restoration and ecosystem preservation. • Incentivize upstream actors to manage water resources in a way that sustains clean and reliable water supplies through watershed payment schemes	• In 2013, **Hitachi** achieved a 39% reduction in water use per unit for business sites outside Japan. Measures included reclaiming wastewater, using improved treatment facilities and reusing the reclaimed water in plants. Overall water use was 42% lower per unit than in 2005. • In China, **the Min River Water Resource Eco-compensation Program**, in the city of Fuzou, which lies downstream, pays about $800 million each to upstream cities Sanming and Nanping for pollution control, source water protection and township waste disposal.

Regulatory risks

Risk type	Mitigation Strategy / Action	Company
Regulation of discharge	Prevent water pollution • Pursue compliance with local requirements. • Optimise cleaning routines and control effluent concentration (to minimise grey wastewater production). Invest in alternative methods such as dry cleaning, cleaning in place. • Examine how to change farming methods, e.g. through adopting more natural solutions (i.e. 'Green' infrastructure approach, such as Natural Water Retention Measures). • Explore the potential for the development of in-factory water quality monitors for chemical and microbiological contaminants. •	• **Rio Tinto** have created a water standard requiring all operations to implement criteria – within internationally accepted guidelines – on water abstraction, dewatering, effluent/discharge or water quality when government regulations are absent/insufficient to adequate protection[172]. • In 2013, Spanish clothing company, **Inditex** invested in training staff at 101 wet-processing factories on efficient water use, management of chemical products and correct wastewater treatment, as part of its Zero Discharge project. • In 2011, **Merck** established a US$100 million capital fund with the goal of reducing water demand, improving wastewater quality, strengthening the storm water management, spill control and discharge of active pharmaceutical compounds and biologics from manufacturing plants.
Higher water prices	• Reduce reliance on potable water by utilising more recycled water. • Monitor changes to subsidy schemes that may currently maintain artificially low prices.	• **Arla Foods** uses anaerobic membrane bioreactor technology followed by reverse osmosis to treat wastewater. The process provides treated water of potable quality and produces biogas - used to fuel the on-site power plant, reducing both water and carbon footprints[173].

[172] CDP 2011, CDP Water Disclosure 2011 Information Request; Rio Tinto. Available online: http://www.riotinto.com/documents/CDP_Water_Disclosure_2011_Information_Request_-_Rio_Tinto_response.pdf

[173] Food & Drink Business Europe, "Veolia Memthane - Veolia Provides Green Wastewater Solution for Arla's New Dairy," Food & Drink Business Europe, p.33, August 2014.

Risk type	Mitigation Strategy / Action	Company
Mandatory water efficiency	Work with regulators • Adopt 'Green' agriculture methods - efficient capture and management of green water (rainwater) where appropriate. • Examine new developments for using renewable solar and wind energy to power the desalination process and improve the viability of desalinated water use in the food industry. Increase monitoring • Monitor consumption, including the installation of submeters which can record water use in different areas or for different uses. • Use metrics to track performance – and to maintain business resilience and a social license to operate. • Apply mobile telecoms technology to water use-related data gathering.	• **PepsiCo extracting water from potatoes:** Chemical engineers have developed a method to capture water from potatoes, which are fried for crisps. Using thermodynamic technology (stack heat), the company is able to extract water and reuse it throughout their plants, increasing efficiency by 20%. • **Volkswagen – Think Blue. Factory** toolkit contains water management incentives, for example, on reducing water consumption. Steps include: 1) Identification of the risks; 2) Evaluation of the risks with their impact; 3) Definition and execution of countermeasures; and, 4) Controlling and reporting of risks and countermeasures. • **Suncor** has developed models and tools to understand available water quantity and quality at the local level e.g. to capture basin level projections that would better inform local water risks. • Leading global pharmaceutical company **GlaxoSmithKline (GSK)** analysed four key categories: water availability, water quality, health impacts, and licence to operate (including reputational and regulatory risks) in order to enable GSK to quantitatively measure, and credibly reduce, its year-on-year water impact[174]. • **Arcelor Mittal:** The regulatory drivers in Jamshedpur (India) are strict because of limited water resources in the region. The river that supplies water to the steel works also supplies water to the city of Jamshedpur. This also fuels a sense of responsibility to manage this utility ably and not create any adverse effect on the surrounding environment.

[174] "Water, water everywhere... or is it? "The Carbon Trust, 26 November 2014.

Reputation risks – The focus of many interventions remains on direct exposures and operational improvements. However, longer-term, more integrated strategic, corporate water stewardship strategies in response to water risks are called for.

