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Dana Krechowicz

Shally Venugopal

Amanda Sauer

HSBC

Sandeep Somani

Shipra Pandey

WEEDING RISK

Financial Impacts of Climate Change and Water Scarcity on Asia's Food and Beverage Sector

India, Indonesia, Malaysia, Philippines, Thailand, Vietnam

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Contents

I. KEY FINDINGS FOR INVESTORS AND ANALYSTS 3

II. SECTOR OVERVIEW 9

III. CLIMATE CHANGE & WATER SCARCITY TRENDS 12

A. Climate Change 12

B. Water Scarcity 14

IV. IMPACTS ON VALUE DRIVERS 17

A. Agricultural Inputs 18

B. Operating Efficiency 22

C. Reputation

V. RISK ASSESSMENT 26

A. Overall Food and Beverage (F&B) Sector Risk Assessment 26

B. Risk Assessment by Subsector 29

VI: FINANCIAL APPLICATION: HSBC CASE STUDY 47

A. Balrampur Chini Mills Ltd 48

VII. NEXT STEPS 57

APPENDIX 1: REPORT FOCUS AND METHODOLOGY 59

APPENDIX 2: LISTED F&B COMPANIES BY REGION 62

KEY EXTERNAL SOURCES 69

NOTES 71

ABOUT THE PROJECT

This report would not have been possible without the financial support of the International Finance Corporation (IFC) and grant funding from the Government of Japan. The research project's objective is to guide investors and analysts through assessing the financial impacts of select environmental trends on listed companies in India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam. Other research reports produced within this series are listed below. More information on the project and copies of the reports are available for download at www.wri.org/project/envest.

- ***Emerging Risk:*** Impacts of Key Environmental Trends in Emerging Asia.
- ***Undisclosed Risk:*** Corporate Environmental and Social Reporting in Emerging Asia.
- ***Over Heating:*** Financial Risks from Water Constraints on Power Generation in Asia.
- ***Surveying Risk, Building Opportunity:*** Financial Impacts of Energy Insecurity, Water Scarcity and Climate Change on Asia's Commercial Real Estate Sector.

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ABOUT THE AUTHORS

Dana Krechowicz is an Associate in the Envest project at WRI. dkrechowicz@wri.org
Shally Venugopal is an Associate in the Envest project at WRI. svenugopal@wri.org
Amanda Sauer is a Senior Associate in the Envest project at WRI. amanda.sauer@wri.org

COVER PHOTO CREDIT

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I. Key Findings for Investors and Analysts

This report identifies the potential financial impacts arising from climate change and water scarcity on the publicly listed companies in the USD[1] $40 billion food and beverage (F&B) sector in South and Southeast Asia. It focuses on domestic companies that process and package foods and non-alcoholic beverages in India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam.

The report examines the potential impact of climate change and water scarcity on three key value drivers (agricultural inputs, operating efficiency, and reputation) for each of the seven most important F&B subsectors — aquaculture, beverages, confectionary, dairy/poultry, edible oils, starches, and sugar.

This report offers a road map for analysts and investors seeking to factor environmental trends and their potential financial impacts into their assessments of companies' strategic positioning in this sector and region.

In a case study, HSBC examines the financial implications of climate change and water scarcity on an Indian sugar company, Balrampur Chini Mills.

CONTEXT

Climate change and water scarcity are two major global environmental trends that are accelerating and already impacting many sectors of the economy worldwide.

- Climate change and water scarcity are complex, long-term and inter-related environmental trends that can create a wide range of consequences for companies and sectors worldwide.
- The specific impacts of these trends and the financial implications for investors vary by company, sector and country. Pertinent characteristics of these trends are provided in Table 1:

TABLE 1. Aspects of Environmental Trends Examined in this Report

Climate Change	Water Scarcity
Temperature increase	Physical scarcity (geography, timing)
Change in precipitation	Decrease in water quality due to pollution
Increase in incidence of extreme weather events	Cost increases due to scarcity
Rising atmospheric carbon dioxide (CO_2) concentrations	Increased conflicts with other users

Source: WRI

South and Southeast Asia are particularly at risk from climate change and water scarcity due to the magnitude of predicted regional impacts and demographic trends.

- The region is already struggling with increased demand for water from population and economic growth while facing diminishing supplies in certain areas, especially parts of India and urban zones in Southeast Asia.
- Climate change models predict that impacts will be severe in this region and will exacerbate water scarcity problems.

The Food and Beverage (F&B) sector is especially vulnerable to climate change and water scarcity because of its close ties to agricultural productivity and changing consumer preferences.

- Access to water supplies and stable climatic conditions are prerequisites for the reliable production of the agricultural inputs required for the F&B industry.
- The agricultural sector's high reliance on chemical inputs and mono crops (growing the same one variety of crop every year on the same land) has made food systems more at risk for disruption from climate change and water scarcity.
- Consumer trends in the region towards more processed foods and increased meat and dairy consumption are requiring more agricultural and natural resources, including water, per unit of food sold.
- Together, these trends are increasing the sector's use of natural resources at the same time that climate change and water scarcity threaten to reduce their supply.

KEY FINDINGS

- This report draws on consultations with experts and the best available literature to assess the financial implications of climate change and water scarcity on the F&B sector in South and Southeast Asia. Our analysis and findings focus on three commonly-accepted value drivers: agricultural inputs, operating efficiency, and reputation.

The most financially material impacts of climate change and water scarcity on the F&B sector are increased agricultural input prices and increased processing costs.

- The impact of climate change and water scarcity on agricultural input prices and processing costs affects all F&B subsectors examined in this report.
- The significance of the impact depends on a number of factors, including location of suppliers and factories, ability to pass costs onto consumers and the sustainability of supplier cultivation practices.
- Figure 1 assesses the likelihood and magnitude of the following risks on the F&B sector:

Climate change and water scarcity can raise agricultural commodity prices and increase price volatility by decreasing yields.

- Climate change and water scarcity can have a direct impact on the availability, quality and price of key food commodity inputs by negatively impacting animal and crop yields.

- Food commodity prices are particularly vulnerable to the shocks of unpredictable extreme weather events, while animal yields are most at risk from increased water temperatures (aquaculture) and access to clean water supplies.

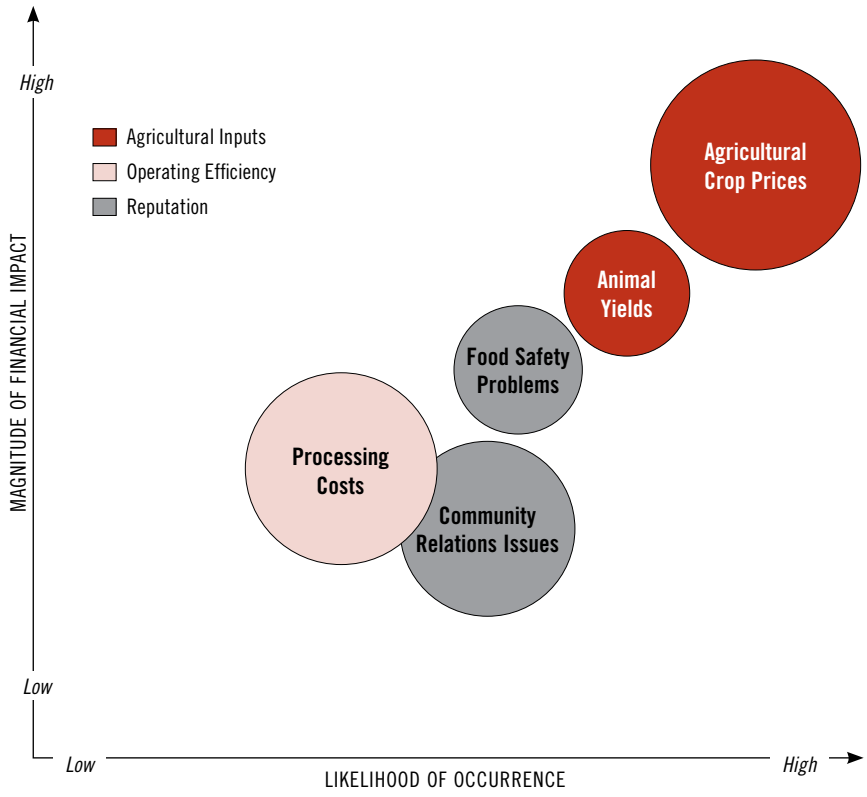
Climate change and water scarcity can increase processing costs through operational disruptions and treatment costs.

- Water scarcity can create operational disruptions since water is 1) a base ingredient and 2) integral to production processes. Water pollution, which contributes to scarcity, requires investments in filtration technology.
- Climate change can create operational disruptions by damaging manufacturing plants and infrastructure.

Climate change and water scarcity can create food safety and stakeholder challenges.

- Climate change and scarcity of clean water can increase exposure to diseases and contamination, especially for animal-based products, increasing food safety risks.
- Competition for water is a source of tension between food processors and stakeholders, creating reputational risks.

FIGURE 1. Sector Risks: Magnitude of Impacts of Climate Change and Water Scarcity on the F&B Sector in South and Southeast Asia



Source: WRI

Notes: Risks, magnitude, and likelihood will vary by location and company and this figure is based on an overall assessment of the following seven subsectors: aquaculture, beverages, confectionary, dairy/poultry, edible oils, starches, and sugar. The placement of the issues represents the authors' best judgment. See Appendix 1 for the report methodology. Bubble size varies by number of companies affected (as shown in Figure 2).

- Table 2 summarizes the potential business risks of climate change and water scarcity impacts on the F&B sector by value driver, while Figure 2 indicates which of these risks are most relevant for each of the seven subsectors analyzed.

TABLE 2. Summary of Business Risks on the F&B Sector

Value Driver	Business Risk		
Agricultural Inputs	Agricultural Crop Prices	Cost ↑	Climate change and water scarcity can affect the availability of key agricultural inputs and result in price changes over the medium to long-term. These price changes can also affect companies with animal-based products through increased feed prices.
		Cost ↑	The increased frequency and severity of extreme weather events, such as storms or droughts, increases the risk of short-term price volatility. Such events may require companies to switch suppliers, make raw material substitutions with little notice and/or source ingredients from further away.
	Animal Yields	Revenue ↓	Aquaculture, dairy, and poultry yields are especially vulnerable to climate change and water scarcity impacts. These inputs are often raised directly by companies rather than sourced from suppliers. Impacts on revenues will depend on supply/demand balance of market.
Operating Efficiency	Processing Costs	Cost ↑	Water scarcity can increase the cost of treating and accessing water.
			The interruption or decline of water supply (from a drought or water rights issues) can create operational disruptions due to its role as a base ingredient and key production input in processing and in the supply chain.
Reputation	Food Safety Problems	Cost ↑	Increased temperatures and decreasing water quality increase the risk of food and beverage contamination, creating a greater risk that F&B companies may face legal exposure to distributors, importers, consumers and governments in the event of food safety problems.
		Revenue ↓	Climate change and water scarcity increase the likelihood of a food safety problem that could result in lost revenues and recall costs from contaminated or recalled foods and/or depressed consumer demand across entire product categories.
	Community Relations Issues	Revenue ↓	Water scarcity increases competition for water resources. Companies may suffer reduced sales from reputational damage due to publicity from conflicts with local communities over rights to water.
		Growth ↓	Competition from local communities for valuable resources like clean water, especially in areas facing water scarcity, can create delays in obtaining permits for new sites. In the most serious cases, policymakers may prohibit or restrict industry activity in sensitive areas.

Source: WRI

CLIMATE CHANGE SCENARIO: FINDINGS OF HSBC CASE STUDY

- WRI developed a scenario to evaluate the potential impacts of climate change at the company level. HSBC's food and beverage analysts in India then assessed the impact of the scenario on a leading Indian company: Balrampur Chini Mills, a sugar producer located in Uttar Pradesh.
  - **Balrampur Chini Mills:** A 1% rise in agricultural input cost leads to a 3-10% decline in profit.
- The results of this analysis demonstrate the potential magnitude of impacts on the bottom line of companies in the region. It highlights the financial case for food and beverage companies to take proactive steps to adapt to climate change risks.

FIGURE 2. Subsector Risks: Magnitude of Financial Impacts of Climate Change and Water Scarcity in South and Southeast Asia

	AGRICULTURAL INPUTS		OPERATING EFFICIENCY	REPUTATION	
	Agricultural Crop Prices	Animal Yields	Processing Costs	Food Safety Problems	Community Relations Issues
Aquaculture	Medium	High	Low	High	Medium
Beverages	Medium	Not applicable	High	Medium	High
Confectionary	Medium	Low	Medium	Low	Low
Dairy/Poultry	Medium	Medium	Low	High	Medium
Edible Oils	High	Not applicable	Medium	Low	Medium
Starch	High	Not applicable	Medium	Low	Low
Sugar	High	Not applicable	Medium	Low	Low

Source: WRI

Notes: See Section V for further information by subsector. Please refer to the appropriate subsector discussion in this report for what products are considered under each of the categories.

Potential Magnitude of Financial Impact

High
Medium
Low
Not applicable

NEXT STEPS FOR INVESTORS AND ANALYSTS

Investors and analysts should integrate current and future climate change and water scarcity risks into their evaluation of food and beverage companies.

- *Weeding Risk* helps investors and analysts take the first steps in this direction by:
  - Providing the groundwork for navigating the complex issues of climate change and water scarcity and their impacts on the F&B sector.
  - Identifying potential financial impacts arising from climate change and water scarcity.
  - Providing indicators and questions to inform engagement with companies on these risks.

Additional information/data needed to assess climate and water risk exposure at the company level may include:

- Financial information, including cost models.
- Facility data, including exposure and vulnerability to water scarcity and climate change impacts.
- Information about supplier cultivation practices and technology, including vulnerability to water scarcity and climate change impacts.
- Detailed local water availability data.

Investors and analysts may need to engage with companies to acquire this information/data. Important questions for investors and analysts to ask F&B companies include:

- Is the facility (or supplier facility) located in a water scarce or climate change prone region?
- What factors threaten the facility's water supply? Are these threats growing in significance? Has the risk of climate change been taken into account?
- What is the facility's water usage? If not reported, what water reducing technologies are in place?
- How is the facility's water supply secured? What degree of volatility exists under this arrangement? Which water users are given priority in scarcity situations?
- What are the supplier practices in the areas of food safety, fertilizer use and crop rotation?

With this information, examples of approaches that can be taken to integrate climate and water risks into the analysis of F&B companies include:

- Sensitivity analysis: For facilities dependent on freshwater resources, conduct a facility level sensitivity analysis of financial impacts (on costs and sales) of water supply distributions. This will reveal which companies have the highest financial risk tied to disruptions.
- Scenario analysis: Develop scenarios around water availability at the river basin level for a given facility based on future projections (if available) or key risk factors present at the local level. When combined with the sensitivity analysis above, this provides insight into which companies are most at risk from water constraints and the potential magnitude of financial impact.
- Management quality analysis: Assess and rank companies based on the ability of corporate initiatives, including comprehensive water management strategies, and advanced technologies, such as water reuse and recycling, to mitigate water risk. Use this information to appropriately adjust conclusions from the sensitivity and scenarios analyses.

How, or if, the results from these approaches can be integrated into financial models will depend on factors including the analyst's view on the probability of impact and the reliability of the underlying data. However, even if they cannot be integrated into financial models they can be used to inform the general view on management quality. This subjective viewpoint on a company, combined with investor data on companies, can inform the following investment decisions: buy/sell decisions, engagement of various intensities and stock/sector weightings in portfolios.

II. Sector Overview

This report examines how two environmental trends—climate change and water scarcity—may impact the profitability and competitive positioning of locally listed food and beverage (F&B) companies in India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam.

Though the focus of this report is on locally listed F&B companies (including local subsidiaries of foreign based companies), foreign companies that are not listed on local stock exchanges also have a significant presence in these six countries. The risks outlined in this report apply to all F&B companies with local operations and/or supply chains.

KEY POINTS:

- Demographic changes are shifting the F&B sector towards more processed foods, increased consumption of animal products, and a higher reliance on retail distribution (especially supermarkets).
- As a result, the F&B sector is requiring a greater amount of energy, water, and agricultural crops per unit of output.

The food and beverage industry is an important economic driver in the region, with close ties to local markets and small scale producers.

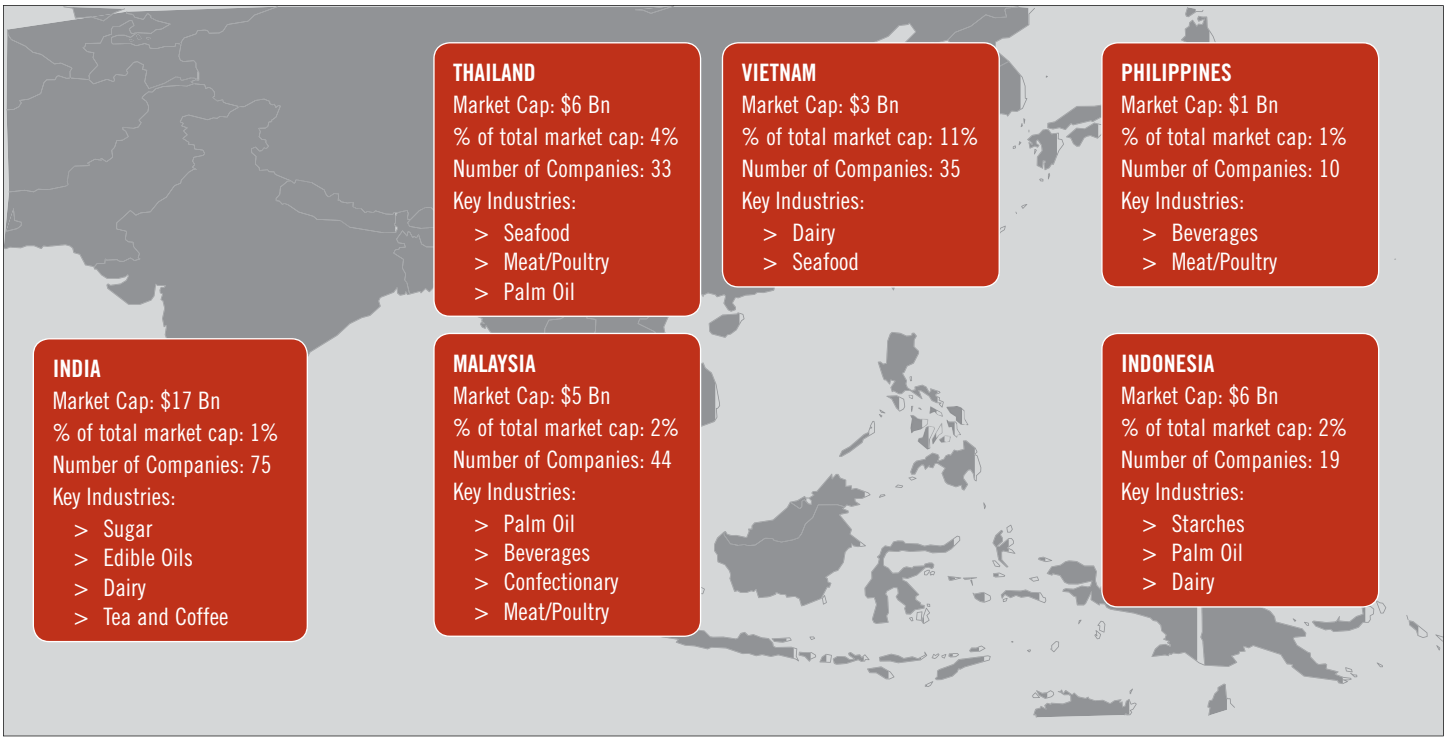
In India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam, the F&B sector includes 216 listed companies with a total market capitalization of USD $40.9 Billion.[2] Figure 3 shows a breakdown of market cap and critical sectors by country. See Appendix 2 for a list of packaged F&B companies in the region.

Most processed foods are sourced, manufactured and sold locally, with only 6% traded internationally.[3] Supply chains are often located within country borders and products are manufactured as close as possible to the end consumer to minimize costs, especially in the case of beverages.[4] However, exports are significant for certain individual food processors, especially in India, Thailand, Vietnam and the Philippines.

Small scale production is significant as listed F&B companies make up a small percentage of the overall F&B industry size and output in each country. The industry is fragmented and dominated by small and medium sized enterprises (SMEs). Some of these SMEs even operate outside of the national legal and regulatory system, as is the case in India, where they account for 75% of food processing industry output.[5]

Given the reliance of listed F&B companies on small producers, relationships with suppliers are critical. F&B companies can influence the agricultural practices of their suppliers, though vertical integration and direct sourcing from farmers may be constrained (as in the case of India) by law.[6&7]

FIGURE 3. Key Packaged F&B Sub-Industry Statistics by Country



Source: Bloomberg (data accessed January 7, 2010)

*Note: Select companies, most notably San Miguel Pure Foods (Philippines), are not included due to unavailability of data. Please see Appendix 2 for list of companies included.

Demographic changes in Asia, most notably the rise of urbanization and a sizeable middle class, are rapidly transforming the F&B sector.