Risk type	Mitigation Strategy / Action	Company
Reputational damage	Strengthen links with the local community ▪ Work with the local community, environmental NGOs, farmers, and agricultural cooperatives to ensure the local context is understood. ▪ Work with stakeholders to expand and promote scientific knowledge on the topic of persistent pharmaceuticals. Engage with internal stakeholders ▪ Introduce company incentives that are linked to sustainability targets. Engage with suppliers ▪ Engage suppliers on the ground. ▪ Provide training to farmers on better farming practices. Educate customers ▪ Build public confidence in recycled water in the food industry. ▪ Help consumers to better understand the environmental performance of their choices. Engage with public policy makers ▪ Promote national and international policies that encourage good water stewardship and ensure environmental flows.	▪ **MillerCoors'** facility in Los Angeles, has worked with municipal water suppliers and local farmers to reduce water use by 1.1 billion gallons. Measure include planting native vegetation, retrofitting irrigation systems and implementing best practices for upstream water management.[175] ▪ **Coca-Cola** have implemented source water protection plans in all bottling plants globally. This aim is to balance manufacturing and expansion needs alongside those of adjacent communities. An inventory of relevant stakeholders, including communities, water providers, regulatory agencies, NGOs, labour and trade organisations etc. provides further insight. ▪ Part of **NOKIA's** solution has been to raise awareness throughout its complex supply chain. The challenges that Nokia has faced have been to understand and identify water risks within a very large supply chain. This has currently been achieved to a Tier two supplier level. Nokia's strategy is to 1) increase awareness of water scarcity in the supply chain through workshops and training and 2) work towards improved water efficiency by cooperating with suppliers operating in water scarce areas and follow-up on water use and reduction targets. ▪ As reported by CDP **Diageo** sees an opportunity to gain competitive advantage through "achieving leadership by setting aggressive, industry-leading targets for water efficiency within direct operations; by collaborating locally and internationally to address the global water crisis; by working with third party manufacturers and suppliers in key agricultural sourcing locations to mitigate local water scarcity;

175 http://business.edf.org/blog/2014/05/30/no-water-means-no-beer-and-other-insights-from-an-la-water-conference/

		and by providing access to clean drinking water and sanitation for communities in water-stressed areas".

In conclusion it is important to recognise that the challenge may often be felt amongst numerous actors in the value chain. This extends from producers to suppliers, from the factory floor and procurement and to senior management. Also risks will be viewed differently depending on an entities perspective and targets. Any solution therefore requires that expertise within a company / community be brought together to identify the full range of imported water issues that could impact an entity's ability to achieve its objectives. Such a collaborative approach will also help to get buy-in to deliver a solution.

8 Appendix I: Sector Water Risk Data

Table 37: The most significant import categories (by volume and value) to the UK

Product Category	Total Weight (Kt)	Total Value (£million)
Extractives (Oil & gas)	**109,099,431**	**52,053,522,456**
Extractives (Coal)	**45,987,285**	**3,023,400,543**
Agriculture (plant)	**17,116,783**	**12,490,047,859**
Food products	**15,604,960**	**15,710,809,672**
Chemicals and chemical products	**14,862,783**	**23,292,099,594**
Extractives (Metals)	**14,689,349**	**2,477,850,246**
Basic metals	**11,683,774**	**20,771,774,757**
Wood and other plant based products	**10,839,719**	**4,292,284,967**
Rubber and plastic products	**7,638,254**	**15,952,505,711**
Other non-metallic mineral products	**7,140,898**	**606,680,539**
Paper and paper products	**6,928,026**	**5,593,202,191**
Motor vehicles, trailers and semi-trailers	**5,523,623**	**42,299,619,246**
Beverages	**4,788,045**	**5,784,817,285**
Construction material	3,928,178	3,563,460,707
Machinery	**3,127,338**	**36,291,302,719**
Agriculture (animal)	3,099,864	7,239,605,574
Technology Hardware and Equipment, Semi conductors	**3,098,152**	**62,275,455,169**
Furniture	2,068,676	6,321,596,540
Apparel	**1,998,891**	**22,152,492,621**
Other goods	**1,418,364**	**36,566,760,677**
Textiles	1,129,555	3,448,098,075
Appliances	**676,426**	**3,578,702,660**
Fisheries	472,158	1,702,866,834
Leather	252,903	2,399,372,563
Pharmaceutical products	**219,292**	**17,817,789,900**
Other transport equipment	147,174	10,800,654,208
Tobacco products	65,323	469,176,998
Energy	245	936,959,724
Estimates	-	74,200,133
Grand Total	293,605,468	419,987,110,168

Key: Product categories in green selected for further analysis.