The rapid growth of the middle and upper classes in the six countries, and in Asia more generally, is changing food preferences, and as a result, food delivery systems.[8] A split between urban and rural food consumption and purchasing patterns is also emerging. Important socio-economic trends affecting the F&B sector include:

- Increased demand for packaged and convenience foods, particularly chilled foods. This is due to rising disposable income, urban lifestyles and more women in the workforce, resulting in high sector growth rates.[9]
- Increased demand for meat and dairy products, particularly poultry. However, this trend has been partly tempered by a cultural proclivity toward vegetarianism in India and increased health consciousness among the upper classes across the region.
- Emergence of new end channels, especially supermarkets. Supermarkets are an important and growing distribution channel for the packaged F&B subsector, especially in urban areas—by 2002, the share of supermarkets in the packaged food retail market was 33% in Indonesia, Thailand and Malaysia.[10]

The sector's shift towards more processed foods, increased consumption of animal products, and a higher reliance on retail distribution are increasing the natural resource intensity of the F&B sector.

Packaged and convenience foods require significant amounts of energy and water to process, package, store and transport, in addition to the resource inputs required to produce the underlying agricultural commodities. Transforming fresh food into packaged foods with an extended shelf life requires resource intensive processes such as dehydration, heating and cooling. Meat and dairy products are also resource intensive, particularly their use of water. For example, on average, one kilogram of chicken requires approximately 3,900 metric tons of water to produce, due mainly to the water required to grow the grains the chicken consumes. Preserving meat, dairy, frozen and other chilled foods requires energy-intensive refrigeration throughout the supply chain of procurement, distribution and sales.

III. Climate Change and Water Scarcity Trends

This report considers the physical impacts of climate change and water scarcity on the F&B sector in South and Southeast Asia. Other important environmental issues affecting the sector, including land and water management, pollution and waste, are discussed only as they relate to climate change and water scarcity.

Climate change and water scarcity are interconnected because climate change is a major contributor to water scarcity. For example, climate change will exacerbate water scarcity in some areas due to lower precipitation, and in other areas could cause flash floods due to higher precipitation. In the long term, melting glaciers can change river patterns, causing some of the perennial rivers to become more seasonal. Therefore the discussion of water scarcity also implies climate change unless specifically noted in the text.

KEY POINTS:

- The physical impacts of climate change are predicted to affect operating and growing conditions for the F&B industry and its agricultural inputs.
- As a large water user, the F&B industry and its agricultural inputs will face increased water scarcity in some regions due to climate change as well as declining water quality.

A. CLIMATE CHANGE

Climate change is predicted to increase temperatures, alter precipitation patterns, and increase the frequency and intensity of extreme weather events.

The burning of fossil fuels and land use changes such as deforestation have resulted in rapidly increasing global emissions of greenhouse gases (GHGs). The accumulation of these heat trapping gases in the atmosphere creates changes in the earth's climate, also known as global climate change, which is leading to floods, droughts, and extreme weather events. Concern over the physical impacts of climate change has accelerated in recent years, resulting in international pressure to reduce GHG emissions and shift to low-carbon technologies and practices.

Global climate change is expected to induce gradual shifts in climatic conditions that over time have the potential for dramatic impacts on the F&B sector's direct operations and supply chains. In South and Southeast Asia, the physical impacts of climate change—specifically, changes in precipitation patterns, temperature and the intensity and frequency of extreme weather events—are likely to have a significant impact on many sectors.

The physical impacts of climate change most relevant to the F&B sector include:

- Temperature increases: The mean surface temperature in Southeast Asia is projected to rise by more than the global average over the next 100 years.[12] Table 3 shows the

observed temperature increases to date, as well as the projected increases to 2100. Average temperature in India is projected to rise more than Southeast Asia in general. Temperature increases can directly affect crop and aquaculture yields and contribute to water scarcity, including increasing the intensity of heat waves and droughts.

- Changes in precipitation: From 1960-2000, Southeast Asia experienced a decrease in rainfall and a decreased number of rainy days, with the country-specific trends, and future projections, shown in Table 4. In the next 50 years, under a high emissions (base case) scenario, precipitation in Southeast Asia is projected to decrease, but then to increase by the end of the century, with strong variation expected between March and May. In broad terms, the wet season will become wetter and the dry season drier. In India, precipitation is expected to increase much more than in Southeast Asia. Changes in precipitation patterns will increase the need for irrigated agriculture to provide reliable water supplies and can contribute to water scarcity problems.
- Increase in frequency and severity of extreme weather events: The number of extreme weather events, such as heat waves, floods, droughts and typhoons, has been increasing in Southeast Asia in recent decades.[13] India has experienced an increase in the number and intensity of heat waves in recent years, as well as recent severe droughts in the North-West and North-East.[14] The North-East also experienced floods in 2002, 2003 and 2004.[15] Extreme weather events can destroy entire crop harvests, especially where crop growing is geographically concentrated – as will as disrupt food processing operations and distribution.
- Rising CO_2 concentration: The concentration of CO_2 in the atmosphere increased to 379ppm by 2005.[16] Higher concentrations of CO_2 can increase photosynthesis and reduce plant water loss, potentially partially offsetting the yield declines that are predicted due to climate change. [17] This is known as the carbon fertilization effect.

In South and Southeast Asia, the physical impacts of climate change will have a greater impact on the F&B sector than national or international policy responses to mitigate GHGs.

TABLE 3. Projected Temperature Increases in Select Asian Countries Over Next 100 Years

Country	Observed temperature increases (°C) (1979–2005)	Range of projected temperature increases (mean surface temperature*) (°C) 2010–2039	2040–2069	2070–2099
India	0.68 per century	0.89-0.92	1.54-2.56	2.34-4.5
Indonesia	1.04–1.40 per century	0.75-0.87	1.32-2.01	1.96-3.77
Malaysia	Data not available			
Philippines	1.4 per century			
Thailand	1.04–1.80 per century			
Vietnam	1.0 per century			

Source: Asian Development Bank. April 2009. "The Economics of Climate Change in Southeast Asia: A Regional Review." Page 23.

Contribution of Working Group II to the Fourth Assessment Report, Climate Change 2007, Impacts, Adaptation and Vulnerability, p. 475.

Note: *Range based on low and high emissions scenarios. Temperature increases for India are from data for South Asia averaged over 4 seasons. Baseline period is 1980–1999.

TABLE 4. Projected Precipitation Changes in Select Asian Countries Over Next 100 years

Country	Observed changes in precipitation*	Projected mean change in precipitation (%)**		
		2010–2039	2040–2069	2070–2099
India***	Increase in extreme rains in North-West during summer monsoon in recent decades; lower number of rainy days along East coast.	2.5–5.5	10.25–11.75	9.75–16.75
Indonesia	Decrease in annual rainfall during recent decades in some areas.	0.25 to -1.00	1.00–2.25	3.00–8.00
Malaysia	Number of rainy days has declined throughout Southeast Asia.			
Philippines	Increase in annual rainfall and in the number of rainy days.			
Thailand	Decreasing annual rainfall for the last five decades.			
Vietnam	Decrease in monthly rainfall in July-August and increase in September to November.			

Source: 1. Asian Development Bank. April 2009. "The Economics of Climate Change in Southeast Asia: A Regional Review." Page 27.

2. Contribution of Working Group II to the Fourth Assessment Report, Climate Change 2007, Impacts, Adaptation and Vulnerability, Page 475.

Notes:

* Studies conducted over varying time periods.

** Range based on low and high emissions scenarios. Baseline period is 1961–1990.

*** Precipitation changes for India are from data for South Asia averaged over 4 seasons.

B. WATER SCARCITY

Water scarcity is a growing concern for many parts of the world. In India in particular, and in parts of the other five countries, high demand for water, coupled with water pollution, means that water reserves are being used faster than they can be replenished. This trend will accelerate in some areas, as population and economic growth lead to higher water consumption in the region. Figure 4 shows annual renewal water availability per capita.[18]

As a large water user, the F&B sector is at risk from decreasing water supplies in parts of emerging Asia (most notably India).

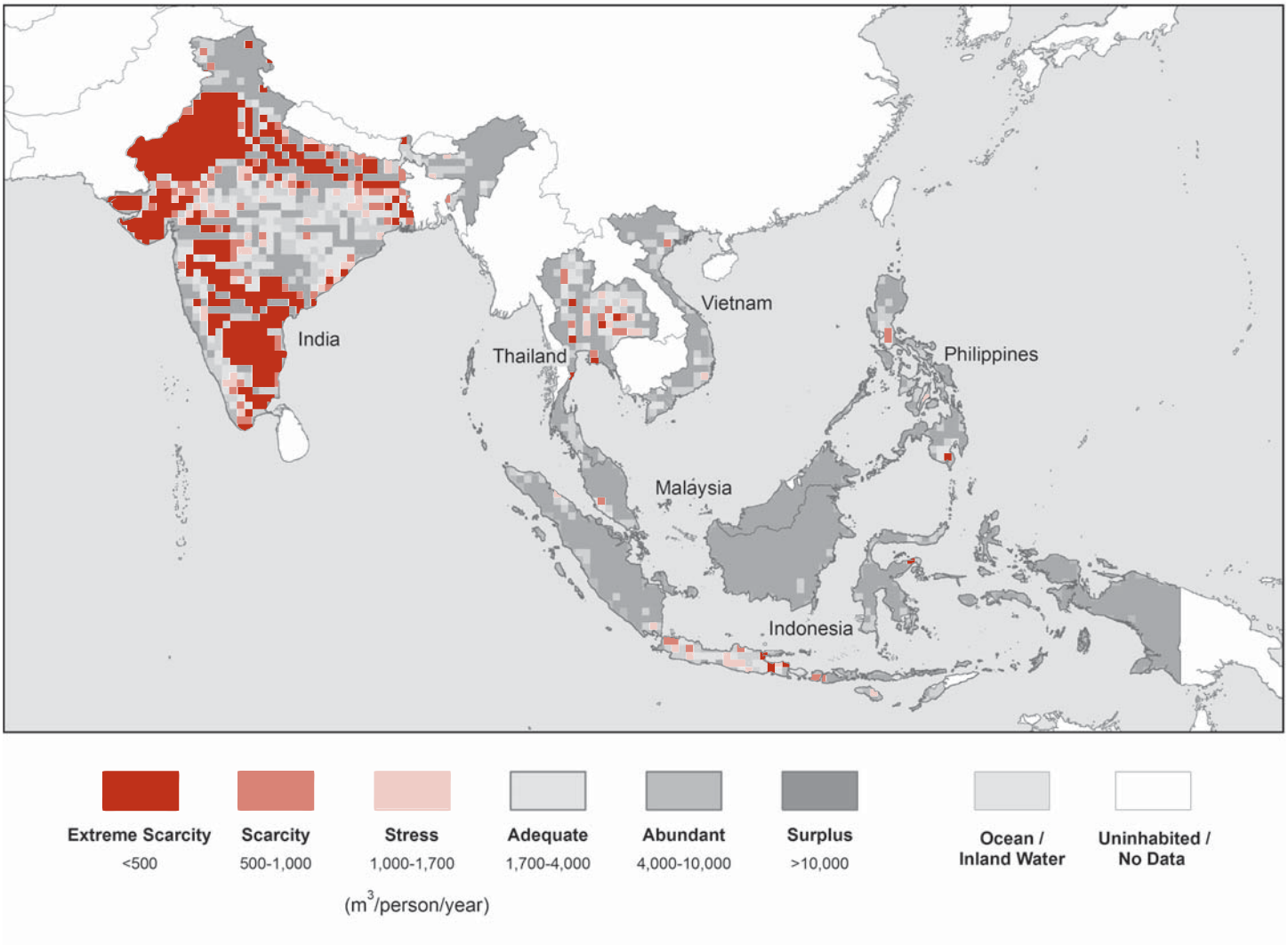
The F&B sector is a significant water user, especially in its supply chain, as agriculture comprises the largest user of water in the six countries (as is the case in many countries), as shown in Figure 5. Water usage is greatest in the growing, harvesting, and rearing phases of production. The sector's high water dependency makes the impacts of water scarcity more pronounced.

Water quality is also an important factor during processing activities.[19] Water is a key ingredient in many products, and is used extensively as a cleaning and processing agent, requiring high quality water to maintain food safety standards.

Maintaining reliable water supplies for the F&B sector will be a challenge due to the following factors:

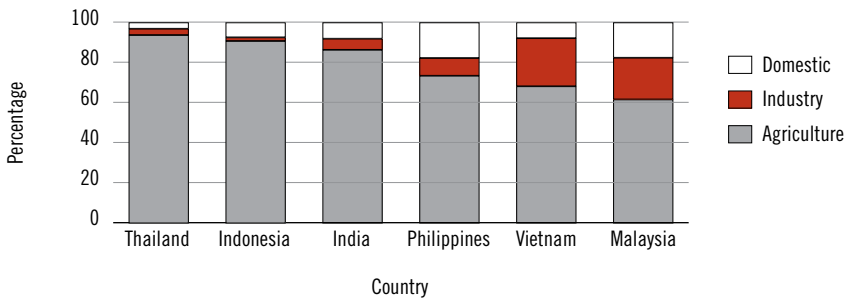
- Physical water scarcity: Most F&B companies draw their water from the local groundwater, as well as rivers. Groundwater can become scarce when withdrawals are greater than the recharge rate (i.e., quantity of water per unit of time that replenishes or refills an aquifer) (see Figure 4). Water renewals in the region tend to be seasonal, such as rainy seasons (e.g. the Monsoons in India) or snow and glacial melting (e.g. the Himalayas).

FIGURE 4. Annual Renewable Freshwater Supply Per Capita



Sources: ISciences LLC: University of New Hampshire/Global Runoff Data Center; Center for International Earth Science Information Networks/Centro International de Agricultura Tropical.

FIGURE 5. Sectoral Withdrawals as a Percentage of Total Water Withdrawals (2004)



Source: FAO Aquastat 2004

The Himalayan glaciers continue to melt. Though the complete disappearance of the glaciers is not imminent, changes in river flow patterns might arise.

- Decrease in water quality due to pollution: Water pollution in the six countries, from a variety of industrial and household sources, has been worsening in recent years. Water pollution, which F&B companies also contribute to, can reduce the amount of usable water available, which increases the cost of filtration (if filtration is possible).
- Increased conflicts with other users: Water allocations to the F&B sector and supply chains are often determined by the local legal structure governing water access. As water scarcity increases, competition for water resources will become more intense from domestic and industrial users. For example, Coca-Cola's perceived over-extraction of groundwater in some parts of India has made it the target of local communities and activist groups.

The magnitude and scope of climate change and water scarcity trends will influence the continuing transformation of the F&B sector in emerging Asia.

The industry trends described in Section II are increasing the resource intensity of F&B production at the same time that climate change and water scarcity impacts are constraining them. Water and agricultural inputs, including animal feed, are most at risk. The convergence of industry and environmental trends ensure that climate change and water scarcity will have a greater impact on the F&B sector in the future.

IV. Impacts on Value Drivers

This section analyzes how climate change and water scarcity trends can create risks and financial impacts for three of the food and beverage sector's widely-accepted value drivers – agricultural inputs, operating efficiency, and reputation. The assessment draws on primary and secondary research, including interviews with experts. The methodology is described in Appendix 1.

KEY POINTS:

- Climate change and water scarcity could lead to declining crop yields that can contribute to higher prices for agricultural inputs. Declining animal yields can directly impact aquaculture, meat, and dairy production.
- Climate change and water scarcity can increase operating costs through expenditures to adapt to lower water availability and quality as well as operational disruptions from lack of water or extreme weather events.
- The impacts of climate change and water scarcity can increase reputational and legal risks from food safety and community relations problems.

This report focuses on key value drivers for the F&B sector, including:

1. Agricultural Inputs: The F&B sector depends on plant and animal agricultural products as key raw material inputs. A company's ability to source these inputs from suppliers at the right cost, at the right time, and in the right quality is important to maintaining profitable operations. For aquaculture, meat and dairy operations, animal-based inputs are often produced within the company rather than sourced from suppliers.
2. Operating Efficiency: F&B operations, including processing, packaging and storage comprise the backbone of the sector's business. F&B companies' operations are heavily dependent on water as a key ingredient, processing agent and cleansing agent.
3. Reputation: A company's reputation and sales can be tarnished by local and international scandals that receive media attention. Such incidents can have financial impacts even if they occur for a competitor as consumer demand may decrease across an entire product category. Food safety and stakeholder relations regarding shared natural resources are two important issues that can impact a company's reputation.

The financial impacts of the environmental trends on each of these value drivers for F&B companies in South and Southeast Asia are summarized in Table 5.

TABLE 5. Summary of Potential Financial Impacts of Climate Change and Water Scarcity on the F&B Sector in South and Southeast Asia

Value Driver	Business Risk		
Agricultural Inputs	Agricultural Crop Prices	Cost ↑	Climate change and water scarcity can affect the availability of key agricultural inputs and result in price changes over the medium to long-term. These price changes can also affect companies with animal-based products through increased feed prices.
		Cost ↑	The increased frequency and severity of extreme weather events, such as storms or droughts, increases the risk of short-term price volatility. Such events may require companies to switch suppliers, make raw material substitutions with little notice and/or source ingredients from further away.
	Animal Yields	Revenue ↓	Aquaculture, dairy, and poultry yields are especially vulnerable to climate change and water scarcity impacts. These inputs are often raised directly by companies rather than sourced from suppliers. Impacts on revenues will depend on supply/demand balance of market.
Operating Efficiency	Processing Costs	Cost ↑	Water scarcity can increase the cost of treating and accessing water.
			The interruption or decline of water supply (from a drought or water rights issues) can create operational disruptions due to its role as a base ingredient and key production input in processing and in the supply chain.
Reputation	Food Safety Problems	Cost ↑	Increased temperatures and decreasing water quality increase the risk of food and beverage contamination, creating a greater risk that F&B companies may face legal exposure to distributors, importers, consumers and governments in the event of food safety problems.
		Revenue ↓	Climate change and water scarcity increase the likelihood of a food safety problem that could result in lost revenues and recall costs from contaminated or recalled foods and/or depressed consumer demand across entire product categories.
	Community Relations Issues	Revenue ↓	Water scarcity increases competition for water resources. Companies may suffer reduced sales from reputational damage due to publicity from conflicts with local communities over rights to water.
		Growth ↓	Competition from local communities for valuable resources like clean water, especially in areas facing water scarcity, can create delays in obtaining permits for new sites. In the most serious cases, policymakers may prohibit or restrict industry activity in sensitive areas.

Source: WRI

Note: See Appendix 1 for Methodology.

The following section describes the impacts of climate change and water scarcity on F&B value drivers in more detail.

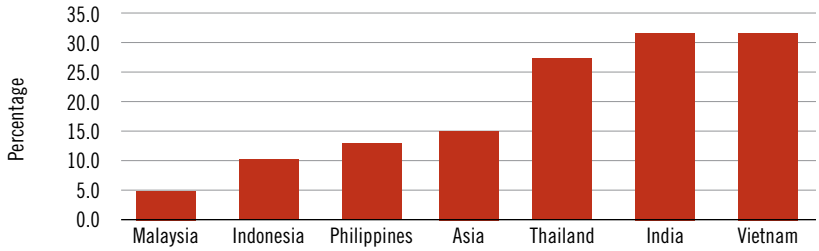
A. AGRICULTURAL INPUTS

Climate change and water scarcity can reduce crop and animal yields in certain countries.

Climate change is expected to raise temperatures and change precipitation patterns in all six countries of focus, with longer dry seasons and more intense wet seasons.[20,21] All agricultural crops depend on water from a combination of sources: rain, rivers, reservoirs or irrigation water drawn from the ground (which is also dependent on precipitation to some extent to recharge the groundwater). Crops that are the most vulnerable to the physical impacts of climate change are those located in regions where they are near their maximum temperature tolerance, in dry, rain-fed soil, and where there is a likelihood of decreased rainfall.[22] Much of the agricultural production in the six countries can be categorized by these characteristics.

India, Thailand and Vietnam have a high percentage of irrigated crops, compared to the Asian average, as shown in Figure 6.

FIGURE 6. Irrigated Land as a Percent of Total Agricultural Area (2003)



Source: WRI Earth Trends.