Table 38: Water risk per product category

Product Category	WRF Country	% by Weight	Total Weight (Kt)	Total Value (£million)	Basin-related Risk			
					Overall	Physical	Regulatory	Reputational
Extractives (Oil & gas)	Norway	33%	35,639	14,237	1.51	1.46	1.45	2.05
Extractives (Oil & gas)	Netherlands	11%	11,944	5,712	2.18	2.33	1.20	3.05
Extractives (Oil & gas)	Russian Federation	7%	7,579	4,203	2.33	1.91	4.00	2.45
Extractives (Oil & gas)	Qatar	6%	6,679	2,148	3.65	3.79	3.50	3.00
Extractives (Oil & gas)	Algeria	6%	6,128	3,276	3.97	3.99	4.80	2.60
Extractives (Oil & gas)	Nigeria	5%	5,707	3,049	3.19	2.89	4.80	3.00
Extractives (Oil & gas)	Belgium	4%	4,325	2,073	2.27	2.45	1.45	2.60
Extractives (Oil & gas)	Sweden	3%	3,219	1,944	1.55	1.51	1.45	2.05
Extractives (Oil & gas)	Saudi Arabia	3%	2,822	1,597	4.01	4.19	3.55	3.45
Extractives (Oil & gas)	Kuwait	2%	2,342	1,488	3.84	4.04	3.55	3.00
Extractives (Coal)	Russian Federation	39%	17,845	1,081	2.29	1.93	4.00	2.45
Extractives (Coal)	United States	26%	12,129	803	2.49	2.42	2.20	3.45
Extractives (Coal)	Columbia	19%	8,661	502	2.50	2.21	3.20	3.60
Extractives (Coal)	Australia	3%	1,570	172	3.11	3.21	1.75	4.45
Extractives (Coal)	Sri Lanka	2%	1,121	77	2.61	2.43	3.25	3.05
Extractives (Coal)	Canada	2%	715	42	1.88	1.57	2.00	4.00
Extractives (Coal)	Poland	1%	544	39	2.23	2.12	2.00	3.45
Extractives (Coal)	Switzerland	1%	454	35	2.11	2.23	1.20	2.60
Extractives (Coal)	South Africa	1%	426	29	3.12	3.15	2.75	3.45
Extractives (Coal)	Ireland	1%	412	33	1.45	1.43	1.45	1.60
Agriculture (plant)	France	13%	2,240	955	2.55	2.67	2.00	3.45
Agriculture (plant)	Netherlands	12%	1,980	2,353	2.05	2.31	1.20	3.05
Agriculture (plant)	Spain	11%	1,803	1,546	2.94	3.31	2.15	3.05
Agriculture (plant)	Germany	8%	1,441	693	2.04	2.22	1.20	3.45
Agriculture (plant)	Ireland	4%	636	324	1.46	1.45	1.45	1.60
Agriculture (plant)	Canada	4%	619	224	1.96	1.61	2.00	4.00
Agriculture (plant)	Brazil	3%	519	308	2.42	1.69	3.00	5.00
Agriculture (plant)	Ukraine	3%	515	132	3.51	3.26	4.05	3.45
Agriculture (plant)	Belgium	3%	510	507	2.21	2.53	1.45	2.60
Agriculture (plant)	United States	3%	440	411	2.47	2.45	2.20	3.45

Food products	Netherlands	15%	2,385	1,978	2.13	2.30	1.20	3.05
Food products	Argentina	8%	1,311	363	2.99	2.89	3.55	2.45
Food products	France	8%	1,300	1,479	2.59	2.63	2.00	3.45
Food products	Belgium	8%	1,270	1,200	2.29	2.56	1.45	2.60
Food products	Germany	8%	1,245	1,936	2.14	2.21	1.20	3.45
Food products	Ireland	8%	1,184	1,610	1.46	1.43	1.45	1.60
Food products	Italy	6%	862	922	2.92	3.08	2.20	3.45
Food products	United States	4%	643	408	2.52	2.42	2.20	3.45
Food products	Spain	4%	565	632	2.93	3.23	2.15	3.05
Food products	Brazil	3%	488	393	2.53	1.72	3.00	5.00
Chemicals and chemical products	Netherlands	19%	2,775	3,115	2.13	2.27	1.20	3.05
Chemicals and chemical products	Germany	17%	2,465	3,718	2.12	2.20	1.20	3.45
Chemicals and chemical products	Belgium	10%	1,504	1,611	2.40	2.64	1.45	2.60
Chemicals and chemical products	France	9%	1,408	2,903	2.53	2.55	2.00	3.45
Chemicals and chemical products	Norway	8%	1,134	415	1.47	1.39	1.45	2.05
Chemicals and chemical products	Spain	4%	650	681	2.87	3.05	2.15	3.05
Chemicals and chemical products	Ireland	3%	456	1,482	1.43	1.40	1.45	1.60
Chemicals and chemical products	China	3%	447	1,132	3.35	3.20	3.55	4.00
Chemicals and chemical products	Russian Federation	3%	437	382	2.41	1.95	4.00	2.45
Chemicals and chemical products	United States	3%	407	1,928	2.43	2.35	2.20	3.45
Extractives (Metals)	Brazil	46%	6,716	534	2.24	1.72	3.00	5.00
Extractives (Metals)	Russia	13%	1,922	155	2.29	1.93	4.00	2.45
Extractives (Metals)	Sweden	12%	1,711	155	1.51	1.45	1.45	2.05
Extractives (Metals)	Canada	9%	1,372	158	1.88	1.58	2.00	4.00
Extractives (Metals)	South Africa	8%	1,211	299	3.13	3.17	2.75	3.45
Extractives (Metals)	Norway	5%	730	46	1.50	1.43	1.45	2.05
Extractives (Metals)	United States	3%	398	540	2.49	2.42	2.20	3.45
Extractives (Metals)	Saudi Arabia	1%	160	12	4.00	4.16	3.55	3.45
Extractives (Metals)	Spain	1%	118	21	3.18	3.49	2.15	3.05
Extractives (Metals)	Belgium	0%	67	9	2.27	2.45	1.45	2.60
Basic metals	Germany	15%	1,697	3,234	2.03	2.22	1.20	3.45