In the future, climate change will increase the need for irrigation due to higher temperatures and an increased likelihood of droughts.[23] At the same time, climate change can diminish the amount of water available for irrigation in some regions because irrigation water supplies must be recharged from climate dependent sources including groundwater, precipitation, and/or glacial melting. For example, parts of India are dependent on glacier fed rivers for agricultural irrigation, whose flow may be reduced as ice resources recede.[24]

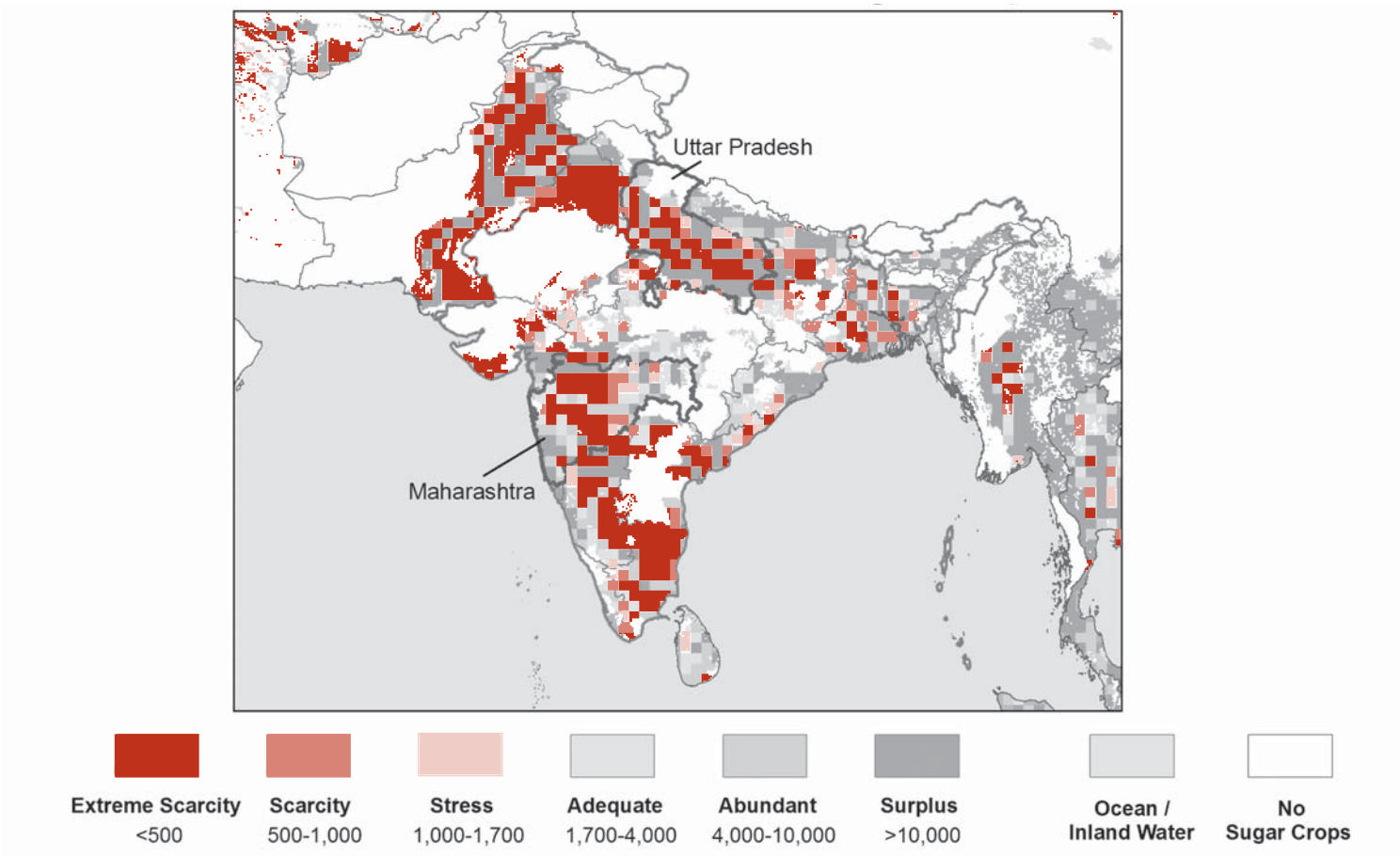
In regions facing water scarcity, irrigated crops will face increasing competition with other users for water resources, also making farmers and companies who use irrigation more susceptible to regulatory changes to control water allocation rights. Irrigation also increases the operating costs of agriculture as more energy is required to access and transport water. The extent to which these costs impact agricultural commodity prices will depend on energy and water subsidies and can vary greatly by political jurisdiction.

Key areas of agricultural production in India are particularly vulnerable to groundwater scarcity for irrigation water. For example, Figure 7 shows the groundwater supply for areas under cultivation for sugarcane, highlighting the key growing states of Uttar Pradesh and Maharashtra.

Increasing water scarcity can cause yields to decrease due to lack of water, and can also raise the cost of production by necessitating additional investments in irrigation and other specialized technology. Given its declining availability, water must be used more productively to increase current agricultural yields.[25]

The IPCC estimates that in parts of Asia, climate change could result in declines in agricultural (not including animal) output by between 2.5–10% by the 2020's and by 5–30% by the 2050's compared to 1990 levels (without CO_2 fertilization effects).[26] Figure 8 shows longer-term estimates of the crop yield decreases in the six focus countries. The declines are lower if carbon fertilization — a process whereby elevated levels of carbon dioxide in the atmosphere may lead to an increase in crop productivity — is taken into account. Whether the carbon fertilization effect will materialize is uncertain, though it is unlikely to fully make up for crop yield decreases, as shown in Figure 8. Certain crops, including rice and soybeans, benefit from additional atmospheric CO_2 much more than others, such as sugarcane. It is also unlikely that agricultural technology, such as crop breeding and drip irrigation could fully make up for the projected yield decreases, even if they could be deployed on the necessary scale.

FIGURE 7. Annual Renewable Freshwater Supply Per Capita (2000) in Areas Under Cultivation for Sugar Crops



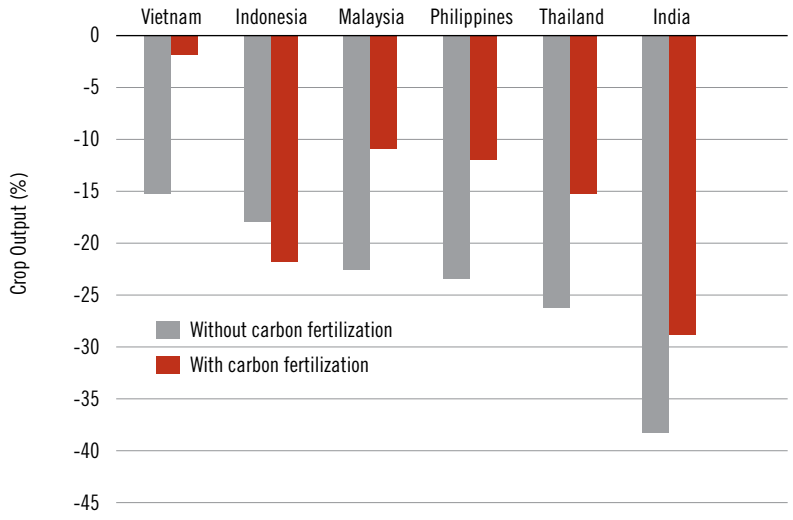
Sources: ISciences LLC: University of New Hampshire/Global Runoff Data Center; Center for International Earth Science Information Networks/Centro International de Agricultura Tropical; and Montreda et al, 2008.

Poultry, dairy and aquaculture yields are likely to be impacted by changing weather conditions which affect animal health, growth and reproduction and create ripe conditions for new diseases. Animals also require clean water to thrive, which if compromised by pollution or availability, can negatively impact yields. In addition, feed crops face the same risks as other agricultural crops from climate change and water scarcity impacts. In the most extreme cases, feed crop shortages can lead to declining animal yields.

Declining crop yields will contribute to higher prices for agricultural products, especially in the medium to long-term.

Global commodity prices are projected to increase over the long-term due to demographic trends, especially population growth. Even without considering the impacts of climate change, studies have predicted price increases of 29-37% for rice and 81-102% for wheat by 2050.[27]

FIGURE 8. Estimated Percentage Declines In Crop Output Due to Climate Change by 2080



Source: William R. Cline, 2007. "Global Warming and Agriculture: Impact Estimates by Country." Pages 69–71.

Note: Carbon fertilization refers to the process by which higher concentrations of CO_2 can increase photosynthesis and reduce plant water loss, potentially offsetting the yield declines that are predicted due to climate change.

The impacts of climate change on reduced yields will exacerbate price increases. Global cereal prices have been projected to increase more than 300 percent by 2080 due to climate change and its impact on water availability.[28] Other climate change studies have shown moderate agricultural price increases to 2050, with more substantial increases thereafter.[29] Decreases in certain crop yields will also lead to higher meat, poultry and aquaculture prices by affecting feed prices.

Sudden crop losses in areas of concentrated production can create global price volatility.

In addition to long-term price trends, climate change will increase the frequency and severity of severe weather events. Such events may create unpredictable price spikes for crops with concentrated areas of production, such as wheat, sugar and palm oil, if sudden crop losses disrupt global supplies.

The need to adapt to climate change can raise the cost of production.

To make up for yield declines, farmers would need to invest in adverse weather resistant seeds, new technology, medicine, fertilizers, pesticides, as well as potentially expand production – all of which raises input costs. Gains in yields from these and other "second-generation" technologies are also more costly because they are more specialized in terms of knowledge and location.

Farmers may not be able to pass costs on to food processors in the short-term, but without the ability to raise prices, the increased costs associated with adaptation could push some farmers out of production (thus decreasing supply, and increasing prices).

F&B companies will face increasing uncertainty over agricultural input costs.

F&B companies may be able to hedge against longer-term price increases to some extent, but are less able to prepare for sudden price spikes. Companies may increasingly need to buy agricultural supplies from foreign or even overseas rather than local markets, creating price and transport cost uncertainty, and likely, increases.

B. OPERATING EFFICIENCY

Water is a base ingredient and a key production input for F&B products, as shown in Table 6. Food and beverage production requires 1) the right amount of water at 2) the right quality at 3) the right time, and at 4) the right place.[30] Water availability can be diminished not only from a physical lack of groundwater, but also from legal disputes over water access or a polluted local water supply.

The physical interruption of water supply can create operational disruptions, due to its role as a base ingredient and key production input in processing and in the supply chain.

A disruption in water supply can have a significant impact on an F&B company's financials.

Water scarcity can also affect energy availability and cost because thermal power generators are dependent on water for cooling. Lack of water can reduce local power production and force F&B companies to run on expensive emergency generators. The same is true for hydro power generation in the event of low water reserves.[31]

Extreme weather events like floods, cyclones and heavy rains are expected to increase in frequency and severity due to climate change. Although unpredictable, these events can create operational disruptions due to physical damage to manufacturing facilities. These weather events can also hinder access to municipal resources used during production, like energy and water, and can affect end market demand patterns.

Water scarcity can increase the cost of obtaining, treating and accessing water.

For companies operating in areas where water is becoming increasingly scarce or heavily polluted, investments in water efficient and filtration technology is essential. In additional to these investments, companies can also reconfigure their production line layout in order to increase water-use efficiency and prevent water dormancy. For example, water used for product rinse water can be used for the production of ice, hot water or steam.[32] Companies who do not plan ahead for operating in water scarce conditions will be forced to ship in water to keep plants running at full capacity, which is expensive, and not a long-term solution to managing water scarcity risks.

TABLE 6. Water Quantity and Quality Requirements for Selected Processes in Food Production

Process	Water Quantity	Water Quality
Food Processing		
Direct Preparation of Product	Low	High-Potable
Bottled Water	High	High-Potable
Cooling Water	High	Medium-High
Product Washing	High	Medium-High
Fluming Water	High	Medium-High
Production of ice, hot water, and steam	Varies	Medium-High
Air conditioning and humidity control	Varies	Medium-High
Starting-up, rinsing, and cleaning of processing equipment	High	High
Cleaning and disinfection of processing facilities	High	Medium
Boiler feed water and fire extinguishing	High	Medium

Source: Kirby et al, Water in Food Production and Processing: quantity and quality concerns, July 2002, Elsevier Science Ltd.

C. REPUTATION

1. Food Safety

Food contamination is already an important risk facing the F&B industry worldwide. Processed food and beverages can be contaminated via bacterial or viral means, typically from human sewage, infected food handlers, animals and their feces, and temperature or air exposure.[33] Viral infections are often harder to trace and in some cases harder to prevent. Contamination triggers are present during sourcing, processing and distribution. Of particular concern is the potential of disease to spread between animal products that lay next to each other on the production line.[34]

Extreme weather events, including hotter days and increased rainfall and/or droughts, increase the spread of bacteria and viruses.

Hotter temperatures, especially when accompanied by poor refrigeration infrastructure (common in the region), promote multiplication of pathogenic microorganisms and thus increase the spread of certain bacteria like salmonella or campylobacter. Waterborne bacteria, viruses and chemicals may contaminate water across the entire value chain, i.e. from sourcing, during processing and distribution as shown in Table 7. Flooding or increased rainfall promote the spread of waterborne bacteria and viruses.

Food contamination may have significant financial impacts for a company or entire product category.

Climate change and water scarcity increase the risk of a food safety incident, which may result in lost revenues and recall costs from contaminated or recalled foods and/or depressed consumer demand. For example, sales of Coca-Cola in India dropped by 30-40% in only two weeks after concerns of elevated pesticide levels in the product were reported.[35] Such events may increase in occurrence if access to clean water supplies becomes more difficult in the future.

TABLE 7. Water-Related Contamination Sources Across the Value Chain

	Sourcing			Processing		
	Cereals, Grains, Vegetables	*Livestock, Poultry*	*Aquaculture*	*Incoming water used during processing (through municipal facilities or owned wells)*	*Factory environment including water storage and distribution system*	*Factory workers*
Water-related contamination sources	Dirty irrigation water, poor washing /handling, and contamination from livestock/ poultry/ aquaculture.	Consumption of dirty water.	Waste dumping, agricultural run-off, and water pollutants.	Water-related weather events (precipitation and drought), sewage, industrial activities create and spread disease, and concentrate toxicity.	Dirty ice; lack of water can contribute to spoiling of foods requiring cooling; dormant water acts as a vehicle for disease transmission.	Lack of or weak enforcement of hand washing.
Solutions	Monitor water quality and access near suppliers.			Collaborate with municipal entities to ensure water access/quality and sewage processing; if water sourced from wells, monitor leakage from nearby contaminants.	Examine water quality at all processing points, eliminate dormant water, and monitor ice quality used by distributors.	Bacterial risks limited through alcohol sanitization; viral risk prevention requires clean water access.

Source: Rose et al, Climate Variability and Change in the United States: Potential Impacts on Water- and Foodborne Diseases Caused by Microbiologic Agents, Environmental Health Perspectives Volume 109, Supplement 2, May 2001.

Reputational damage and lost sales may occur even when the incident occurs for a competitor as consumers may not distinguish between brands and boycott an entire product category. F&B companies may also face costs related to legal exposure to distributors, importers, consumers and governments.

2. Community Relations

Water scarcity can create or exacerbate existing tensions between F&B processors and local stakeholders.

Beverage manufacturers are at high risk for conflicts with communities over clean water rights, especially given the increasing number of contamination and resource competition issues during the past decade. Coca-Cola's situation, described in Box 1, is illustrative of the potential tensions that may develop between F&B processors and their stakeholders as a result of resource shortages.

Companies (especially those exporting to international markets) may suffer reduced sales from reputational damage due to publicity from conflicts with local communities over rights to water. In addition, competition from local communities for valuable resources like clean water can create delays in obtaining permits for new sites. F&B processors may hedge against these risks by reducing their water use, ensuring clean water is returned to the local water supply, and collaborating with stakeholders to find mutually beneficial solutions.

Box 1. Water Scarcity and Coca-Cola in Kerala, India

In 2000, Coca-Cola opened a bottling plant in Palakkad, Kerala, India, which shared its water supply with local people and farmers. But by 2002, the local water supply had become depleted or polluted, and the locals blamed Coke. In response, Coke claimed that its treatment of wastewater was adequate and instead blamed the reduced rainfall. Nevertheless, the public perception was that the company was responsible, and the ensuing protests and legal action caused the plant to be closed in 2004. In addition, the state of Kerala banned the manufacturing and consumption of Coke (and Pepsi) in 2006, although this ban was quickly overturned in court.

This is a good example of environmental regulatory risk: the actual extent to which Coke, the local farmers, the lack of rainfall, or other factors contributed to the water shortage was irrelevant. Instead, the public perception that Coke was responsible resulted in legal fees, lost sales, and damage to its brand. Coca-Cola now has a water conservation policy to help mitigate the risk of loss of water supply. The policy states that "by 2010, it aims to return all the water it uses in its manufacturing processes back to nature."

V. Risk Assessment

This section analyzes the effect of the physical impacts of climate change and water scarcity on the overall industry as well as the following seven F&B subsectors:

1. *Aquaculture*
2. *Beverages (including soft drinks, tea and water)*
3. *Confectionary*
4. *Dairy and Poultry*
5. *Edible Oils (including Palm Oil)*
6. *Starches*
7. *Sugar*

Some of these subsectors are interlinked (for example, soy is a critical feed stock for meat, poultry and aquaculture). This report attempts to consider some of the more obviously related risks, but the authors acknowledge that this is not an exhaustive analysis of linked factors.

To illustrate how analysts and investors can apply the information in this section, a case study on a sugar company in India is presented in section VI.

KEY POINTS:

- Water scarcity and climate change impacts can affect agricultural input prices and processing costs for all F&B subsectors examined in this report.
- Risks vary substantially between countries and companies, even within the same subsector.
- There is a common set of risk factors that can help investors and analysts determine a company's exposure to climate change and water scarcity risks.
- Analysts and investors should engage companies to solicit relevant information in order to assess potential financial impacts.

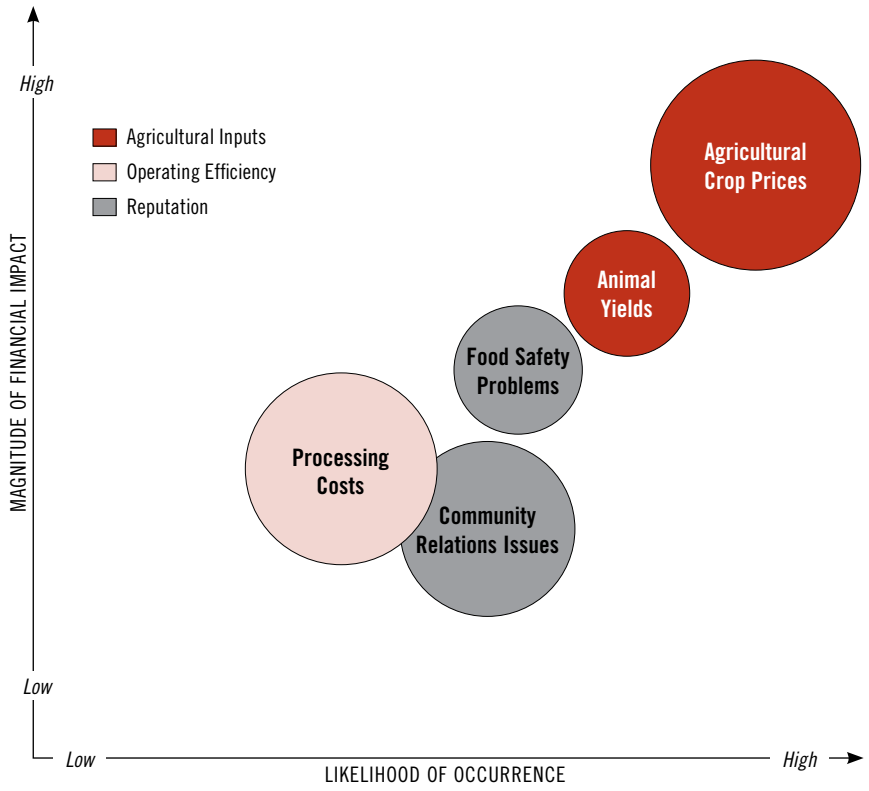
A. OVERALL F&B SECTOR RISK ASSESSMENT

The authors examined several factors when evaluating the effect of the climate change and water scarcity trends on the industry as a whole and each subsector. Specifically:

- Cost structure of subsectors (if information is available)
- Availability of substitute ingredients/products in the marketplace
- Nature of product (branded or commodity-like), i.e. ability to pass costs on
- The bargaining power of F&B companies relative to suppliers and customers
- Location of costs in the value chain

Using this criteria, Figure 9 illustrates the authors' best judgement for the likelihood and magnitude of the risks identified in Section IV for the F&B industry as a whole.

FIGURE 9. Likelihood and Magnitude of the Impacts of Climate Change and Water Scarcity on the F&B Sector in South and Southeast Asia



Source: WRI

Note: Bubble size varies by number of companies affected.

The financial impacts of climate change and water scarcity will be different for each country, subsector and company.

The evaluation of the financial impacts of climate change and water scarcity is dependent on which mix of subsectors and companies are under consideration. As a result, the placement and size of the impacts shown in Figure 9 will vary by location, subsector and company.

The profile of the F&B sector looks different within each country covered in this report. For example, the F&B sector in Thailand and Vietnam has a large aquaculture subsector while India, Indonesia and Malaysia have large edible oils subsectors. Table 8 shows which subsectors are important in each country based on market capitalization and number of listed companies.