Basic metals	China	9%	1,071	2,025	3.41	3.26	3.55	4.00
Basic metals	Spain	9%	1,036	934	2.94	3.31	2.15	3.05
Basic metals	Netherlands	8%	992	1,036	2.05	2.31	1.20	3.05
Basic metals	France	7%	815	1,435	2.54	2.66	2.00	3.45
Basic metals	Belgium	6%	659	910	2.21	2.53	1.45	2.60
Basic metals	Italy	5%	590	1,173	2.89	3.14	2.20	3.45
Basic metals	Turkey	4%	522	507	3.43	3.66	3.25	2.60
Basic metals	Irish Republic	3%	358	301	1.46	1.45	1.45	1.60
Basic metals	Russian Federation	2%	282	257	2.59	1.92	4.00	2.45
Wood and other plant based products	United States	18%	1,912	387	2.50	2.45	2.20	3.45
Wood and other plant based products	Sweden	15%	1,636	622	1.53	1.47	1.45	2.05
Wood and other plant based products	Canada	13%	1,421	233	1.92	1.61	2.00	4.00
Wood and other plant based products	Ireland	8%	921	221	1.46	1.45	1.45	1.60
Wood and other plant based products	Latvia	7%	712	199	1.93	1.47	3.50	2.05
Wood and other plant based products	Finland	5%	592	260	1.75	1.58	2.20	2.05
Wood and other plant based products	Germany	5%	528	273	2.14	2.22	1.20	3.45
Wood and other plant based products	China	4%	486	518	3.40	3.27	3.55	4.00
Wood and other plant based products	Brazil	4%	404	174	2.28	1.69	3.00	5.00
Wood and other plant based products	Portugal	2%	257	83	3.19	3.34	2.95	2.60
Rubber and plastic products	Germany	21%	1,608	3,119	2.01	2.20	1.20	3.45
Rubber and plastic products	Belgium	13%	1,008	1,611	2.34	2.64	1.45	2.60
Rubber and plastic products	Netherlands	11%	876	1,438	2.04	2.27	1.20	3.05
Rubber and plastic products	France	8%	625	1,325	2.46	2.55	2.00	3.45
Rubber and plastic products	China	8%	614	1,572	3.33	3.20	3.55	4.00
Rubber and plastic products	Italy	4%	291	775	2.78	2.94	2.20	3.45
Rubber and plastic products	Saudi Arabia	3%	253	221	3.93	4.10	3.55	3.45
Rubber and plastic products	United States	3%	208	958	2.37	2.35	2.20	3.45
Rubber and plastic products	Ireland	2%	184	342	1.42	1.40	1.45	1.60
Rubber and plastic products	Spain	2%	178	437	2.82	3.05	2.15	3.05
Other non-metallic mineral products	Spain	25%	1,790	73	3.18	3.49	2.15	3.05
Other non-metallic mineral products	Norway	20%	1,423	33	1.54	1.49	1.45	2.05
Other non-metallic mineral products	Ireland	12%	850	61	1.49	1.48	1.45	1.60

Other non-metallic mineral products	Denmark	6%	399	14	2.13	2.26	1.95	1.60
Other non-metallic mineral products	India	5%	333	67	3.83	3.82	3.30	5.00
Other non-metallic mineral products	Netherlands	4%	317	30	2.18	2.33	1.20	3.05
Other non-metallic mineral products	France	4%	296	44	2.67	2.75	2.00	3.45
Other non-metallic mineral products	Germany	4%	263	41	2.15	2.23	1.20	3.45
Other non-metallic mineral products	Belgium	3%	241	42	2.27	2.45	1.45	2.60
Other non-metallic mineral products	Greece	3%	191	13	3.45	3.65	3.20	2.60
Paper and paper products	Germany	18%	1,277	1,061	2.14	2.22	1.20	3.45
Paper and paper products	Sweden	17%	1,183	674	1.53	1.47	1.45	2.05
Paper and paper products	Finland	15%	1,046	663	1.75	1.58	2.20	2.05
Paper and paper products	France	8%	559	476	2.61	2.67	2.00	3.45
Paper and paper products	Netherlands	4%	311	273	2.16	2.31	1.20	3.05
Paper and paper products	Italy	4%	284	303	2.99	3.16	2.20	3.45
Paper and paper products	Norway	4%	283	119	1.51	1.45	1.45	2.05
Paper and paper products	United States	4%	247	240	2.50	2.45	2.20	3.45
Paper and paper products	Austria	3%	188	138	2.04	2.06	1.20	3.60
Paper and paper products	China	3%	180	361	3.40	3.27	3.55	4.00
Motor vehicles, trailers and semi-trailers	Germany	35%	1,919	16,937	2.06	2.19	1.20	3.45
Motor vehicles, trailers and semi-trailers	Spain	9%	509	3,268	2.80	2.96	2.15	3.05
Motor vehicles, trailers and semi-trailers	France	9%	476	3,287	2.46	2.51	2.00	3.45
Motor vehicles, trailers and semi-trailers	Belgium	8%	454	4,603	2.42	2.67	1.45	2.60
Motor vehicles, trailers and semi-trailers	Italy	4%	229	1,519	2.76	2.87	2.20	3.45
Motor vehicles, trailers and semi-trailers	Turkey	4%	221	1,107	3.39	3.48	3.25	2.60
Motor vehicles, trailers and semi-trailers	China	4%	218	588	3.30	3.18	3.55	4.00
Motor vehicles, trailers and semi-trailers	Netherlands	3%	180	1,307	2.09	2.26	1.20	3.05
Motor vehicles, trailers and semi-trailers	Japan	3%	180	1,686	1.92	1.96	1.50	3.05
Motor vehicles, trailers and semi-trailers	Poland	3%	160	904	2.18	2.15	2.00	3.45
Beverages	France	18%	872	1,576	2.73	2.78	2.00	3.45
Beverages	Netherlands	16%	765	562	2.22	2.34	1.20	3.05
Beverages	Italy	10%	472	701	3.15	3.37	2.20	3.45
Beverages	Ireland	10%	466	257	1.50	1.50	1.45	1.60
Beverages	Belgium	9%	453	218	2.25	2.42	1.45	2.60
Beverages	Germany	6%	310	398	2.21	2.24	1.20	3.45

Beverages	Australia	5%	245	291	3.19	3.34	1.75	4.45
Beverages	Spain	5%	226	332	3.21	3.58	2.15	3.05
Beverages	United States	3%	152	273	2.61	2.55	2.20	3.45
Beverages	Chile	2%	112	185	3.06	3.03	3.50	2.60
Appliances	Turkey	22%	149	403	3.51	3.70	3.25	2.60
Appliances	China	20%	135	424	3.40	3.29	3.55	4.00
Appliances	Poland	17%	114	306	2.14	2.10	2.00	3.45
Appliances	Italy	12%	80	437	2.93	3.23	2.20	3.45
Appliances	Germany	7%	49	616	1.98	2.22	1.20	3.45
Appliances	Korea, Republic of	2%	16	70	2.87	2.55	3.60	2.60
Appliances	Spain	2%	15	88	3.01	3.40	2.15	3.05
Appliances	Hungary	2%	12	74	2.10	1.84	2.45	3.45
Appliances	France	2%	12	149	2.53	2.71	2.00	3.45
Appliances	Ireland	2%	10	54	1.47	1.46	1.45	1.60
			-					
Machinery	Germany	22%	703	6,325	1.98	2.22	1.20	3.45
Machinery	China	13%	418	2,092	3.40	3.29	3.55	4.00
Machinery	Italy	8%	236	1,968	2.93	3.23	2.20	3.45
Machinery	France	7%	213	2,301	2.53	2.71	2.00	3.45
Machinery	Netherlands	6%	198	1,987	2.02	2.32	1.20	3.05
Machinery	United States	5%	167	5,952	2.45	2.48	2.20	3.45
Machinery	Japan	4%	128	1,978	1.82	1.87	1.50	3.05
Machinery	Belgium	4%	123	968	2.18	2.49	1.45	2.60
Machinery	Spain	3%	95	782	3.01	3.40	2.15	3.05
Machinery	India	3%	93	466	3.66	3.72	3.30	5.00
Technology Hardware and Equipment, Semi conductors	China	20%	634	9,278	3.40	3.29	3.55	4.00
Technology Hardware and Equipment, Semi conductors	Germany	17%	520	7,133	1.98	2.22	1.20	3.45
Technology Hardware and Equipment, Semi conductors	Netherlands	8%	254	8,339	2.02	2.32	1.20	3.05
Technology Hardware and Equipment, Semi conductors	Turkey	5%	164	836	3.51	3.70	3.25	2.60
Technology Hardware and Equipment, Semi conductors	France	5%	154	2,413	2.53	2.70	2.00	3.45
Technology Hardware and Equipment, Semi conductors	Poland	4%	123	1,709	2.13	2.10	2.00	3.45
Technology Hardware and Equipment, Semi conductors	Czech Republic	4%	122	1,745	2.19	2.07	2.25	3.45
Technology Hardware and Equipment, Semi conductors	Italy	3%	107	1,160	2.93	3.23	2.20	3.45
Technology Hardware and Equipment, Semi conductors	Hong Kong	3%	93	3,214	2.01	1.28	3.50	2.60

Technology Hardware and Equipment, Semi conductors	Spain	3%	86	805	3.01	3.40	2.15	3.05
Apparel	China	39%	771	5,914	3.49	3.31	3.55	4.00
Apparel	Bangladesh	8%	169	1,662	3.66	3.06	4.30	4.60
Apparel	India	7%	132	1,491	3.84	3.82	3.30	5.00
Apparel	Pakistan	6%	111	609	3.79	3.97	3.85	3.00
Apparel	Turkey	5%	91	1,515	3.43	3.75	3.25	2.60
Apparel	Hong Kong	4%	79	1,133	2.14	1.28	3.50	2.60
Apparel	Viet Nam	3%	55	700	3.05	2.63	3.35	4.00
Apparel	Italy	3%	50	1,305	2.99	3.30	2.20	3.45
Apparel	Sri Lanka	3%	50	646	2.92	2.70	3.25	3.05
Apparel	Belgium	2%	48	574	2.17	2.45	1.45	2.60
Other goods	China	36%	515	2,832	3.35	3.22	3.55	4.00
Other goods	Germany	9%	126	2,061	2.03	2.21	1.20	3.45
Other goods	Hong Kong	8%	110	1,287	2.00	1.28	3.50	2.60
Other goods	Belgium	8%	107	659	2.33	2.63	1.45	2.60
Other goods	United States	7%	93	4,789	2.44	2.42	2.20	3.45
Other goods	France	4%	62	1,161	2.49	2.59	2.00	3.45
Other goods	Italy	4%	51	511	2.88	3.12	2.20	3.45
Other goods	Netherlands	3%	45	621	2.05	2.28	1.20	3.05
Other goods	Spain	2%	35	751	2.96	3.31	2.15	3.05
Other goods	Czech Republic	2%	33	228	2.20	2.08	2.25	3.45
Pharmaceuticals	Germany	16%	34	3,747	1.98	2.22	1.20	3.45
Pharmaceuticals	France	16%	34	960	2.53	2.71	2.00	3.45
Pharmaceuticals	Ireland	15%	33	1,693	1.47	1.46	1.45	1.60
Pharmaceuticals	India	10%	21	284	3.66	3.72	3.30	5.00
Pharmaceuticals	China	7%	14	110	3.40	3.29	3.55	4.00
Pharmaceuticals	Belgium	6%	13	2,031	2.18	2.49	1.45	2.60
Pharmaceuticals	Italy	4%	10	777	2.93	3.23	2.20	3.45
Pharmaceuticals	United States	4%	8	1,194	2.45	2.48	2.20	3.45
Pharmaceuticals	Spain	4%	8	449	3.01	3.40	2.15	3.05
Pharmaceuticals	Austria	4%	8	111	1.91	2.11	1.20	3.60