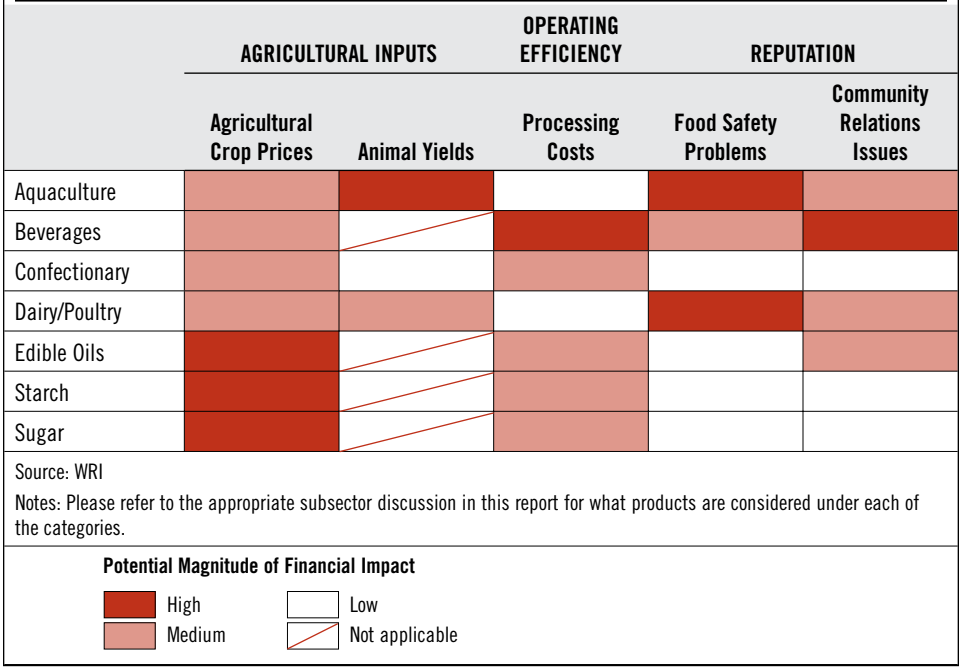
TABLE 8. Key F&B Subsectors by Country (2010) (based on market capitalization and number of listed companies)

Country	India	Indonesia	Philippines	Malaysia	Thailand	Vietnam
Key Sectors	• Sugar • Edible Oils • Dairy • Tea/Coffee	• Starches • Palm Oil • Dairy	• Beverages • Meat & Poultry	• Palm Oil • Beverages • Confectionary • Meat & Poultry	• Aquaculture • Meat & Poultry • Palm Oil	• Dairy • Aquaculture

Source: Bloomberg, Accessed January 7, 2010
Note: See Appendix 2 for a list of market capitalization and sector by company*
* Key F&B subsectors chosen by evaluating the market cap of and number of companies, with a focus on the largest companies by market capitalization.

Figure 10 compares WRI's assessment of impacts identified in each subsector. Further information on the risks and potential impacts for each subsector can be found on pages 30–46.

FIGURE 10. Potential Magnitude of Financial Impacts of Climate Change and Water Scarcity by F&B Subsector in South and Southeast Asia



Source: WRI
Notes: Please refer to the appropriate subsector discussion in this report for what products are considered under each of the categories.

Despite the diversity of the F&B sector, similar risk factors exist to help determine exposure to climate change and water scarcity risks.

To understand risk exposure, analysts and investors will need to consider the potential impact of climate change and water scarcity trends at the company level. Companies across the various subsectors of the food and beverage sector face similar factors that make them susceptible to climate change and water scarcity trends. The key risk factors, explanations of their relevance and related indicators that can be used to assess a company's exposure to these factors are shown in Table 9. Investors and analysts should use these criteria to better understand a company's exposure to climate change and water scarcity risks.

TABLE 9. Risk Factors and Indicators to Assess Exposure to Climate Change and Water Scarcity Trends

Risk Factor	Relevance	Indicator
Location of suppliers, plantations and processing plants	The impact of climate change and water scarcity on crop and animal yields (and therefore, prices) and F&B processing operations is largely determined by the location of the suppliers or plants. Locations in climate change prone or water scarce areas are more vulnerable.	• % of key agricultural inputs sourced from areas prone to climate change and water scarcity impacts.
Practices of suppliers	Land and water management practices that degrade the soil and make crops and animals more susceptible to disease, such as monocropping and overuse of fertilizer and antibiotics, make certain suppliers more vulnerable than others to climate change and water scarcity effects. F&B companies also need to know how their suppliers intend to adapt to the changing climate conditions they are facing. Suppliers that are certified under the relevant certification body (e.g. Roundtable for Sustainable Palm Oil) should have better land and water use management practices.	• % of suppliers that meet company and/or subsector best practices and safety standards. • % of suppliers certified by applicable certification body.
Ability to pass on costs	Pricing power is concentrated at different points in the value chain for different industries. Subsectors with a limited ability to pass costs on, such as aquaculture, are at higher risk.	Qualitative assessment of company's ability to pass costs on based on these factors: • Value add/brand of product. • Availability of substitutes. • Degree of competitors' exposure to the same conditions. • Target market.
Water intensity of production	The greater the water intensity of production, the more a company will find it difficult to cope with water scarcity.	• Water use/unit of product. • % of recycled water used in the manufacturing process. • % of wastewater treated and returned to water table.
Taste tied to certain ingredients	The more a certain product's taste depends on one or several ingredients, the more vulnerable it is to environmental trends that may cause shortages of locally available ingredients. Companies will be forced to source from further away, or substitute other ingredients, which could change the product's taste.	• % of agricultural inputs that are substitutable.

Source: WRI

Most of these risk factors and indicators go beyond traditional environmental health and safety (EH&S) and sustainability reporting and therefore the data required to report on them may not be currently known by companies. Climate change and water scarcity issues are inherently uncertain as both physical impacts and political factors that might mitigate these impacts are difficult to predict and vary greatly by region. Given the uncertainty, investors and analysts should engage companies directly to better understand how these risk factors may affect company performance. In turn, companies will need to engage their supply chain to report this information to investors and analysts.

B. RISK ASSESSMENT BY SUBSECTOR

Each of the following sections identifies the most financially significant potential impacts arising from climate change and water scarcity. Questions and risk factors are presented for analysts and investors to use to further determine a company's exposure to climate change and water scarcity risks.

1. AQUACULTURE

INVESTOR QUESTIONS
for aquaculture companies include:

- Describe water access and quality around supplier' farms and investment in water purification technology.
- What are the food safety practices in the processing plant and that of suppliers and distributors?

The section examines the effect of climate change and water scarcity trends on the two major aquaculture products produced in the region:

- Shrimp in Thailand
- Pangasius fish (striped catfish) in Vietnam

Most listed aquaculture companies in Thailand and Vietnam, especially those with larger market capitalizations, are involved in processing shrimp and pangasius fish. Aquaculture activity is also significant in India, Indonesia and Phillipines, though less common among listed companies in these countries. The largest aquaculture companies are listed in Table 10.

TABLE 10. 5 Largest Non-Diversified Aquaculture Companies (2010)

Company	Market Cap ($ USD Millions)	Country	Product Focus
Thai Union Frozen	897	Thailand	Shrimp
Hung Vuong Corp.	187	Vietnam	Pangasius
Minh Phu Seafood	137	Vietnam	Pangasius
Enernal Energy	132	Thailand	Shrimp
Vinh Hoan	86	Vietnam	Pangasius

Source: Bloomberg (January 7, 2010), Google Finance, Company Websites
Note: Market capitalization represents total capitaliztion of company not of product-specific businesses.

Using the criteria described on pages 26–27 and in Appendix 1, the authors determined the most important risks facing the aquaculture sector from climate change and water scarcity as shown in Figure 11 and Table 11.

Of the potential financial impacts facing aquaculture companies, food safety issues are the most preventable and can be used to determine relative competitive advantage and management quality.

The increased risk in food safety issues due to climate change and water pollution is a real threat to the subsector, especially as disease incidence and compromised yields are already prevalent due to over-harvesting, misuse of antibiotics, tourism, water pollution and over reliance on a few species. Suppliers can help mitigate this risk through maintaining high food safety and water quality standards.

Aquaculture risk factors include:

- Location of commercial farms:
  - Yields can be reduced by water scarcity and pollution, and climate change (precipitation, floods, droughts, sea levels) to varying degrees, depending on location (see Box 2).
- Practices of suppliers:
  - Limited or single species farming increases disease vulnerability. Extreme weather events, including hotter days and increased rainfall and/or droughts, increase the spread of bacteria and viruses.

- Suppliers overly reliant on antibiotics and fertilizer are vulnerable to decreased yields over time, as the overuse of chemicals makes yields more vulnerable to disease.
- Adaptation to climate change (i.e. use resistant species or new technologies) may raise initial costs of production for suppliers but defray future costs.

Ability to pass on costs:

- The shrimp and Pangasius industries in Thailand and Vietnam have limited ability to pass costs on given their positioning in the export market as low cost products and the numerous players involved in the distribution chain.

Box 2: Spotlight on Aquaculture Vulnerability in Thailand

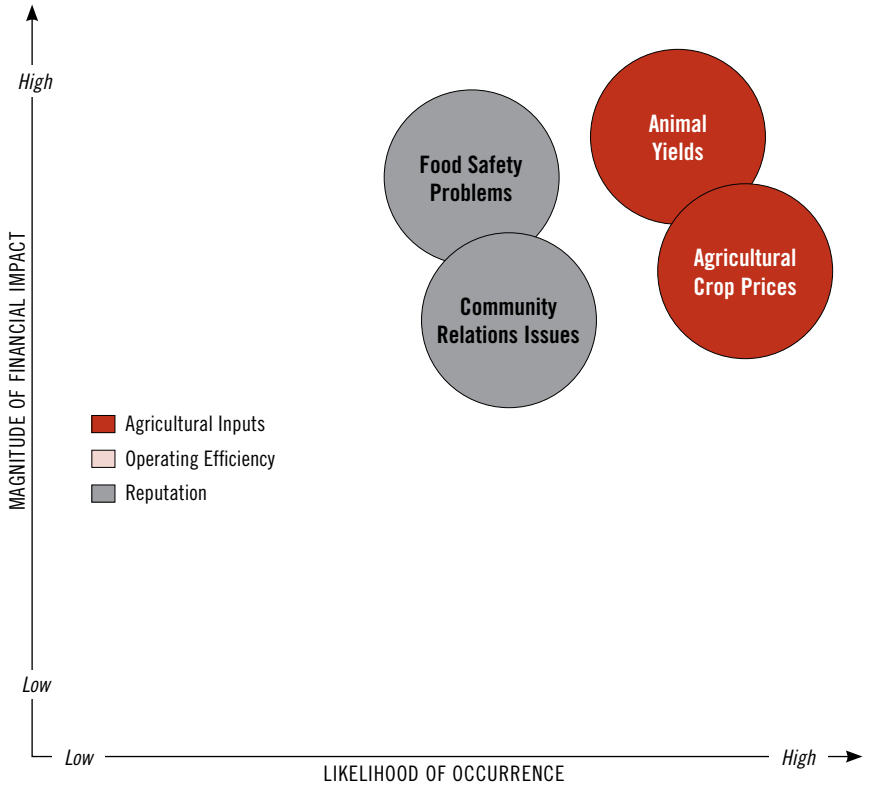
Aquaculture is a significant contributor to Thailand's economy, with exports increasing rapidly over the last decade and a majority of the listed packaged F&B companies involved in aquaculture-related businesses. The potential for increased flooding and droughts resulting from climate change is likely to affect the industry negatively, particularly in the face of intensive commercial farming.

Intensive shrimp farming in Thailand has contributed to lowering the water table and created salinity problems. Salinization reduces water availability for agricultural as well as industrial uses. Under climate change scenarios that increase the frequency of drought, there may be conflict between the aquaculture, agriculture and industrial sectors in Thailand.

Thai aquaculture businesses may benefit from higher fish prices, but will also face higher input costs (as fish oil and fishmeal is used to feed fish) and the inability to pass costs onto consumers in light of lower aquaculture vulnerabilities in major export markets like the US and Europe.

Source: Handisyde et al. Department for International Development. "The effects of climate change on world aquaculture: a global perspective." 2006, and WRI.

FIGURE 11. Magnitude of Impacts of Climate Change and Water Scarcity on the Aquaculture Subsector in South and Southeast Asia



Source: WRI

TABLE 11. The Financial Impact of Climate Change and Water Scarcity Trends on Aquaculture

Value Driver		Business Risk		Timeframe of Impact
Agricultural Inputs	Agricultural Crop Prices	Cost ↑	Fishmeal costs, which are typically among the largest operational costs (40-60% for shrimp* and 25% for Pangasius**), may increase due to lower soy crop yields from climate change induced effects. Poor water quality and extreme weather events may also hamper reliable access to raw feed. Aquaculture companies can, to some degree, switch to feed produced from the lowest priced agricultural inputs.	Immediate (with increased likelihood in future)
	Aqua-culture Yields	Revenue ↓	Decreasing annual rainfall in Thailand, changing rainfall patterns in Vietnam and flooding/droughts near commerical farms will alter the water conditions for shrimp and pangasius, which in turn can create unexpected supply (typically lower yields, but in some cases higher yields may occur). Changing water temperatures will also affect the health and yield of aquaculture.	Future
Reputation	Food Safety Problems	Cost ↑ Revenue ↓	Nitrogen and pollutant concentration is already very high in aquaculture farms, from their own activities. Already polluted water, combined with changing water temperature due to climate change will make it more challenging for suppliers to maintain food safety standards.	Immediate (with increased likelihood in future)
	Community Relations Issues	Revenue ↓ Growth ↓	Competition from local communities and other agricultural producers for clean water, especially in areas facing water scarcity, can conflict for resources. Policymakers could prohibit or restrict industry activity in sensitive areas.	Immediate (with increased likelihood in future)

Source: WRI

Notes:

* Barbara Hardinghaus, "Will Success Kill the Pangasius?" Speigel Online International, March 18, 2009. Accessed at: http://www.spiegel.de/international/world/0,1518,613246,00.html

** Handisyde et al. Department for International Development. "The effects of climate change on world aquaculture: a global perspective." 2006.

2. BEVERAGES

INVESTOR QUESTIONS
for beverage companies include:

- What is your main water source and who are the other users?
- What steps have been taken to improve water use effiency and/or minimize competition with local communities for water resources?

This section examines the effect of climate change and water scarcity trends on producers of:

- Bottled water
- Tea
- Soft drinks (carbonated and non-carbonated)

Most non-diversified beverage, and some diversified companies, are involved in processing one of these three products as shown in Table 12.

TABLE 12. 5 Largest Non-Diversified Beverage Companies (2010)

Company	Market Cap ($ USD Millions)	Country	Focus
Tata Tea	1398	India	Tea
McLeod Russel India	729	India	Tea
Pepsi Cola Phil	192	Philippines	Soft Drinks
Tata Coffee	164	India	Coffee
Serm Suk Public	135	Thailand	Soft Drinks

Source: Bloomberg (January 7, 2010), Google Finance, Company Websites
Note: Market capitalization represents total capitaliztion of company not of product-specific businesses.

Using the criteria described on pages 26–27 and in Appendix 1, the authors determined the most important risks facing the beverage sector from climate change and water scarcity as shown in Figure 12 and Table 13.

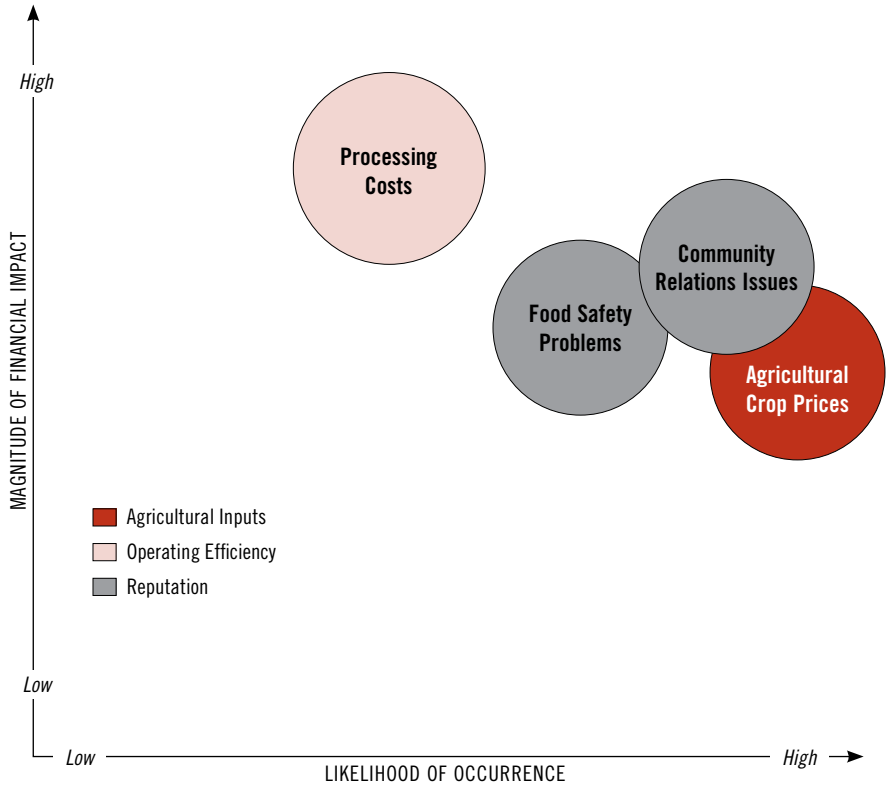
Water sourcing and use issues are the most important for assessing a beverage company's risk exposure.

The source of beverage companies' water, including physical water availability, legal structure governing access and relationships with other competiting users are critical risk areas related to climate change and water scarcity. Other important water related risks are how beverage companies filter incoming and outgoing water and water use efficiency.

Beverage risk factors include:

- Location of processing plant
  - Plants may be impacted by environmental trends to varying degrees depending on where they are located; temperature, drought/flood prone areas and water accessibility are key factors.
- Ability to pass on costs
  - The price the end market will bear depends on the type of product, availability of substitutes, degree of competitors' exposure to the same conditions and target market.

FIGURE 12. Magnitude of Impacts of Climate Change and Water Scarcity on the Beverages Subsector in South and Southeast Asia



Source: WRI

Note: This figure primarily applies to water and soft drinks. Tea and coffee production will mainly face higher crop prices.

TABLE 13. The Financial Impact of Climate Change and Water Scarcity Trends on Beverages

Value Driver			Business Risk	Timeframe of Impact
Agricultural Inputs	Agricultural Crop Prices	Cost ↑	Sugar and tea yields, major cost inputs for the soft drinks and tea sectors, are predicted to decline due to climate change and water scarcity.	Immediate (with increased likelihood in future)
Operating Efficiency	Processing Costs	Cost ↑	The beverages subsector is critically dependent on water for both processing and as a key ingredient; scarcity can create operational disruptions.	Immediate (with increased likelihood in future)
Reputation	Food Safety Problems	Cost ↑ Revenue ↓	Water quality is critical to avoiding contamination issues. Increased scarcity of high quality water supplies will increase the costs of avoiding contamination. An incident can lead to depressed sales.	Immediate (with increased likelihood in future)
Reputation	Community Relations Issues	Cost ↑ Revenue ↓	Bottled water and soft drink companies draw large amounts of water from the groundwater around their manufacturing facilities; putting them at risk for conflicts with other users.	Future

Source: WRI

3. CONFECTIONARY

INVESTOR QUESTIONS
for confectionary companies include:

- Are there substitutes for ingredients that do not change the taste or production process and do not add significant additonal cost?

The confectionary subsector consists of companies that produce the following products:

- Bakery goods (including pies, wafers and cakes)
- Candy and chocolates

Edible oils, starches and sugar are critical ingredients for confectionary companies. For more detail on any of these ingredients, see the appropriate section. The largest confectionary companies in the six countries are shown in Table 14. Malaysia has the largest number of pure play confectionary companies with eight, followed by Vietnam with four, and Indonesia with two and India with one, while Philippines and Thailand have none.

TABLE 14. 5 Largest Non-Diversified Confectionary Companies (2010)

Company	Market Cap ($ USD Millions)	Country	Focus
Mayora Indah	329	Indonesia	Biscuits, candy, wafers
Kinhdo Corp.	304	Vietnam	Cookies, chocolates, candy
Silver Bird Group	73	Malaysia	Bakery goods
Apollo Food	65	Malaysia	Chocolate
Hup Seng	50	Malaysia	Bakery goods

Source: Bloomberg (accessed January 7, 2010)
Note: Market capitalization represents total capitaliztion of company not of product-specific businesses.

Using the criteria described on pages 26–27 and in Appendix 1, the authors determined the most important risks facing the confectionary sector from climate change and water scarcity as shown in Figure 13 and Table 15.

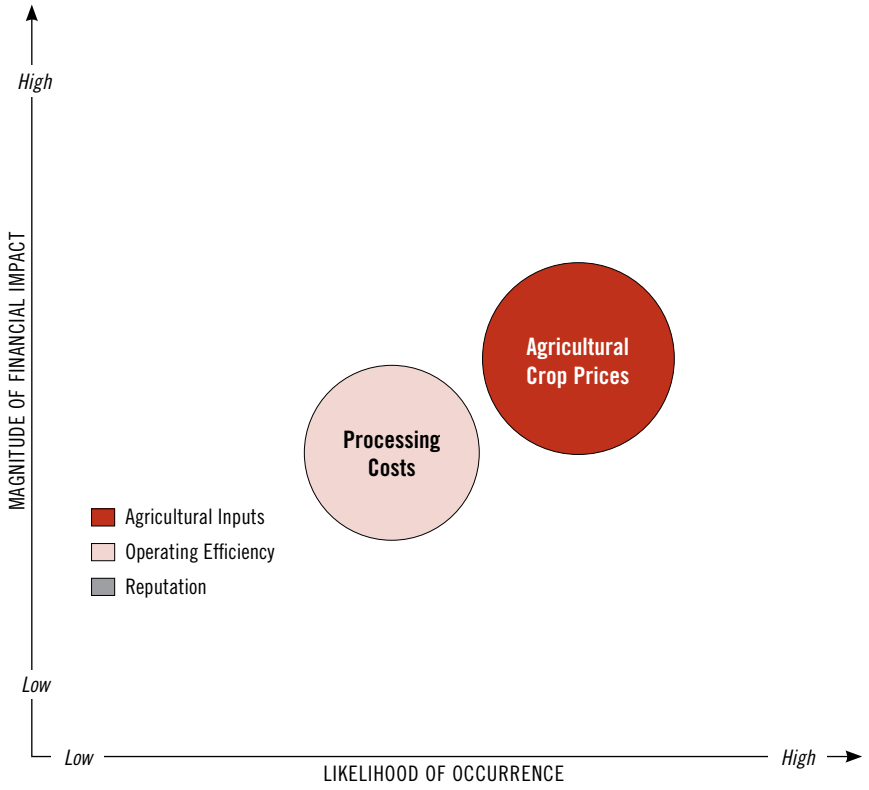
Of the potential financial impacts facing confectionary companies, higher sugar, wheat and oil input prices are the most pressing.

In addition to being affected by higher agricultural input prices, confectionary companies' products' tastes can be tied to ingredients sourced from certain regions. Demand for certain products could decline if a company is forced to switch suppliers and the taste of products changes.

Confectionary risk factors include:

- Taste tied to certain ingredients:
  - The more a certain product's taste depends on one or several ingredients, the more vulnerable it is.
- Ability to pass on costs:
  - The price the end market will bear depends on the type of product, availability of substitutes, degree of competitors' exposure to the same conditions and target market.

FIGURE 13. Magnitude of Impacts of Climate Change and Water Scarcity on the Confectionary Subsector in South and Southeast Asia



Source: WRI

TABLE 15. The Financial Impact of Climate Change and Water Scarcity Trends on Confectionary

Value Driver			Business Risk	Timeframe of Impact
Agricultural Inputs	Agricultural Crop Prices	Cost ↑	Confectionary companies are subject to input price risk due to the impacts of climate change and water scarcity on the subsectors they depend on for inputs, especially sugar and starch.	Immediate (with increased likelihood in future)
Operating Efficiency	Processing Costs	Cost ↑	Water is used as an ingredient, processing agent and sanitizer in confectionary production; scarcity could cause production disruptions.	Immediate (with increased likelihood in future)

Source: WRI

4. DAIRY & POULTRY

INVESTOR QUESTIONS
for dairy/poultry companies include:

- How do you work with your suppliers to ensure a high standard of food safety practices?
- How often do you test water quality around your plants?

The dairy and poultry subsector consists of companies that produce the following products:

- Chicken and duck products
- Milk and milk powders

Most non-diversified meat and poultry companies are involved in poultry processing, primarily chicken and duck, as shown in Table 16. Some companies are vertically integrated, i.e. they also produce animal feed for their livestock.

Large dairy producers typically produce milk products including milk powder as shown in Table 17. It is estimated that by 2020, 31% to 40% of global milk and meat production will occur in Asia.[36] India is already the largest global producer of milk.[37]

TABLE 16. 5 Largest Non-Diversified Meat & Poultry Companies (2010)

Company	Market Cap ($ USD Millions)	Country	Focus
Charoen Pokphand Foods	2577	Thailand	Chicken, duck, swine, feed
GFPT	139	Thailand	Chicken, feed
CCK Consolidated	32	Malaysia	Poultry, feed
Emivest Bhd	21	Malaysia	Duck, chicken
LTKM	16	Malaysia	Poultry, feed

Source: Bloomberg (January 7, 2010), Google Finance, Company Websites
Note: Market capitalization represents total capitaliztion of company not of product-specific businesses.

TABLE 17. 5 Largest Non-Diversified Dairy Companies (2010)

Company	Market Cap ($ USD Millions)	Country	Focus
Viet Nam Dairy	1502	Vietnam	Milk/Milk powders
Kwality Dairy	587	India	Milk/Milk powders
Dutch Lady	224	Malaysia	Milk/Milk powders
Zydus Wellness	222	India	Milk/Milk powders
Ultrajaya Milk	167	Indonesia	Milk/Milk powders

Source: Bloomberg (January 7, 2010), Google Finance, Company Websites
Note: Market capitalization represents total capitaliztion of company not of product-specific businesses.

Using the criteria described on pages 26–27 and in Appendix 1, the authors determined the most important risks facing the dairy & poultry sector from climate change and water scarcity as shown in Figure 14 and Table 18.

Of the potential financial impacts facing dairy and poultry companies, feed prices and animal yields are the most likely to cause a financial impact.

Higher temperatures can not only reduce yields of the grains that dairy and poultry companies are dependent on for animal feed; they also have a significant impact on animal health (see Box 3). Companies can mitigate against this risk to some extent by using cooling technology to lower air temperatures to make animals more comfortable. However, this will increase costs.

Dairy/poultry risk factors include:

- Processing practices of suppliers, company and industry:
  - The food safety practices of suppliers, the company and the industry as a whole can expose companies to reputational, product quality and consumer demand risks.
- Ability to pass on costs:
  - The price the end market will bear depends on the type of product, availability of substitutes, degree of competitors' exposure to the same conditions and target market.
  - Fortifying brand strength with respect to food safety and resource use are likely to increase consumer demand and product acceptance.

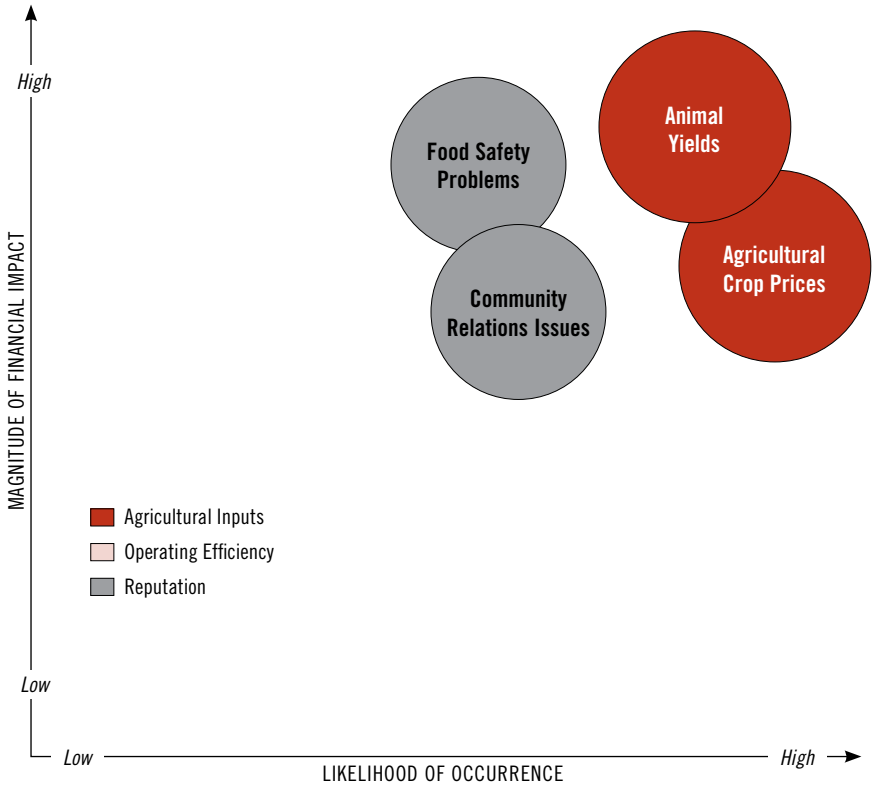
Box 3: Spotlight on Vinamilk (Viet Nam Dairy)

The Vietnamese dairy industry faces unique challenges as a majority of dairy plants and processors in Vietnam are located in the south, many in the Mekong River Delta, and in the North East including the Red River Delta.* These two deltas are susceptible to rising sea levels, frequent flooding, and variability in rainfall as a result of climate change.

Vinamilk may face increasing variability in milk supply and potentially lower yields due to the combination of where dairy farms are located and Vietnam's vulnerability to climate change effects.

Source: WRI, Dairy Vietnam and Company Annual Report 2008
Note: * Dairy Vietnam: http://dairyvietnam.org.vn/en

FIGURE 14. Magnitude of Impacts of Climate Change and Water Scarcity on the Dairy/Poultry Subsector in South and Southeast Asia



Source: WRI

TABLE 18. The Financial Impact of Climate Change and Water Scarcity Trends on Dairy & Poultry

Value Driver			Business Risk	Timeframe of Impact
Agricultural Inputs	Agricultural Crop Prices	Cost ↑	Climate change and water scarcity are expected to create volatility and longer-term price increases for animal feed, which is a significant cost for dairy and poultry companies. Dairy and poultry companies can, to some degree, switch to feed produced from the lowest priced agricultural inputs.	Immediate (with increased likelihood in future)
	Animal Yields	Cost ↑ Revenue ↓	Heat-related stress and disease affects reproduction, milk yield and animal health.* The thermoneutral zone for dairy cattle is –4°C to +18.5ºC; when the ambient temperature increases to 27ºC, heat stress occurs.* To cope with rising temperatures, farmers will incur increased costs for new species and technologies.*	Future
Reputation	Food Safety Problems	Cost ↑ Revenue ↓	The emergence or re-emergence of infectious diseases and animal health in general is critically dependent on water and climatic conditions.* Rising temperatures, floods and droughts, and polluted water will make it more difficult for companies to maintain product safety standards throughout the value chain.	Future
	Community Relations Issues	Revenue ↓ Growth ↓	Competition from local communities and other agricultural producers for clean water, especially in areas facing water scarcity, can create conflict for resources. Policymakers could prohibit or restrict industry activity in sensitive areas.	Immediate (with increased likelihood in future)

Source: WRI

Notes: * S Forman et al, "Climate change impacts and risks for animal health in Asia." Rev Sci Tech. 2008 Aug;27(2):581-97

5. EDIBLE OILS (Palm and Non-Palm Oils)

INVESTOR QUESTIONS
for Edible Oil companies include:

- Is your palm oil plantation on or planned on primary forested land?
- What arrangements (e.g. profit sharing) have been made with local communities living close to your palm oil plantation?

The edible oils subsector consists of companies that produce the following products:

- Mustard, palm and soya oil

Edible oil companies are engaged in fruit and seed sourcing, and oil extraction and refining. In Indonesia, Malaysia, Thailand and Vietnam, the main product is palm oil, which is used in a wide variety of processed foods, personal care products and as a stock for biofuel. In India, edible oil companies are largely producing mustard and soya oils. The largest companies in the six countries are shown in Table 19. In terms of pure play edible oil companies; there are ten in India, five in Thailand, two in both Malaysia and Indonesia and one in Vietnam.

TABLE 19. The Largest Edible Oils Companies in the Six Countries (2010)

Company	Market Cap ($ USD Millions)	Country	Focus
Smart Tbk	832	Indonesia	Palm oil
K.S. Oils Ltd.	541	India	Mustard and soya oil
Ruchi Soya	426	India	Soya oil
Sanwaria Agro	236	India	Soya oil
TH Plantations	220	Malaysia	Palm oil

Source: Bloomberg (accessed January 7, 2010)
Note: Market capitalization represents total capitaliztion of company not of product-specific businesses.

Palm oil cultivation has important climate change impacts that may create unique challenges for the industry, especially in Indonesia and Malaysia. Researchers estimate that between 1990 and 2005, 55–60% of oil palm expansion in Malaysia and Indonesia occurred at the expense of forests.[38] Given that it is a factor in deforestation (which exacerbates climate change and is a major source of GHGs[39]), palm oil cultivation is currently targeted by international efforts to curb deforestation. As a result, new regulations or other mechanisms with the goal of reducing palm oil expansion in forested areas could come into effect in the next five years. The regulations could could make it economically attractive for palm oil companies to develop plantations on degraded land or make current plantations more efficient, as opposed to developing plantations in virgin forests. Indonesia in particular has abundant degraded land that is suitable for oil palm cultivation, and in some cases, with no significant increase in production costs.[40, 41]

Using the criteria described on pages 26–27 and in Appendix 1, the authors determined the most important risks facing the edible oil sector from climate change and water scarcity, as shown in Figure 15 and Table 20.

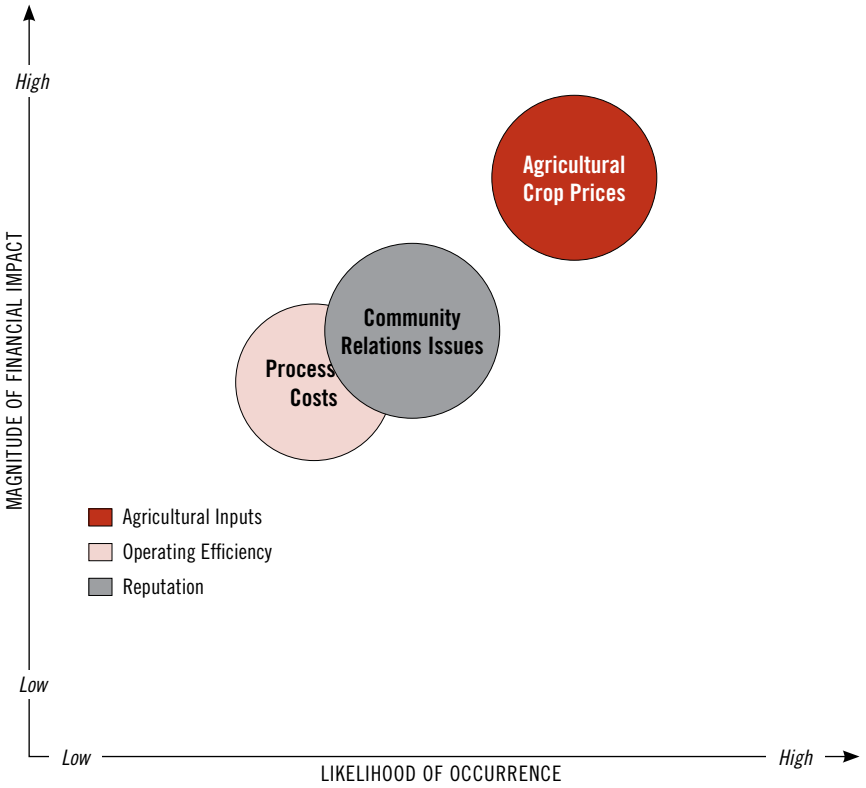
The impacts of climate change and water scarcity on reduced oilseed yields (leading to higher prices) stands out as the greatest threat facing edible oil companies.

Soya and mustard seeds in particular are vulnerable to reduced yields, given that they are cultivated in regions in India that are prone to water scarcity. Palm oil companies may need to become sustainably certified or face obstacles to growth.

Edible Oil risk factors include:

- Location of supplier/processing plant:
  - Farms, plantations and plants will be impacted by environmental trends to varying degrees depending on where they are located.
- Practices of supplier:
  - Palm oil producers who expand into forested lands face legal, reputational and community relations risks.
  - Monocrops are more vulnerable to disease.[42]
  - Need to adapt to climate change (i.e. use drought resistant seeds) can raise the costs of production for suppliers.
  - Key concern is whether suppliers can manage in the face of environmental risks.
- Ability to pass on costs:
  - The price the end market will bear depends on the type of product, availability of substitutes, degree of competitors' exposure to the same conditions and target market.

FIGURE 15. Magnitude of Impacts of Climate Change and Water Scarcity on the Edible Oils Subsector in South and Southeast Asia



Source: WRI

TABLE 20. The Financial Impact of Climate Change and Water Scarcity Trends on Edible Oil

Value Driver			Business Risk	Timeframe of Impact
Agricultural Inputs	Agricultural Crop Prices	Cost ↑	Edible oil companies source oilseeds from a fixed local area. The seeds are perishable, so they can't be transported great distances. Due to the high capital expenditure to build plants in the vicinity of oilseed growing regions, edible oil companies located in regions where oilseed yields fall are vulnerable to oilseed supply and price risk. Reduced water availability in key growing areas, such as Rajasthan in India (both mustard and soya seed), will put pressure on oilseed yields.	Immediate (with increased likelihood in future)
Operating Efficiency	Processing Costs	Cost ↑	Plants located in regions prone to water scarcity and/or climate change are more susceptible to operational disruptions.	Immediate (with increased likelihood in future)
Reputation	Community Relations Issues	Growth ↓ Revenue ↓	Palm oil companies engaging in deforestation, and/or whose products are not certified by the Roundtable on Sustainable Palm Oil (RSPO), may be less able to attract investment, especially from foreign investors and may lose customers due to their practices. In addition, palm oil production is particularly vulnerable to conflicts with local communities, which can halt production.	Immediate (with increased likelihood in future)

Source: WRI

6. STARCHES

INVESTOR QUESTIONS
for starches companies include:

- How well are your suppliers positioned to maintain yields when faced with climate change and/or water scarcity?
- How much would transport/raw materials costs increase if you would have to source from alternate suppliers?

The starches subsector consists of companies that produce the following products:

- Rice and rice based products (including noodles and snack foods)
- Wheat based products (including bakery goods, snack foods, and flour)

The largest starch companies in the six countries are shown in Table 21. There are eight pure play starch companies in India, seven in Thailand, four in Indonesia, three in Malaysia, and one in Philippines and Vietnam.

TABLE 21. 5 Largest Non-Diversified Starches Companies

Company	Market Cap ($ USD Millions)	Country	Focus
Indofood Sukses	3292	Indonesia	Noodles, wheat flour, snack foods
Britannia Inds	854	India	Bakery goods, bread, cakes
Rei Agro Ltd.	376	India	Rice
Thai President	373	Thailand	Noodles
President Bakery	253	Thailand	Bakery goods

Source: Bloomberg (accessed January 7, 2010)
Note: Market capitalization represents total capitaliztion of company not of product-specific businesses.

Using the criteria described on pages 26–27 and in Appendix 1, the authors determined the most important risks facing the starch sector from climate change and water scarcity as shown in Figure 16 and Table 22.

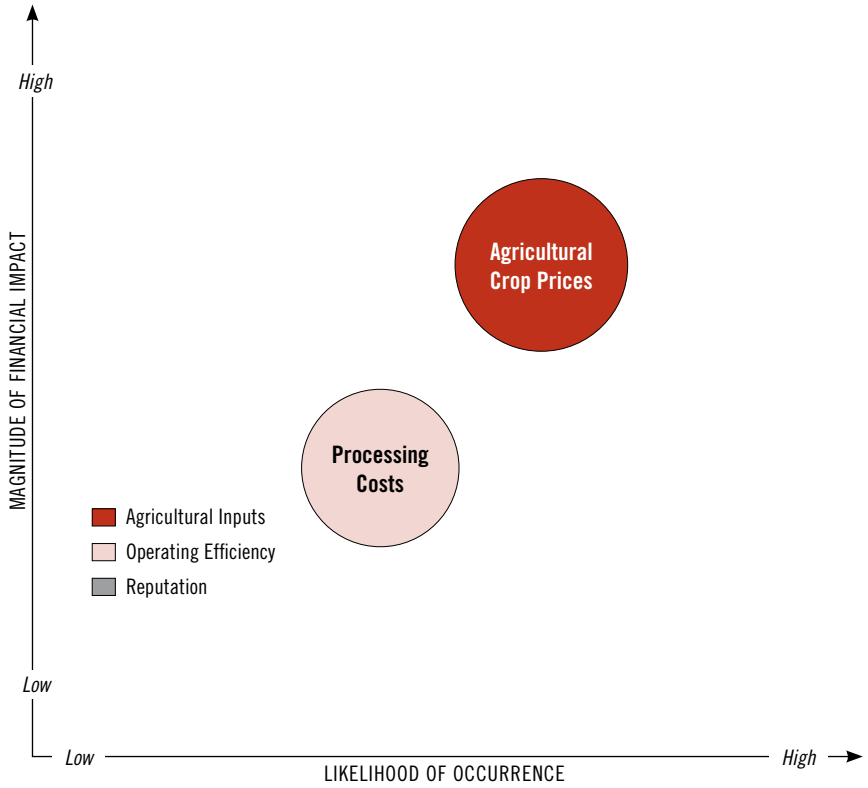
Of the potential financial impacts facing starch companies, declining yields of wheat and rice leading to high input prices is the most pressing.

The vulnerability of wheat and rice yields to climate change (e.g. higher temperatures) and water scarcity is a major concern for starch-producing companies, who may be forced to source from further away than usual, or switch suppliers suddenly in the case of crop failures.

Starches risk factors include:

- Location of supplier/processing plant:
  - Farms, plantations and plants may be impacted by environmental trends to varying degrees depending on where they are located.
- Practices of supplier:
  - Monocrops are more vulnerable to disease.[43]
  - Need to adapt to climate change (i.e. use drought resistant seeds) can raise the costs of production for suppliers.
  - Key concern is whether suppliers can manage in the face of risks.
- Ability to pass on costs:
  - The price the end market will bear depends on the type of product, availability of substitutes, degree of competitors' exposure to the same conditions and target market.

FIGURE 16. Magnitude of Impacts of Climate Change and Water Scarcity on the Starches Subsector in South and Southeast Asia



Source: WRI

TABLE 22. The Financial Impact of Climate Change and Water Scarcity Trends on Starches

Value Driver			Business Risk	Timeframe of Impact
Agricultural Inputs	Agricultural Crop Prices	Cost ↑	Yields of rice and wheat are likely to decline due to climate change. Rice yields have already been in decline in recent years. Recent studies suggest a 2 to 5% decrease in yield potential of wheat for a temperature rise of 0.5 to 1.5°C in India.* The need for climate change adaptation (i.e. using climate resistant seeds) can also raise production costs for both crops, which will contribute to price inflation.	Immediate (with increased likelihood in future)
Operating Efficiency	Processing Costs	Cost ↑	Water is used at various points in the starches production process; scarcity could cause production disruptions.	Immediate (with increased likelihood in future)

Source: WRI

Note: *Contribution of Working Group II to the Fourth Assessment Report, Climate Change 2007, Impacts, Adaptation and Vulnerability, page 480.