Table 39: Water risk by agricultural commodity

Agricultural Commodity	Country	Total Weight (Kt)	Total Value (£million)	% by Weight	Basin-related Risk					Commodity-related Risk
					Overall	Physical	Regulatory	Reputational		
Wheat	Germany	814	190	35%	2.2	2.3	1.0	3.5		1.4
Wheat	France	441	92	19%	2.8	2.7	2.6	3.5		1.4
Wheat	Canada	364	94	15%	2.1	1.8	2.0	3.9		1.4
Wheat	Denmark	195	36	8%	2.0	2.1	2.0	1.6		1.4
Wheat	Finland	95	20	4%	1.8	1.7	2.2	2.1		1.4
Wheat	Bulgaria	86	14	4%	2.7	2.5	3.0	3.7		1.4
Wheat	United States	82	19	3%	2.6	2.5	2.6	3.5		3.0
Wheat	Estonia	64	12	3%	1.9	1.6	3.2	2.1		1.4
Wheat	Poland	63	12	3%	2.4	2.3	2.6	3.3		1.4
Wheat	Ireland	41	8	2%	1.7	1.5	2.3	1.8		1.4
Maize	France	665	132	33%	2.8	2.7	2.6	3.5		3.1
Maize	Ukraine	420	78	21%	3.2	3.1	3.6	3.3		3.1
Maize	Bulgaria	260	35	13%	2.6	2.3	3.0	3.7		1.5
Maize	Argentina	148	30	7%	3.4	3.4	3.6	2.5		1.5
Maize	Ireland	126	23	6%	1.8	1.6	2.3	1.8		1.5
Maize	Poland	101	20	5%	2.6	2.5	2.6	3.3		1.5
Maize	Canada	61	12	3%	2.2	2.1	2.0	3.9		1.5
Maize	Russia	53	11	3%	2.8	2.4	4.3	2.5		3.9
Maize	Denmark	49	8	2%	2.0	2.0	2.0	1.6		1.5
Maize	Brazil	49	9	2%	2.8	2.5	3.0	5.0		1.5
Banana	Colombia	281	140	25%	2.4	2.0	3.2	3.6		1.6
Banana	Dominican Republic	222	117	19%	2.9	2.7	4.2	2.1		1.6
Banana	Costa Rica	178	70	16%	2.3	1.9	3.2	3.0		2.4
Banana	Ecuador	157	63	14%	2.2	1.8	3.5	2.2		2.4
Banana	Cote d'Ivoire	73	25	6%	2.5	1.9	4.5	2.6		1.6
Banana	Belize	73	37	6%	2.1	2.0	2.9	2.1		2.4
Banana	Cameroon	66	26	6%	2.7	2.2	4.8	2.2		2.4
Banana	Panama	32	14	3%	1.8	1.4	2.9	2.6		2.4
Banana	Saint Lucia	14	7	1%	1.5	1.3	2.0	2.2		1.4
Banana	Ghana	12	4	1%	2.2	1.9	3.2	2.6		1.7