7. SUGAR

INVESTOR QUESTIONS
for sugar companies include:

- How well are your suppliers positioned to maintain yields when faced with climate change and/or water scarcity?
- How much would transport/agricultural input costs increase if you have to source from alternate suppliers?

The sugar subsector consists of companies that produce the following products:

- Refined sugar

Sugar companies are engaged in the sourcing and processing of sugarcane into refined sugars that are mostly sold to wholesalers (not directly to the consumer), with most ending up in confectionary.[44] The largest sugar companies in the six countries are shown in Table 23. Indonesia, Malaysia and Philippines do not have any publicly listed pure play sugar companies, whereas India has 24, Vietnam three and Thailand one.

Using the criteria described on pages 26–27 and in Appendix 1, the authors determined the most important risks facing the sugar sector from climate change and water scarcity as shown in Figure 17 and Table 24.

TABLE 23. 5 Largest Non-Diversified Sugar Companies by Market Capitalization (2010)

Company	Market Cap ($ USD Millions)	Country
Bajaj Hindusthan	888	India
Balrampur Chini	783	India
Khon Kaen	709	Thailand
Triveni engineer	640	India
Bannari Amman	266	India

Source: Bloomberg (accessed January 7, 2010)
Note: Market capitalization represents total capitaliztion of company not of product-specific businesses.

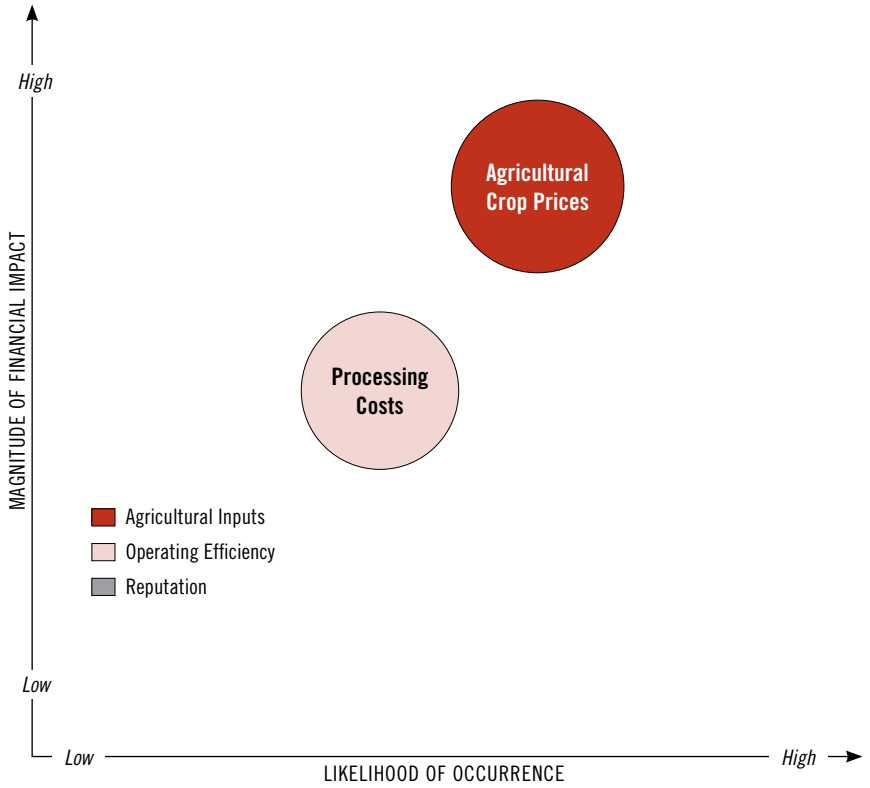
Declining yields of sugarcane due to climate change and water scarcity, leading to high input prices, will likely have the most significant financial impact of the issues considered.

The vulnerability of wheat and rice yields to climate change (e.g. higher temperatures) and water scarcity is a major concern for starches companies, who may be forced to source from further away than usual, or switch suppliers suddenly in the case of crop failures.

Sugar risk factors include:

- Location of supplier/processing plant:
  - Farms, plantations and plants may be impacted by environmental trends to varying degrees depending on where they are located.
- Practices of supplier:
  - Monocrops are more vulnerable to disease.[45]
  - Need to adapt to climate change (i.e. drought resistant seeds) will raise the costs of production for suppliers.
  - Key concern is whether suppliers can manage in the face of environmental risks.
- Ability to pass on costs:
  - The price the end market will bear depends on the type of product, availability of substitutes, degree of competitors' exposure to the same conditions and target market.

FIGURE 17. Magnitude of Impacts of Climate Change and Water Scarcity on the Sugar Subsector in South and Southeast Asia



Source: WRI

TABLE 24. The Financial Impact of Climate Change and Water Scarcity Trends on Sugar

Value Driver			Business Risk	Timeframe of Impact
Agricultural Inputs	Agricultural Crop Prices	Cost ↑	Yields of sugarcane are likely to decline in certain regions due to climate change and water scarcity. Two states in India, Maharashtra and Uttar Pradesh, are major sugar growing states that are also prone to water scarcity. Sugar processing plants are located near a captive supply of sugar growers.* If local suppliers are impacted by climate change or water scarcity, then sugar companies would have to transport in more expensive supply.	Immediate (with increased likelihood in future)
Operating Efficiency	Processing Costs	Cost ↑	Sugarcane processing is water intensive, requiring 111.2 m^3 of water for each ton of sugar produced;** scarcity could cause production disruptions.	Immediate (with increased likelihood in future)

Source: WRI

Notes:

*Jason Clay. 2004. "World Agriculture and the environment: A Commodity-by-Commodity Guide to Impacts and Practices." Page 163.

**United Nations Industrial Development Organization (UNIDO). "Rationalization of Water Use at a Sugar Mill in Mexico." Available at: http://www.p2pays.org/ref/10/09311.htm.

Written by Sandeep Somani and Shipra Pandey, HSBC India

VI. Financial Application: Subsector Case Study

The case study below is written by an HSBC equity research analyst and is based on his/her knowledge of the climatic and environmental factors that have an impact on the business of companies in this sector. It does not constitute investment research and is not part of the analyst's ongoing research coverage. Readers of this report, whether existing clients of HSBC or not, should in no circumstances rely on this material when making investment decisions or use it as the basis of an investment strategy.

HSBC, with input from WRI, developed an in depth case study of an Indian sugar company, Balrampur Chini Mills. Appendix 1 describes the methodology used, and why this company was chosen for analysis.

KEY POINTS

- For Balrampur Chini Mills, the impact of an change in raw material cost has a manifold impact on profit. Each 1% change results in a change in earnings of about 3-10%, depending on the sugarcane supply-demand cycle. The effect can be both on the upside and downside.

The case study analyzes the impact of climate change on a key value driver highlighted throughout this report: agricultural inputs. A hypothetical scenario is applied to Balrampur Chini Mills in order to explore the risks and opportunities climate change poses both for investors and a specific company.

A key takeaway from this analysis is that companies can take cost-effective actions that will mitigate their exposure to environmental risks, even if there is considerable uncertainty about the timing and magnitude of the risk.

In assessing the effect of climate change on these companies' prospects, HSBC analysts faced the following challenges:

- Obtaining facility level data.
- Obtaining financial data broken down along product lines.
- Obtaining reliable information on local climate change trends, soil fertility levels and water table levels in order to estimate long-term availability of feedstock.
- Translating climate change trends into physical effects, especially since the weather is already a variable factor.
- Given the volatile nature of agricultural commodity prices, driven by national and international supply-demand factors, it is difficult to model with sufficient certainty the timing and financial magnitude of environmental impacts in a discounted cash flow (DCF) model.

As a result of these challenges, the financial impacts of environmental trends highlighted in this section are calculated on a short term (1–2 years) basis, even though some of the impacts will not manifest until the medium (2–5 years) or longer term (more than 5 years).

SUGAR COMPANY: BALRAMPUR CHINI MILLS

Overview

Impact of environmental trends:

- Sugar cane availability and price will be affected by both climatic conditions and water availability. Sugar processing also requires significant amounts of water.

Company Background:

- Balrampur Chini (BCML) is India's oldest sugar manufacturing company with an capacity of 76,000TCD (tonnes crushed per day). It is the 6th largest listed food and beverage company in India by market capitalization (as on January 7, 2010) and the second largest sugar company by capacity (after Bajaj Hindustan).
- Along with sugar manufacturing, Balrampur Chini also has distillery and cogeneration capacities which add considerably to its profitability and provide a steady cash flow and a cushion for tough times, such as those faced in FY07 when these two segments contributed ~60% to the company's overall profits, although sugar is its dominant business line, as shown in Table 25.
- Current distillery capacity is 320 kilolitres of production per day (KLPD) and power generation capacity is 181MW, of which 126MW can be sold to third parties.
- The power division has entered into a purchasing power agreement with Uttar Pradesh State Electricity Board, selling power at a fixed price of INR4/unit.

SUGAR PRODUCTION PROCESS

Sugarcane is processed into sugar by crushing the cane and extracting the juice. The juice is evaporated to create syrup, which is then crystallized, dried and refined.

TABLE 25. Company Revenue Breakdown by Business Area

Revenue Composition (%)	2005	2006	2007	2008	2009
Sugar	84%	86%	79%	76%	83%
Distillery	10%	9%	11%	10%	7%
Power	6%	5%	10%	14%	10%
Others	0%	0%	0%	0%	0%
Total	100%	100%	100%	100%	100%

Source: HSBC

ANALYSIS BY VALUE DRIVER

1. Agricultural Inputs

- The primary raw material for BCML is sugarcane. The states of Uttar Pradesh and Maharashtra are the largest cane producing states in India and contributed ~70% to total production in the 2007-08 crushing season (CS).
- The cost of sugarcane is not only determined by the supply-demand situation but also by the recovery factor of sugar.

Table 26 shows the climatic conditions required by sugarcane. Figure 18 depicts the impact of changes in rainfall on sugar cane yields. Lower rainfall has been a key factor in yield decreases along with overuse of fertilizer.

TABLE 26. Climatic Conditions Required by Sugarcane

Water	Climate	Location
• Average annual rainfall of 75-120cm • Has a long growing season, which makes consistent water availability a critical factor for a good harvest. • Sensitive to lack or surplus of water. During 2008 Maharashtra witnessed lower rainfall than average, resulting in reduced yields (tonnes of cane per hectare of land cultivated). However in the same year, cane availability was negatively impacted in Uttar Pradesh due to floods.	• Hot and humid tropical regions with a temperature range of 26-32 degrees Celsius.	• Maharashtra is best suited for cane production followed by Uttar Pradesh.

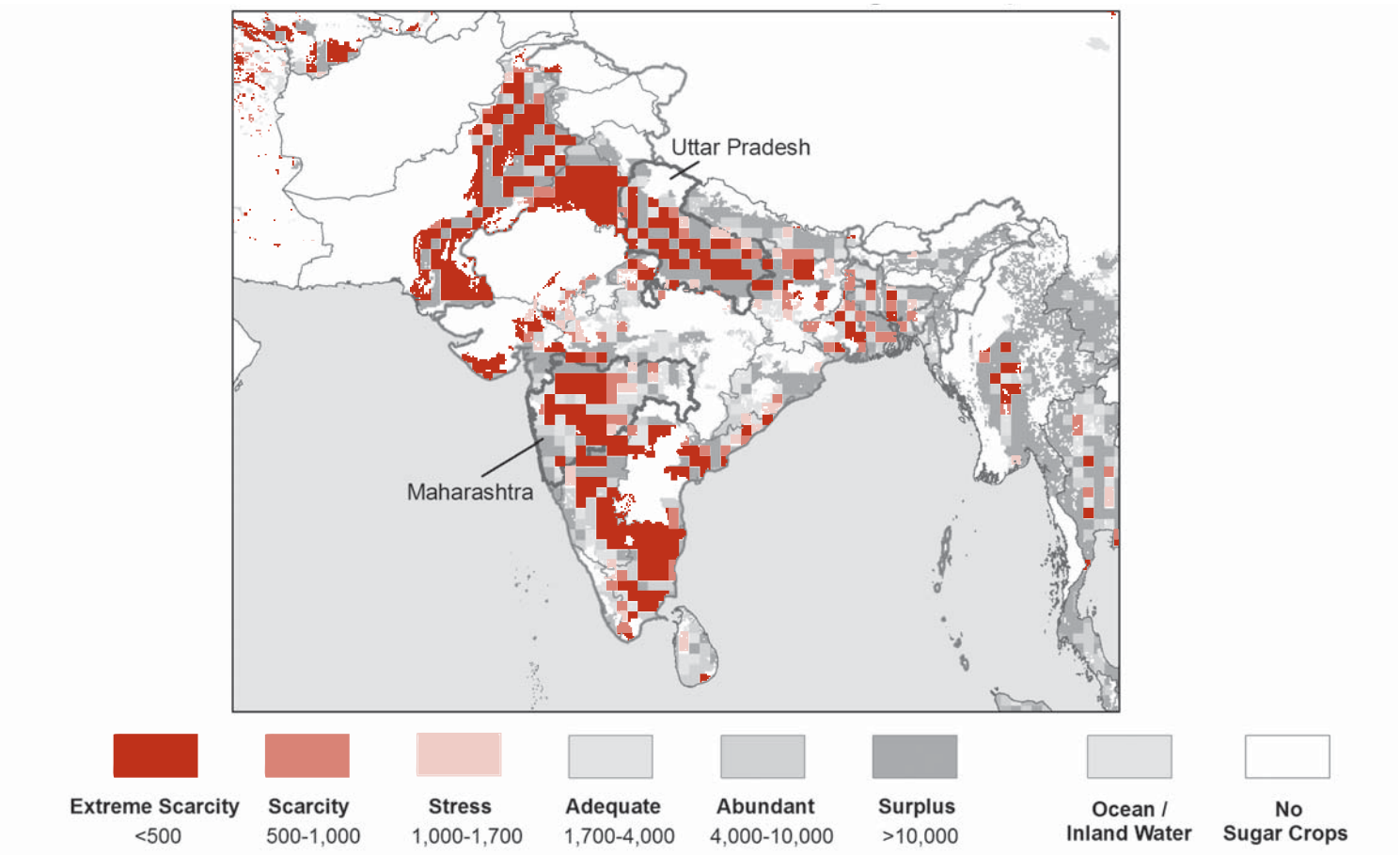
Source: HSBC

FIGURE 18. Yearly Change in Cane Yield in India With Rainfall

Source: CMIE

For Balrampur Chini, we expect drought to be less of a concern than floods since the company's mills are located in the flood-prone Indo-Gangetic plains. Droughts are more likely to affect competitors located in Maharashtra.

FIGURE 19. Annual Renewable Freshwater Supply Per Capita (2000) in Areas Under Cultivation for Sugar Crops



Sources: ISciences LLC: University of New Hampshire/Global Runoff Data Center; Center for International Earth Science Information Networks/Centro International de Agricultura Tropical; and Montreda et al, 2008.

Figure 19 shows the annual renewable freshwater supply in India, highlighting the states of Uttar Pradesh and Maharashtra where sugarcane is grown. Besides climate change impacts on water supply, some regions in these states are already experiencing extreme water scarcity.

Raw Material Sourcing and Pricing

- Cane is purchased directly from farmers. Each mill has a command area mandated by the government (~15km around the manufacturing facility) and is dependent on cane production within this area. Farmers may choose buyers but by law companies may not decline farmers cane at the factory gate.
- Cane cost is determined by availability (support prices are announced by the government) and also by the recovery factor, a function of the sugar content in cane.
- The cost of raw material in years of scarce availability can substantially increase for the company, as in financial year FY09.

- A restricted procurement area and lack of long-term contracts make the company vulnerable to commodity price shocks due to changes in demand-supply scenario.
- In the 2008-2009 season, due to lower cane availability, crushing days declined to 80 days of production vs. approximately 106 days in 2006-07.

Pricing Mechanisms

The central government has assigned a SMP (Statutory Minimum Price) of INR81.1/quital for sugarcane while the Uttar Pradesh state government has announced a SAP (State Advised Price) of INR140/quintal for the September 2008–9 cane crushing season.

Though these prices provide a guideline on the minimum payment to farmers, actual payment depends on cane availability. For example, in the state of Uttar Pradesh, though SMP was declared at INR140/quintal, the farmers were paid ~INR155/quintal during the latter half of the crush season due to lower crop availability.

FINANCIAL IMPLICATIONS OF ENVIRONMENTAL TRENDS ON AGRICULTURAL INPUTS

Table 27 shows the predicted impact of featured environmental trends on BCML's ability to reliably source sugarcane at a reasonable price.

TABLE 27. Impacts of Environmental Trends on BCML's Sugarcane Sourcing

Environmental Trend	Physical Impact	Impact on BCML
Climate change	• Decreased yield of sugarcane	• Higher raw material price • Supply disruptions • Difficulty in meeting consumer demand and maintaining profitability
Water Scarcity	• Decreased or intermittent access to water	

Source: WRI

Passing costs to consumers

Increases in raw material costs are not necessarily passed on to the consumer. Rather, prices are largely driven by national and international demand-supply scenario for sugar.

The Indian government's intervention mechanisms ensure a minimum price paid to farmers. However, there is no corresponding policy to ensure that sugar producers receive a minimum price for the commodity, thereby creating a risk for the producers who may not be able to pass increases in feedstock costs to end consumers.

2. Operating Efficiency

Water Consumption

Water is a key input in sugar production making access to secure water resources a critical priority for BCML. On average the company's operations use 2.5KL of water to crush one tonne of sugar. Table 28 gives the daily requirement to run the company's sugar, distillery and co-generation business units.

TABLE 28. Water Required Per Day by Balrampur Chini

Balrampur Chini	Capacity	Water required (in KL)
Sugar	76,000 TCD	190,000
Distillery	320 KLPD	41,600
Cogeneration	181 MW	724
TOTAL WATER REQUIRED PER DAY		232,324

Source: Company, HSBC

- The process of cogeneration uses steam to run the turbines. Lower availability of water may lead to lower utilization of power plant, impacting revenue and profitability.
- For the distillery as well as co-generation operations, the company needs to filter water. BCML has incurred a capital expenditure of ~INR0.8m for setting up de-mineralised and de-alkalised plants for filtering water.
- BCML has also set up a facility to carry out reverse osmosis for water purification at a capital expenditure of ~INR10m for a co-generation capacity of 20 MW (requirement of about 80KL).

Water Availability

- Currently, the cost incurred to provide sufficient quantity of water is less than 1% of total manufacturing expenses. However, this may change in the face of water scarcity.
- Currently there is no restriction on amounts consumed from the water table Some areas of Maharashtra and Uttar Pradesh are water scarce, while others are relatively water abundant. If local climate conditions change, especially affecting precipitation patterns, so could the water table equations in the states.
- Tube wells owned by the company provide its water; the use of ground water links the supply to local precipitation levels, and to consumption by other users of water in the region. Changes in either of these factors could impact the supply of clean, usable water for BCML.

FINANCIAL IMPLICATIONS OF ENVIRONMENTAL TRENDS ON OPERATING EFFICIENCY

Any interruption in water access would clearly have bottom line impacts, although these have not materialized to date. Table 29 shows the extensive predicted impact of environmental trends on BCML's ability to maintain operations and control costs.

TABLE 29. Impacts of Environmental Trends on BCML's Operating Efficiency

Environmental Trend	Physical Impact	Impact on BCML
Water Scarcity	• Decreased or intermittent access to water	• Operational disruptions • Reduced operating efficiency • Additional cost to transport water to the plant • Difficulty in meeting consumer demand and maintaining profitability

Source: WRI

3. Reputation

The company may be exposed to political and community concerns regarding resource use. The main concerns might revolve around the possibility of limited return of water to the water table, and the discharge of effluents during the manufacturing process. From the information available to us, we understand that the company recycles water prior to effluent discharge and adheres to the state norms on emissions and effluent discharge. However, water scarcity and pollution concerns still pose a strategic risk.

BALRAMPUR CHINI SCENARIO ANALYSIS

Below we present two different scenarios analysing the impact of commodity availability. The scenario is hypothetical, although realistic. They serve to demonstrate how environmental trends can become material risks for investors and companies.

Scenario 1

Risk: Increase in Agricultural Input Prices

- Cane is a perishable agricultural product. Thus, no inventory is carried over as it cannot be stored. Annual sugar production depends entirely on the availability of cane during that year. For example, in 2008-09 sugar production fell by 45% year-over-year due to unavailability of cane.
- The price of sugarcane is determined by the demand supply scenario in a particular year with government intervention through a pricing mechanism ensuring minimum support price. It is also dependent on the recovery of sugar from cane which in turn depends on growing season weather conditions (likely to shift as a result of climate change) and on the variety of cane.

Tables 30, 31 and 32 show the financial implications of an agricultural input price increase and the effect of a change in the cane recovery factor on the per unit raw material cost. We have done the sensitivity analysis to capture the impact of raw material price rise for FY08 and FY09.

TABLE 30. Financial Implications of an Increase/Decrease in Agricultural Input Price (FY08, 09)

Heads	FY08 reported	FY08 adjusted*	FY09 reported	FY09 adjusted*
Sales	14,909	14,909	17,471	17,471
Raw material	10,483	10,587	7,822	7,900
EBITDA	3,141	3,036	4,472	4,393
PAT	783	704	2,095	2,024
Change		-10%		-3%

Source: HSBC

Note: *Adjusted figures show a 1% increase in raw material prices. Sugarcane makes up a majority of the raw material.

TABLE 31. Sensitivity Analysis of Raw Material Price and Profits (FY08, 09)

Year	Sugar cycle	Price change of raw material	Profitability change
FY08	Down cycle (high sugar production and low sugar prices)	+/- 1%	-/+10%
FY09	Up cycle (low sugar production and high sugar prices)	+/-1%	-/+3%

Source: HSBC

TABLE 32. Financial Implications of an Increase/Decrease in Cane Recovery Factor (FY08): Sensitivity Analysis

RECOVERY OF CANE

Cane recovery factor	Raw material cost
+/– 1%	–/+ 11%

Source: HSBC

In FY08 the sugar production of the country was ~26m tonnes. The company had an opening inventory of ~240m kgs valued at ~INR14.4/kg. The average sugar sale price for the year was INR15.1/kg while the cost of production was ~INR14.9/kg. During this year, which was a part of the sugar down cycle, the sensitivity of 1% higher raw material price on the net profits was 10%. (See calculation below in Table 31).

During FY09, the production for the country declined by ~45% year-over-year to 14.7m tonnes. The company had an opening inventory of ~316m kgs valued at INR14.9kg. The average sale price was INR22/kg while the cost of production was INR21.2/kg. However during this year, which was a part of the sugar upcycle, the sensitivity of 1% higher raw material cost on the net profits was 3%, due to benefit from sale of low cost inventory.

The average recovery factor for cane is ~10% in India. (Recovery is the % of sugar extracted from cane). A 1% (100bp) lower recovery from this average would increase or decrease the raw material cost by 11%.

Scenario 2

Opportunity: Agricultural Input Prices and Alternative Suppliers

In general, there are two options a company can pursue to reduce the impact of future raw material price rises:

- Search for an alternative supplier by building relationships;
- Vertical (or backward) integration.

Due to regulatory restrictions, Indian sugar companies follow a *command area* concept; farmers may choose their customers, but sugar manufacturing companies may not choose their suppliers.

Vertical Integration

Unlike Brazilian sugar companies which have backward integrated their manufacturing process by purchasing cane farms, Indian sugar companies have not followed this practice. This poses a high risk for BCML's operations as its raw material sourcing is not fixed.

We conclude that positive impacts of vertical integration on the company would be two-fold:

- Raw material sourcing: Ideal raw material sourcing at the statutory minimum price (set by the government).
- Optimum irrigation: The ability to install better (i.e. drip) irrigation facilities in the source farms, thus ensuring better control of water supply to crops and a good crop yield with high recovery.

While vertical integration may be beneficial, however, procuring land and farmers may be difficult due to the small, fragmented nature of fields and to political obstacles. Vertical integration could also pose risks if sourcing is not diversified geographically, since negative yield impacts would not be absorbed by third party suppliers.

Likely scenario over short term: We believe that cane availability over the short term i.e. FY10 (September 2009–October 2010) would remain constrained, as in the previous year. Lower availability of raw material is therefore a likely scenario for the very near future And hence we believe that cane costs would be higher in FY10. However, actual feedstock prices may prove to be even higher than our estimates, if the supply constraints exceed our expectations or producers of competitive products are willing to pay higher prices to cane farmers, leading to pressure on the earnings.

CORPORATE SUSTAINABILITY OUTLOOK

Over the years BCML has diversified its business segmentation from sugar to distillery (ethanol, alcohol) to co-generation (for captive consumption and external sales). These latter two business segments are more profitable and less volatile vis-à-vis the sugar business, promoting the company's sustainability. We believe the following measures would help the

company further reduce some of the business risks it faces in relation to environmental trends:

- Establish sugar refining capacities: India is the second largest sugar producer in the world and has the advantage of being located in the vicinity of sugar importing countries. During periods of surplus domestic production, the company can cater to the needs of Asian sugar importing countries.
- BCML can expand operations using the leasing model (generally non-integrated sugar plants) thereby reducing its capital investments.
- The company can diversify operations outside the state of Uttar Pradesh, where it is currently based, into states like Maharashtra, where cane prices are better linked with sugar prices. This would also spread the risks faced by the company due to environmental factors.

VII: Next Steps

The potential financial impacts of climate change and water scarcity on the food and beverage sector are significant. Analysts and investors should examine how the companies they cover and invest in are positioned to manage risks and take advantage of opportunities arising from these two environmental trends.

Fully incorporating climate change and water scarcity concerns into the investment decision-making process remains a challenge.

Obstacles to understanding the full financial impact of climate change and water scarcity trends include:

- Lack of data: Obtaining reliable information on local climate change trends and projections, soil fertility levels and water table levels is difficult in many areas.
- Uncertain nature of issues: Climate change and water scarcity impacts are difficult to predict, even with good data. Especially challenging is the inability to predicting the timing of potential impacts, making it very difficult to incorporate them into a discounted cash flow (DCF) model or other longer-term analysis in order to determine the financial magnitude of impacts.
- Communicating with companies: Climate change and water scarcity issues are unlike many of the compliance-based environmental regulations that companies are used to dealing with. As a result, it may be difficult to engage companies to obtain relevant information. For example, obtaining data on local water availability requires mapping with geographical information systems (GIS) technology, which many companies are not actively using at present.

Investors and analysts can engage with companies to publicly disclose relevant environmental data.

Although companies around the globe are beginning to disclose information on environmental performance, some of it quite detailed and sophisticated, the information disclosed rarely reveals the risks companies are truly facing. In order to make an accurate assessment of a company's risk exposure to environmental issues, investors and analysts will have to engage companies to begin measuring and reporting with more depth and context on environmental risks than is currently common practice.

Although this report focused on two key environmental trends, the food and beverage sector in South and Southeast Asia also faces other environmental challenges.

Additional environmental issues with the potential for financial impacts on the F&B sector, of which investors need to be aware, include:

- Energy: The sector's agricultural practices, processing, packaging and distribution (especially to overseas markets) are fossil fuel-intensive. Companies' dependence on fossil fuel derived energy sources is problematic as governments scale back energy subsidies

amid volatility in global prices (as evidenced in India, Indonesia and Malaysia). The sector's dependence on fossil fuels, coupled with the common practice of turning forests into agricultural land, make it a significant emitter of GHGs. In a carbon constrained global economy, the industry will be forced to redesign its processes and practices. A shift towards cleaner sources of energy, especially on-site, could help mitigate these risks.

- Land and water management: Cultivation techniques in both agriculture and aquaculture have made plant and animal yields vulnerable. In agriculture, the over-reliance on fertilizer and pesticides contaminates local water supplies and degrades soil. In addition, mono cropping - growing the same one variety of crop every year on the same land - makes the crop more susceptible to disease. In aquaculture, the overuse of antibiotics pollutes the water while over harvesting decreases the fish stock. If agricultural and aquaculture yields are to increase to feed the growing world population, the food system is unlikely to be able to meet that demand with current practices.
- Waste and pollution: Waste (especially from packaging), and pollution (of air, water and land) from the food and beverage sector is significant. Land and water pollution in particular threatens the yields of suppliers as they degrade the local soil and water quality on which yields are dependent.

Corporate responses to environmental issues serve as a good proxy for overall management quality.

Leading companies will find ways to build corporate and supply chain resilience to potential risks. Climate change and water scarcity have the potential to impact the F&B sector's core value drivers. Companies with good leadership should develop and implement risk mitigation and hedging strategies that protect core value drivers from long-term threats. Such actions might include strategic and operational changes to protect against physical impacts like flooding; policy responses such as water rationing; and consumer responses such as favoring responsibly produced goods. Companies that understand the risks they are facing, and are actively building their resilience to the impacts, are better long-term investments.

Appendix 1: Report Focus and Methodology

WHY FOOD AND BEVERAGE WAS CHOSEN AS THE FOCUS OF THIS REPORT

The food and beverage sector was chosen as the focus of this report in order to capture the importance of food-based agriculture in the target economies. Relative to other consumer facing industries, the food and beverage industry represents a significant portion of consumer expenditures in the region. In 2005, food and beverage as a proportion of total consumer spending ranged from 25% in Malaysia to almost 60% in Indonesia.[46] Finally, this sector was chosen as there is a large opportunity to integrate sustainable practices into the supply chain.

The authors chose to narrow the scope of analysis of the sector by excluding alcoholic beverages.

WRI METHODOLOGY

WRI conducted primary and secondary research, including interviews with experts, primarily in the financial and agricultural science fields, to provide the basis for the analysis. The methodology used in each of the sections is described below.

A Note on Materiality

WRI's assessment of the materiality of environmental impacts was guided by the definition of materiality used by the International Accounting Standards Board (IASB) as well as the US Financial Accounting Standards Board (FASB).

Financially materiality impacts are those that:

- Could have a sizable impact (a benchmark for sizable is 0.5% or more of revenues).
- Could result in a judgment error if omitted.

According to IASB/FASB, the concept of "material" is a threshold, not a specific characteristic which information must have to be useful. In this report, WRI identified impacts of environmental trends that the authors deemed to meet the threshold of materiality – the size of the impact on specific companies or subsectors can be examined by analysts. The questions, indicators and risk factors are tools WRI has provided to help analysts assess how the companies they invest in are positioned to manage the impacts.

Section IV: Impacts on Value Drivers

1. The authors identified the value (cost and revenue) drivers in the food and beverage industry by reviewing F&B equity research reports and engaging with HSBC F&B equity analysts.
2. Climate change and water scarcity were chosen by the authors due to data availability and WRI expertise. The impacts of these trends also met the threshold of materiality. Each F&B company will be uniquely susceptible based on a variety of factors, for example, location, type of ingredients, consumer base or adaptability.
3. To analyze how these trends were likely to impact the value drivers the authors drew upon:

    a. Primary and secondary research on the food, beverage and agricultural industries.

    b. Consultations with agricultural experts, regional equity analysts, and F&B industry participants.

    c. Interviews with food and beverage companies (conducted by HSBC).

    d. Information identified in the preceding June 2009 scoping report: *Emerging Risk: Impacts of Environmental Trends in Emerging Asia.*

Section V: Risk Assessment

The authors examined several factors when evaluating which subsectors would be affected by each risk:

- Cost structure of the subsector (if info available). For example, the percentage of costs represented by agricultural commodities in the form of feed or agricultural inputs.
- Availability of substitute ingredients. For example, producers of animal based products can substitute different ingredients for feed depending on their relative prices.
- Nature of product (high value added and branded or commodity-like) -i.e. ability to pass costs on.
- The bargaining power of F&B companies relative to suppliers.
- Location of costs in the value chain.
- Likely timing and magnitude of the impact.

The timing, likelihood and magnitude of the impact was determined based on the environmental and subsector research conducted for this report. The likelihood was assessed based on a five year time frame.

Questions and Indicators for Investors

Questions

The authors developed questions for investors based on the research and analysis provided in Sections III, IV and V. The objective of these questions is to highlight companies' potential environmental vulnerabilities.

Indicators

- The authors identified common sustainability indicators drawing on sources including:
  a. Global Reporting Initiative Food Processing Sector Guidelines.
  b. Leading food and beverage companies' sustainability reports.
  c. Leading retailers' supplier selection guidelines.
- The authors created additional indicators with the aim of providing tools for investors to quantify and compare environmental risk/performance across companies.

Section VI: Financial Application: HSBC Case Study

The demonstration of the financial relevance of the trends was conducted in collaboration with our partner, HSBC Climate Change Centre of Excellence and HSBC India's team of equity analysts.

1. WRI and HSBC identified a company to analyze based on:
   a. HSBC's equity coverage.
   b. The company reports revenues from food processing as a separate line item (in order to be able to isolate environmental trends on food processing business activities).
   c. The company may be unable to pass cost increases to consumers in the long run.
2. HSBC used information provided by WRI on how environmental trends are likely to impact the sector as a basis to quantify financial impacts. This information included:
   a. WRI data and research on environmental impacts for the sector.
   b. Questions (developed by WRI) to ask companies.
   c. Scenarios that WRI developed in consultation with HSBC's equity research coverage team, as well as HSBC's interaction with the company.

Appendix 2. Listed F&B Companies by Region

INDIA. Listings on all Major Stock Exchanges

Food and Beverage Companies Listed Under "Packaged Food and Meats, and Soft Drinks" (GICS Classification)

Total Market Capitalization (INR)*: 786,784,098,818

Total Market Capitalization (USD): 17,069,200,000

	Ticker	Short Name	Market Cap (INR)	Revenue:T12M	F&B Focus
1	NEST IN Equity	NESTLE INDIA LTD	INR 242,288,607,232	INR 43,242,450,944	*Diversified*
2	TT IN Equity	TATA TEA LTD	INR 64,468,201,472	INR 48,478,744,576	*Tea and Coffee*
3	SKB IN Equity	GLAXOSMITHKLINE	INR 57,940,549,632	INR 15,427,785,728	*Diversified*
4	BJH IN Equity	BAJAJ HINDUSTHAN	INR 40,960,110,592	INR 20,259,500,032	*Sugar*
5	BRIT IN Equity	BRITANNIA INDS	INR 39,395,799,040	INR 34,212,280,320	*Starches*
6	BRCM IN Equity	BALRAMPUR CHINI	INR 36,086,931,456	INR 17,470,900,224	*Sugar*
7	MCLR IN Equity	MCLEOD RUSSEL LT	INR 33,608,460,288	INR 8,288,662,016	*Tea and Coffee*
8	TRE IN Equity	TRIVENI ENGINEER	INR 29,514,369,024	INR 19,128,698,880	*Sugar*
9	KLD IN Equity	KWALITY DAIRY	INR 27,072,499,712	INR 5,828,027,904	*Dairy*
10	KSO IN Equity	KS OILS LTD	INR 24,957,030,400	INR 31,470,901,248	*Edible oils*
11	RSI IN Equity	RUCHI SOYA INDUS	INR 19,650,060,288	INR 124,848,414,720	*Edible Oils*
12	REIA IN Equity	REI AGRO LTD	INR 17,336,340,480	INR 24,462,475,264	*Starches*
13	BNRI IN Equity	BANNARI AMMAN	INR 12,294,670,336	INR 6,948,262,400	*Sugar*
14	SAO IN Equity	SANWARIA AGRO	INR 10,902,670,336	INR 11,114,355,712	*Edible Oils*
15	ZYWL IN Equity	ZYDUS WELLNESS	INR 10,270,100,480	INR 1,947,408,000	*Dairy*
16	GRSL IN Equity	GOKUL REFOILS &	INR 8,012,620,800	INR 28,064,223,232	*Edible Oils*
17	TCO IN Equity	TATA COFFEE LTD	INR 7,583,795,200	INR 11,130,582,016	*Tea and Coffee*
18	ASAM IN Equity	ASSAM CO INDIA	INR 7,412,848,128	INR 1,344,466,048	*Tea and Coffee*
19	DSM IN Equity	DHAMPUR SUGAR	INR 6,874,919,936	INR 9,337,140,224	*Sugar*
20	ATFL IN Equity	AGRO TECH FOODS	INR 6,840,377,856	INR 7,736,100,352	*Diversified*
21	KRB IN Equity	KRBL LTD	INR 5,361,790,976	INR 13,117,281,280	*Starches*
22	JTI IN Equity	JAYSHREE TEA	INR 4,366,373,888	INR 3,549,376,000	*Tea and Coffee*
23	BJHS IN Equity	BAJAJ HINDUSTHAN	INR 4,153,600,000	INR 3,603,000,064	*Sugar*
24	GDRK IN Equity	GOODRICKE GROUP	INR 3,983,040,000	INR 2,938,279,424	*Tea and Coffee*
25	HTSMF IN Equity	HATSUN AGRO PROD	INR 3,496,240,896	INR 10,130,500,608	*Dairy*
26	KCPS IN Equity	KCP SUGAR & INDU	INR 3,486,588,928	INR 2,097,978,240	*Sugar*
27	DCMSI IN Equity	DCM SHRIRAM INDS	INR 2,942,001,920	INR 7,986,185,216	*Sugar*
28	CCLP IN Equity	CCL PRODUCTS IND	INR 2,862,806,016	INR 4,682,477,568	*Tea and Coffee*
29	UGSW IN Equity	UGAR SUGAR WORKS	INR 2,857,499,904	INR 4,097,981,952	*Sugar*
30	GMR IN Equity	GMR INDUSTRIES L	INR 2,812,604,928	INR 1,268,433,024	*Sugar*
31	RJOIL IN Equity	RAJ OIL MILLS	INR 2,691,756,032	INR 1,224,886,016	*Edible oils*
32	MEM IN Equity	MOUNT EVEREST MI	INR 2,446,011,904	INR 219,942,896	*Beverages*
33	RSSC IN Equity	RAJSHREE SUGARS	INR 2,387,197,952	INR 4,326,402,048	*Sugar*
34	HTFI IN Equity	HERITAGE FOODS	INR 2,367,685,888	INR 7,925,553,664	*Dairy*
35	RANA IN Equity	RANA SUGARS LTD	INR 2,217,810,944	INR 2,568,385,024	*Sugar*
36	ANIK IN Equity	ANIK IND LTD	INR 2,200,813,056	INR 10,104,351,744	*Dairy*

INDIA. Listings on all Major Stock Exchanges *(cont.)*

Food and Beverage Companies Listed Under "Packaged Food and Meats, and Soft Drinks" (GICS Classification)

37	DHNT IN Equity	DHUNSERI TEA	INR 2,166,514,944	INR 12,170,723,328	*Tea and Coffee*
38	UTSM IN Equity	UTTAM SUGAR MILL	INR 2,109,192,960	INR 2,830,500,096	*Sugar*
39	RDSD IN Equity	RIDDHI SIDDHI GL	INR 2,093,984,000	INR 2,298,632,192	*Sugar*
40	KFL IN Equity	KOHINOOR FOODS	INR 1,709,918,976	INR 7,458,100,224	*Diversified*
41	LTFO IN Equity	LT FOODS LTD	INR 1,535,516,032	INR 10,831,323,136	*Starches*
42	JYPS IN Equity	JEYPORE SUGAR CO	INR 1,518,770,944	INR 1,732,959,488	*Sugar*
43	MF IN Equity	MILKFOOD LTD	INR 1,441,959,936	INR 2,336,379,904	*Dairy*
44	MWNS IN Equity	MAWANA SUGAR	INR 1,342,155,008	INR 7,194,399,744	*Sugar*
45	UGSI IN Equity	UPPER GANGES SUG	INR 1,305,362,944	INR 4,350,181,376	*Sugar*
46	MRD IN Equity	MODERN DAIRIES	INR 1,288,422,016	INR 4,570,758,656	*Dairy*
47	PSER IN Equity	PONNI SUGARS ERO	INR 1,271,213,952	INR 1,374,865,920	*Sugar*
48	HIMIN IN Equity	HIMALYA INTL	INR 1,250,162,048	INR 587,065,984	*Produce*
49	ADFL IN Equity	ADF FOODS LTD	INR 1,222,024,960	INR 958,644,992	*Diversified*
50	UAL IN Equity	USHER AGRO LTD	INR 1,107,750,016	INR 2,089,502,720	*Starches*
51	EMPE IN Equity	EMPEE SUGARS	INR 1,043,027,008	INR 464,358,016	*Sugar*
52	TFD IN Equity	TEMPTATION FOODS	INR 949,110,528	INR 8,700,741,632	*Produce*
53	SBECS IN Equity	SBEC SUGAR LTD	INR 924,742,400	INR 2,043,594,880	*Sugar*
54	SSLE IN Equity	SIR SHADI LAL EN	INR 898,012,480	INR 3,033,766,400	*Sugar*
55	JVLA IN Equity	JVL AGRO INDUSTR	INR 891,000,000	INR 13,821,200,384	*Edible Oils*
56	BAPL IN Equity	B&A LTD	INR 807,512,192	INR 759,856,000	*Tea and Coffee*
57	RSF IN Equity	RAVALGAON SUGAR	INR 654,024,000	INR 918,903,040	*Sugar*
58	VDI IN Equity	VADILAL INDS LTD	INR 608,823,616	INR 1,345,395,968	*Diversified*
59	LOTS IN Equity	LOTUS CHOCOLATE	INR 579,129,088	INR 230,364,288	*Confectionary*
60	RSOI IN Equity	RASOI LTD	INR 547,818,624	INR 1,339,116,288	*Edible oils*
61	ADF IN Equity	AGRO DUTCH INDUS	INR 505,153,312	INR 1,384,119,936	*Produce*
62	PCAI IN Equity	PICCADILY AGRO	INR 461,086,688	INR 1,394,922,752	*Sugar*
63	AMRB IN Equity	AMRIT BANASPATI	INR 421,127,712		*Edible oils*
64	EMSI IN Equity	EMMSONS INTL LTD	INR 409,524,992	INR 7,092,722,688	*Starches*
65	FI IN Equity	FOODS & INNS LTD	INR 360,811,808	INR 1,647,851,136	*Produce*
66	ASTX IN Equity	ASIAN TEA & EXPO	INR 312,375,008	INR 1,003,114,368	*Tea and Coffee*
67	SSFP IN Equity	SITA SHREE FOOD	INR 207,147,808	INR 1,034,248,640	*Starches*
68	BCLI IN Equity	BCL INDUSTRIES	INR 159,900,000	INR 4,727,057,920	*Edible oils*
69	WB IN Equity	WATERBASE LTD	INR 138,271,504	INR 335,230,048	*Aquaculture*
70	DVJE IN Equity	DIVYA JYOTI INDU	INR 102,897,000	INR 2,789,538,048	*Diversified*
71	SRVS IN Equity	SHREE VANI SUGAR	INR 95,409,752		*Sugar*
72	SMRF IN Equity	SIMRAN FARMS LTD	INR 74,323,200	INR 713,066,112	*Poultry*
73	ATHL IN Equity	ATCO CORP LTD	INR 71,184,912	INR 169,909,840	*Beverages*
74	UVS IN Equity	UNIVERSAL STARCH	INR 62,243,040	INR 740,434,880	*Starches*
75	IX IN Equity	INDIAN EXTRACTIO	INR 31,707,490	INR 698,361,088	*Edible oils*