Soybean	Brazil	321	120	51%	2.8	2.5	3.0	5.0		1.5
Soybean	Argentina	129	45	20%	3.4	3.4	3.6	2.5		1.5
Soybean	Canada	104	36	16%	2.2	2.0	2.0	3.9		2.2
Soybean	United States	73	27	12%	2.6	2.5	2.6	3.5		3.0
Soybean	China	3	3	0%	3.6	3.5	3.6	3.9		3.9
Soybean	India	1	1	0%	3.7	3.5	3.6	5.0		2.3
Soybean	France	0	0	0%	2.8	2.7	2.6	3.5		3.8
Soybean	Italy	0	0	0%	2.8	2.8	2.6	3.5		3.0
Soybean	Thailand	0	0	0%	2.7	2.4	3.7	3.4		2.3
Soybean	Taiwan	0	0	0%	2.9	3.1	2.6	2.6		2.3
Potatoes	France	200	57	33%	2.8	2.7	2.6	3.5		1.4
Potatoes	Netherlands	80	25	13%	2.2	2.1	2.3	3.1		1.4
Potatoes	Israel	79	28	13%	3.3	3.3	2.6	4.2		3.0
Potatoes	Belgium	67	19	11%	2.3	2.4	1.5	2.6		1.4
Potatoes	Germany	61	13	10%	2.3	2.5	1.0	3.5		1.4
Potatoes	Cyprus	33	15	6%	2.4	2.4	2.9	1.6		2.2
Potatoes	Egypt	29	11	5%	3.5	3.4	3.4	4.0		3.8
Potatoes	Spain	21	9	3%	2.8	2.9	2.3	2.9		2.2
Potatoes	Ireland	15	5	2%	1.8	1.6	2.3	1.8		1.4
Potatoes	Italy	5	2	1%	2.8	2.8	2.6	3.5		2.3
Apples	France	135	93	28%	2.76	2.73	2.55	3.45		2.0
Apples	South Africa	101	94	21%	3.23	3.30	2.85	3.45		3.9
Apples	New Zealand	42	46	9%	2.1	2.0	2.4	2.2		1.1
Apples	Germany	30	14	6%	2.2	2.3	1.0	3.45		1.1
Apples	Chile	26	27	5%	3.0	2.9	3.5	2.6		2.9
Apples	Netherlands	24	17	5%	2.3	2.2	2.3	3.1		1.1
Apples	Italy	21	21	4%	3.0	3.0	2.6	3.5		2.0
Apples	Brazil	17	14	4%	2.6	2.2	3.0	5.0		1.2
Apples	Poland	15	6	3%	2.4	2.2	2.6	3.3		1.2
Apples	Spain	13	11	3%	3.0	3.2	2.3	2.9		3.0
Onions + shallots, green	Netherlands	184	58	43%	2.2	2.1	2.3	3.1		1.3

Onions + shallots, green	Spain	134	35	31%	2.9	3.0	2.3	2.9		2.9
Onions + shallots, green	Poland	36	14	9%	2.5	2.4	2.6	3.3		2.2
Onions + shallots, green	Egypt	24	16	6%	3.6	3.6	3.4	4.0		2.2
Onions + shallots, green	New Zealand	14	7	3%	2.2	2.2	2.4	2.2		1.3
Onions + shallots, green	United States	7	13	2%	2.6	2.5	2.6	3.5		2.2
Onions + shallots, green	Chile	5	3	1%	3.0	2.9	3.5	2.6		2.2
Onions + shallots, green	France	5	3	1%	2.8	2.7	2.6	3.5		1.3
Onions + shallots, green	Ireland	3	2	1%	1.7	1.6	2.3	1.8		2.2
Onions + shallots, green	India	3	1	1%	3.7	3.6	3.6	5.0		2.2
Tomatoes	Netherlands	177	167	42%	2.2	2.1	2.3	3.1		1.3
Tomatoes	Spain	143	138	34%	2.8	2.9	2.3	2.9		2.1
Tomatoes	Morocco	40	39	9%	3.2	3.3	3.2	3.0		2.1
Tomatoes	Germany	18	19	4%	2.3	2.5	1.0	3.5		1.3
Tomatoes	France	12	17	3%	2.8	2.7	2.6	3.5		1.3
Tomatoes	Italy	10	17	2%	2.8	2.8	2.6	3.5		2.1
Tomatoes	Belgium	7	6	2%	2.3	2.4	1.5	2.6		1.3
Tomatoes	Poland	6	5	1%	2.6	2.5	2.6	3.3		1.4
Tomatoes	Portugal	3	6	1%	2.7	2.8	2.6	2.6		1.3
Tomatoes	Senegal	2	2	1%	2.6	2.5	2.9	2.6		2.9
Oil palm	Papua New Guinea	176	100	58%	2.6	2.4	3.2	3.2		1.2
Oil palm	Malaysia	42	21	14%	2.4	2.0	3.7	2.5		1.2
Oil palm	Panama	21	12	7%	2.0	1.6	2.9	2.6		1.2
Oil palm	United States	17	9	6%	2.6	2.5	2.6	3.5		1.2
Oil palm	Indonesia	9	5	3%	3.0	2.6	4.1	3.6		1.2
Oil palm	Thailand	7	4	2%	2.7	2.4	3.7	3.4		1.2
Oil palm	Ecuador	6	4	2%	2.2	1.9	3.5	2.2		1.2
Oil palm	Guatemala	5	3	2%	2.4	2.1	3.2	2.8		1.2
Oil palm	Costa Rica	5	3	2%	2.3	2.0	3.2	3.0		1.2
Oil palm	Australia	4	3	1%	3.0	3.2	1.8	4.5		1.2
Grapes	South Africa	60	107	24%	3.2	3.3	2.9	3.5		2.9
Grapes	Chile	42	67	17%	3.0	2.9	3.5	2.6		1.3
Grapes	Spain	34	58	14%	2.9	3.0	2.3	2.9		3.0
Grapes	Egypt	21	34	8%	3.6	3.6	3.4	4.0		2.9

Grapes	Greece	14	22	6%	2.9	3.0	2.6	2.6		3.0
Grapes	India	14	21	6%	3.7	3.6	3.6	5.0		3.0
Grapes	Brazil	14	26	5%	2.7	2.3	3.0	5.0		2.2
Grapes	Italy	12	23	5%	2.9	2.9	2.6	3.5		2.2
Grapes	Peru	11	24	4%	2.8	2.4	3.8	3.0		1.4
Grapes	Germany	10	10	4%	2.2	2.4	1.0	3.5		3.0
Coffee	Viet Nam	39	57	27%	3.1	2.7	4.1	4.0		3.1
Coffee	Brazil	33	69	23%	2.6	2.2	3.0	5.0		3.2
Coffee	Colombia	21	49	15%	2.5	2.1	3.2	3.6		3.2
Coffee	Indonesia	18	28	12%	2.8	2.3	4.1	3.6		3.2
Coffee	Honduras	7	16	5%	2.5	2.3	3.2	2.8		3.2
Coffee	Peru	5	13	4%	2.7	2.3	3.8	3.0		3.2
Coffee	Ethiopia	4	13	3%	3.7	3.5	4.3	3.5		2.3
Coffee	Nicaragua	2	6	1%	2.6	2.1	4.4	2.8		3.2
Coffee	Guatemala	2	5	1%	2.2	1.9	3.2	2.8		1.4
Coffee	El Salvador	1	4	1%	2.6	2.2	4.0	2.2		2.3
Chillies and peppers, green	Netherlands	103	165	55%	2.2	2.1	2.3	3.1		1.3
Chillies and peppers, green	Spain	54	64	29%	2.8	2.9	2.3	2.9		1.3
Chillies and peppers, green	Israel	8	12	4%	3.3	3.3	2.6	4.2		1.3
Chillies and peppers, green	France	4	6	2%	2.8	2.7	2.6	3.5		2.1
Chillies and peppers, green	Poland	3	3	2%	2.6	2.5	2.6	3.3		2.2
Chillies and peppers, green	Germany	3	5	2%	2.3	2.5	1.0	3.5		2.2
Chillies and peppers, green	Belgium	1	2	1%	2.3	2.4	1.5	2.6		1.3
Chillies and peppers, green	Ghana	1	2	1%	2.5	2.2	3.2	2.6		2.3
Chillies and peppers, green	Turkey	1	2	1%	3.2	3.3	3.1	2.6		3.0
Chillies and peppers, green	India	1	1	1%	3.7	3.5	3.6	5.0		2.2
Tea	Kenya	80	151	58%	3.6	3.6	3.8	4.0		1.3
Tea	India	22	47	16%	3.7	3.6	3.6	5.0		4.9
Tea	Indonesia	7	10	5%	2.9	2.4	4.1	3.6		5.0
Tea	Malawi	6	9	5%	2.7	2.5	3.2	3.0		4.9
Tea	Tanzania	5	10	4%	2.5	2.2	3.2	3.0		4.0
Tea	South Africa	4	6	3%	3.2	3.3	2.9	3.5		4.9
Tea	China	3	9	2%	3.5	3.5	3.6	3.9		4.0

Tea	Argentina	2	2	2%	3.2	3.3	3.6	2.5		4.9
Tea	Sri Lanka	1	7	1%	2.6	2.4	3.1	3.4		5.0
Tea	Zimbabwe	1	2	1%	2.5	2.3	3.2	2.6		4.8
Cocoa	Cote d'Ivoire	65	128	46%	2.6	2.1	4.5	2.6		1.4
Cocoa	Ghana	45	99	31%	2.4	2.2	3.2	2.6		1.4
Cocoa	Nigeria	13	27	9%	3.2	3.0	4.3	3.0		1.4
Cocoa	Malaysia	8	23	5%	2.4	2.0	3.7	2.5		1.4
Cocoa	Indonesia	5	12	3%	2.9	2.5	4.1	3.6		1.4
Cocoa	Peru	1	5	1 %	2.8	2.5	3.8	3.0		1.4
Cocoa	Colombia	1	3	0.7%	2.6	2.3	3.2	3.6		1.4
Cocoa	Ecuador	1	3	0.7%	2.2	1.9	3.5	2.2		1.4
Cocoa	Cameroon	0	1	0.3%	3.1	2.7	4.8	2.2		1.4
Cocoa	Philippines	0	1	0.2%	2.5	2.3	2.9	3.5		1.4

Table 40: Sample mapping of HMRC data to WRF sectors

WWF WRF Sector	HS codes	Reference	Total Value	Total kg
Food producers	11	MILLING INDUSTRY PRODUCTS	336012451	626774559
Food producers	16	ED. PREP. OF MEAT, FISH, CRUSTACEANS, ETC	3052740275	914779238
Food producers	17	SUGARS & SUGAR CONFECTIONERY	1316045676	2576069554
Food producers	18	COCOA & COCOA PREPARATIONS	1556535603	539480660
Food producers	19	PREPS. OF CEREALS, FLOUR, STARCH OR MILK	2636406597	1470460064
Food producers	20	PREPS OF VEGS, FRUITS, NUTS, ETC.	2399775072	2732346830
Food producers	21	MISC. EDIBLE PREPARATIONS	2337857304	1147811510
Food producers	23	RESIDUES FROM FOOD INDUSTRIES, ANIMAL FEED	2075436694	5597237429