Source: Bloomberg, Accessed January 7, 2010
* Does not include market capitalization of some F&B companies

INDONESIA. Listings on all Major Stock Exchanges

Food and Beverage Companies Listed Under "Packaged Food and Meats, and Soft Drinks" (GICS Classification)

Total Market Capitalization (IDR)*: 59,381,568,618,496

Total Market Capitalization (USD): 6,389,460,000

	Ticker	Short Name	Market Cap (IDR)	Revenue:T12M	F&B Focus
1	INDF IJ Equity	INDOFOOD SUKSES	IDR 32,926,599,217,152	IDR 37,101,959,643,136	*Starches*
2	SMAR IJ Equity	SMART TBK	IDR 8,329,360,834,560	IDR 14,091,409,686,528	*Palm Oil*
3	BISI IJ Equity	BISI INTERNATION	IDR 4,589,999,882,240	IDR 1,063,284,015,104	*Produce*
4	MYOR IJ Equity	MAYORA INDAH	IDR 3,296,311,115,776	IDR 4,594,409,013,248	*Confectionary*
5	JPFA IJ Equity	JAPFA COMFEED	IDR 2,858,990,960,640	IDR 13,107,362,267,136	*Diversified*
6	ULTJ IJ Equity	ULTRAJAYA MILK	IDR 1,675,262,033,920	IDR 1,526,434,168,832	*Dairy*
7	GZCO IJ Equity	GOZCO PLANTATION	IDR 1,199,999,942,656	IDR 350,352,945,152	*Palm Oil*
8	BUDI IJ Equity	BUDI ACID JAYA	IDR 826,489,700,352	IDR 1,613,273,989,120	*Starches*
9	DAVO IJ Equity	DAVOMAS ABADI	IDR 620,185,583,616	IDR 945,054,879,744	*Confectionary*
10	AISA IJ Equity	TIGA PILAR FOOD	IDR 585,199,976,448	IDR 499,474,440,192	*Starches*
11	SIPD IJ Equity	SIERAD PRODUCE	IDR 478,946,492,416	IDR 2,958,561,771,520	*Meat or Poultry*
12	CEKA IJ Equity	CAHAYA KALBAR	IDR 440,300,011,520	IDR 1,385,031,860,224	*Diversified*
13	ADES IJ Equity	AKASHA WIRA INTL	IDR 371,634,995,200	IDR 126,829,000,704	*Beverages*
14	MBAI IJ Equity	MULTIBREEDER AD	IDR 359,999,995,904	IDR 1,492,285,358,080	*Meat or Poultry*
15	STTP IJ Equity	SIANTAR TOP	IDR 327,500,005,376	IDR 614,417,661,952	*Starches*
16	MAIN IJ Equity	MALINDO FEEDMILL	IDR 298,320,003,072	IDR 1,889,333,837,824	*Meat or Poultry*
17	SKLT IJ Equity	SEKAR LAUT TBK	IDR 103,611,097,088	IDR 271,040,950,272	*Diversified*
18	DSFI IJ Equity	DHARMA SAMUDERA	IDR 92,856,770,560	IDR 191,621,502,976	*Seafood*
19	CPDW IJ Equity	CIPENDAWA TBK		IDR 47,365,664,768	*Meat or Poultry*

Source: Bloomberg, Accessed January 7, 2010

* Does not include market capitalization of some companies due to unavailable data

MALAYSIA. Listings on all Major Stock Exchanges

Food and Beverage Companies Listed Under "Packaged Food and Meats, and Soft Drinks" (GICS Classification)

Total Market Capitalization (MYR)*: 18,509,723,612

Total Market Capitalization (USD): 5,457,090,000

	Ticker	Short Name	Market Cap (MYR)	Revenue:T12M	F&B Focus
1	NESZ MK Equity	NESTLE (MALAY)	MYR 8,090,250,240	MYR 3,766,249,088	*Diversified*
2	FNH MK Equity	FRASER & NEAVE	MYR 3,871,514,880	MYR 3,660,996,032	*Diversified*
3	DLM MK Equity	DUTCH LADY MILK	MYR 761,600,000	MYR 687,666,992	*Dairy*
4	THP MK Equity	TH PLANTATIONS	MYR 746,311,168	MYR 258,976,000	*Palm Oil*
5	KIML MK Equity	KIM LOONG RESOUR	MYR 684,145,408	MYR 427,721,000	*Palm Oil*
6	TARE MK Equity	THREE-A RESOURCE	MYR 628,320,128	MYR 155,562,000	*Starches*
7	MAMEE MK Equity	MAMEE DOUBLE DEC	MYR 322,213,600	MYR 403,721,000	*Diversified*
8	SBG MK Equity	SILVER BIRD GROU	MYR 250,352,496	MYR 588,891,008	*Confectionary*
9	CIH MK Equity	CI HOLDINGS BHD	MYR 245,660,000	MYR 396,268,000	*Beverages*
10	APOF MK Equity	APOLLO FOOD HLDG	MYR 223,200,000	MYR 153,639,000	*Confectionary*
11	YHSM MK Equity	YEO HIAP(MAL)BHD	MYR 218,037,104	MYR 547,160,000	*Beverages*
12	AJI MK Equity	AJINOMOTO MALA	MYR 202,459,104	MYR 262,625,000	*Other*
13	BORN MK Equity	BORNEO AQUA HARV	MYR 196,350,000	MYR 21,290,156	*Seafood*
14	HSI MK Equity	HUP SENG INDS	MYR 172,800,000	MYR 206,386,000	*Confectionary*
15	NBIO MK Equity	NATURAL BIO RES	MYR 171,000,000	MYR 146,225,000	*Beverages*
16	COLA MK Equity	COCOALAND HOLDIN	MYR 165,600,000	MYR 131,511,000	*Diversified*
17	KFB MK Equity	KAWAN FOOD BHD	MYR 160,800,000	MYR 86,765,234	*Other*
18	GUAN MK Equity	GUAN CHONG BHD	MYR 144,000,000	MYR 575,150,008	*Confectionary*
19	CCK MK Equity	CCK CONSOLIDATED	MYR 109,587,400	MYR 331,518,000	*Meat or Poultry*
20	PMC MK Equity	PAN MALAYSIA	MYR 108,270,000	MYR 77,089,000	*Confectionary*
21	SPZ MK Equity	SPRITZER BHD	MYR 92,767,648	MYR 111,071,000	*Beverages*
22	TSCB MK Equity	TEO SENG CAPITAL	MYR 91,000,000	MYR 172,924,000	*Diversified*
23	OFIH MK Equity	ORIENTAL FOOD IN	MYR 90,000,000	MYR 115,055,000	*Confectionary*
24	LBB MK Equity	LONDON BISCUITS	MYR 85,159,800	MYR 194,546,000	*Diversified*
25	EMIV MK Equity	EMIVEST BHD	MYR 73,800,000	MYR 648,121,008	*Other*
26	LTKM MK Equity	LTKM BHD	MYR 55,116,880	MYR 138,011,002	*Meat or Poultry*
27	KBB MK Equity	KBB RESOURCES BH	MYR 54,000,000	MYR 191,086,000	*Starches*
28	CABC MK Equity	CAB CAKARAN CORP	MYR 42,169,312	MYR 494,417,000	*Meat or Poultry*
29	SHL MK Equity	SIN HENG CHAN	MYR 40,758,380	MYR 60,282,999	*Meat or Poultry*
30	LAY MK Equity	LAY HONG BHD	MYR 39,304,000	MYR 366,037,000	*Meat or Poultry*
31	BIOO MK Equity	BIO OSMO BHD	MYR 37,000,000	MYR 20,051,000	*Beverages*
32	REX MK Equity	REX INDUS BHD	MYR 36,994,072	MYR 167,876,000	*Meat or Poultry*
33	SICB MK Equity	SINARIA CORP BHD	MYR 36,000,000	MYR 127,761,000	*Diversified*
39	TPC MK Equity	TPC PLUS BHD	MYR 22,400,000	MYR 56,275,000	*Meat or Poultry*
40	HWA MK Equity	HWA TAI INDUS	MYR 20,822,050	MYR 70,651,000	*Confectionary*
41	MPG MK Equity	MASTER-PACK GROU	MYR 20,021,900	MYR 50,327,000	*Diversified*
42	SCP MK Equity	SCOPE INDUS BHD	MYR 17,431,820	MYR 28,846,000	*Diversified*
43	KFM MK Equity	KUANTAN FLOUR	MYR 17,120,140	MYR 107,577,000	*Starches*
44	TGN MK Equity	TECK GUAN PERDAN	MYR 12,029,070	MYR 54,264,000	*Confectionary*

Source: Bloomberg, Accessed January 7, 2010. * Does not include market capitalization of some companies due to unavailable data

PHILIPPINES. Listings on all Major Stock Exchanges

Food and Beverage Companies Listed Under "Packaged Food and Meats, and Soft Drinks" (GICS Classification)

Total Market Capitalization (PHP)*: 54,114,280,352

Total Market Capitalization (USD): 1,175,040,000

	Ticker	Short Name	Market Cap (PHP)	Revenue:T12M	F&B Focus
1	URC PM Equity	UNIVERSAL ROBINA	PHP 35,725,590,528	PHP 50,453,000,192	Diversified
2	PIP PM Equity	PEPSI-COLA PROD	PHP 8,865,053,696	PHP 14,522,857,216	Beverages
3	AMC PM Equity	ALASKA MILK CORP	PHP 6,195,364,864	PHP 9,967,757,312	Dairy
4	RFM PM Equity	RFM CORP	PHP 1,801,430,016	PHP 7,550,913,024	Diversified
5	TUNA PM Equity	ALLIANCE TUNA IN	PHP 1,221,938,944	PHP 51,637,100	Seafood
6	VITA PM Equity	VITARICH CORP	PHP 168,087,600	PHP 2,757,507,328	Other
7	SFI PM Equity	SWIFT FOODS INC	PHP 136,814,704	PHP 2,351,773,952	Meat or Poultry
8	CBC PM Equity	COSMOS BOTTLING		PHP 7,887,640,064	Beverages
9	LFM PM Equity	LIBERTY FLOUR MI		PHP 2,069,385,472	Starches
10	PF PM Equity	SAN MIGUEL PUR-A		PHP 71,075,921,920	Diversified

Source: Bloomberg, Accessed January 7, 2010

* Does not include market capitalization of some companies including San Miguel Pure Foods due to unavailable data

THAILAND. Listings on all Major Stock Exchanges

Food and Beverage Companies Listed Under "Packaged Food and Meats, and Soft Drinks" (GICS Classification)

Total Market Capitalization (THB)*: 232,017,735,136

Total Market Capitalization (USD): 6,987,830,000

	Ticker	Short Name	Market Cap (THB)	Revenue:T12M	F&B Focus
1	CPF TB Equity	CHAROEN POK FOOD	THB 84,975,296,512	THB 159,467,364,352	Meat or Poultry
2	TUF TB Equity	THAI UNION FROZE	THB 29,807,020,032	THB 70,202,287,104	Seafood
3	KSL TB Equity	KHON KAEN SUGAR	THB 23,559,999,488	THB 11,688,514,304	Sugar
4	TVO TB Equity	THAI VEGETABLE	THB 12,534,200,320	THB 20,961,516,544	Non-Palm Edible Oils
5	TF TB Equity	THAI PRESIDENT	THB 12,419,999,744	THB 8,312,574,976	Starches
6	SPI TB Equity	SAHA PATHANA INT	THB 8,497,391,104	THB 1,780,211,904	Diversified
7	PB TB Equity	PRESIDENT BAKERY	THB 8,415,000,064	THB 3,857,571,264	Starches
8	UVAN TB Equity	UNIVANICH PALM O	THB 7,567,000,064	THB 3,991,854,592	Palm Oil
9	SAUCE TB Equity	THAI THEPAROS FO	THB 5,292,000,256	THB 2,320,215,200	Other
10	GFPT TB Equity	GFPT PCL	THB 4,639,137,792	THB 11,449,176,320	Meat or Poultry
11	SSC TB Equity	SERM SUK PUB CO	THB 4,493,718,016	THB 19,289,911,808	Beverages
12	EE TB Equity	ETERNAL ENERGY P	THB 4,392,399,872	THB 897,429,304	Seafood
13	LST TB Equity	LAM SOON THAI	THB 3,001,200,128	THB 7,090,289,024	Palm Oil
14	PR TB Equity	PRESIDENT RICE	THB 2,472,000,000	THB 1,120,442,544	Starches
15	TIPCO TB Equity	TIPCO FOODS PCL	THB 2,239,169,024	THB 4,458,305,600	Beverages
16	UPOIC TB Equity	UNITED PALM OIL	THB 2,106,324,992	THB 859,908,448	Palm Oil
17	SSF TB Equity	SURAPON FOODS	THB 1,930,493,056	THB 5,683,211,904	Seafood
18	CM TB Equity	CHIANGMAI FROZ F	THB 1,707,533,056	THB 1,390,221,792	Produce
19	CFRESH TB Equity	SEAFRESH IND PCL	THB 1,630,104,960	THB 2,085,249,152	Seafood
20	SFP TB Equity	SIAM FOOD PROD	THB 1,512,000,000	THB 2,479,887,552	Produce
21	KASET TB Equity	THAI HA PCL	THB 1,366,200,064	THB 1,650,640,544	Starches
22	ASIAN TB Equity	ASIAN SEAFOODS	THB 1,251,899,008	THB 9,623,051,136	Seafood
23	TWFP TB Equity	THAI WAH FOOD	THB 1,197,762,944	THB 1,054,793,216	Starches
24	CPI TB Equity	CHUMPORN PALM	THB 1,160,396,032	THB 4,087,564,928	Palm Oil
25	PPC TB Equity	PAKFOOD PCL	THB 1,035,000,000	THB 8,466,417,920	Seafood
26	CHOTI TB Equity	KIANG HUAT SEAGU	THB 1,020,000,000	THB 3,530,245,888	Seafood
27	TC TB Equity	TROPICAL CANNING	THB 924,000,000	THB 4,050,720,896	Seafood
28	HTC TB Equity	HAAD THIP PCL	THB 371,873,600	THB 2,807,662,336	Beverages
29	FND TB Equity	FOOD & DRINKS	THB 345,000,000	THB 595,148,672	Diversified
30	SORKON TB Equity	S KHONKAEN FOOD	THB 153,615,008	THB 1,173,624,992	Other
31	USC TB Equity	UNIVERSAL STARCH		THB 2,154,517,312	Starches
32	TRS TB Equity	TRANG SEAFOOD		THB 325,724,672	Seafood
33	UFM TB Equity	UNITED FLOUR MIL		THB 3,394,774,592	Starches

Source: Bloomberg, Accessed January 7, 2010 and Google Finance

* Does not include market capitalization of some companies due to unavailable data

VIETNAM. Listings on all Major Stock Exchanges

Food and Beverage Companies Listed Under "Packaged Food and Meats, and Soft Drinks" (GICS Classification)

Total Market Capitalization (VND)*: 71,504,862,117,888

Total Market Capitalization (USD): 3,822,580,000

	Ticker	Short Name	Market Cap (VND)	Revenue:T12M	F&B Focus
1	VNM VN Equity	VIET NAM DAIRY P	VND 28,099,999,694,848	VND 9,993,594,339,328	Dairy
2	MSN VN Equity	MASAN GROUP CORP	VND 18,103,190,683,648	VND 0	Diversified
3	KDC VN Equity	KINHDO CORP	VND 5,692,197,961,728	VND 1,464,417,091,584	Confectionary
4	HVG VN Equity	HUNG VUONG CORP	VND 3,509,999,894,528	VND 2,984,865,431,552	Seafood
5	MPC VN Equity	MINH PHU SEAFOOD	VND 2,568,999,927,808	VND 2,960,119,660,544	Seafood
6	SBT VN Equity	SOCIETE DE BOURB	VND 1,822,154,948,608	VND 655,456,624,640	Sugar
7	VHC VN Equity	VINH HOAN CORP	VND 1,619,999,981,568	VND 2,690,636,120,064	Seafood
8	LSS VN Equity	LAM SON SUGAR JS	VND 1,392,846,962,688	VND 1,021,059,547,136	Sugar
9	ANV VN Equity	NAM VIET CORP	VND 1,305,545,015,296	VND 2,250,483,499,008	Seafood
10	NKD VN Equity	NORTH KINHDO FOO	VND 689,001,725,952	VND 726,735,765,504	Confectionary
11	ABT VN Equity	BENTRE AQUA PROD	VND 652,049,907,712	VND 469,347,573,760	Seafood
12	BHS VN Equity	BIEN HOA SUGAR	VND 648,606,711,808	VND 1,076,448,116,736	Sugar
13	TAC VN Equity	TUONG AN VEGETAB	VND 559,915,925,504	VND 2,491,994,079,232	Non-Palm Edible Oils
14	BBC VN Equity	BIBICA	VND 524,157,714,432	VND 567,067,648,000	Confectionary
15	AGF VN Equity	AGIFISH	VND 466,792,185,856	VND 1,426,149,310,464	Seafood
16	AAM VN Equity	MEKONG FISHERIES	VND 404,833,206,272	VND 398,517,108,736	Seafood
17	TS4 VN Equity	SEAPRIEXCO NO.4	VND 392,153,006,080	VND 257,948,694,528	Seafood
18	ATA VN Equity	NTACO CO	VND 304,000,008,192		Seafood
19	IFS VN Equity	INTERFOOD SHAREH	VND 291,409,788,928	VND 1,435,710,455,808	Diversified
20	ACL VN Equity	CUULONG FISH JSC	VND 273,600,004,096	VND 598,720,061,440	Seafood
21	TRI VN Equity	TRIBECO	VND 267,219,107,840	VND 572,995,944,448	Beverages
22	SCD VN Equity	CHUONG DUONG BEV	VND 219,570,896,896	VND 273,034,752,000	Beverages
23	ICF VN Equity	INVESTMENT COMME	VND 208,754,098,176	VND 519,459,864,576	Seafood
24	HNM VN Equity	HANOIMILK JSC	VND 182,499,999,744	VND 245,580,480,512	Dairy
25	BAS VN Equity	BASACO	VND 170,880,008,192	VND 233,921,347,584	Seafood
26	LAF VN Equity	LAFOOCO	VND 159,932,203,008	VND 536,903,581,696	Seafood
27	FMC VN Equity	SAO TA FOODS JSC	VND 138,240,000,000	VND 983,545,880,576	Seafood
28	SGC VN Equity	SAGIANG IMPORT E	VND 134,018,998,272	VND 106,744,334,336	Diversified
29	HHC VN Equity	HAI HA CONFECTIO	VND 130,304,999,424	VND 445,845,397,504	Confectionary
30	CAD VN Equity	CADOVIMEX SEAFOO	VND 127,200,002,048	VND 992,293,486,592	Seafood
31	AGC VN Equity	AN GIANG COFFEE	VND 124,500,000,768	VND 1,745,438,113,792	Tea and Coffee
32	SAF VN Equity	SAFOCO FOODSTUFF	VND 93,086,400,512	VND 301,559,267,328	Starches
33	SJ1 VN Equity	SEAFOOD JSC	VND 80,201,949,184	VND 168,477,263,872	Seafood
34	CAN VN Equity	HALONG CANNED	VND 74,998,202,368	VND 389,858,336,768	Diversified
35	BLF VN Equity	BAC LIEU FISHERI	VND 71,999,995,904	VND 276,915,585,024	Seafood

Source: Bloomberg, Accessed January 7, 2010

* Does not include market capitalization of some companies due to unavailable data

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Philippine Stock Exchange
Stock Exchange of Thailand
Food and Agriculture Organization of the United Nations
United Nations Population Division
World Bank

INTERVIEWS

Dr. Jason Clay, Senior Vice President Market Transformation, World Wildlife Fund, USA.

Maaike Fleur, Sector Supplement Manager, Global Reporting Initiative, Netherlands.

Ralf Frank, Managing Director, Society of German Investment Professionals (DVFA), Germany.

Dr. Allan Goss, Assistant Finance Professor, Ryerson University, Canada.

Dr. Axel Hesse, Senior Consultant, SD-M Sustainable Development Management, Germany.

Maurice Landes, Senior Economist, Economic Research Service, United States Department of Agriculture (USDA), USA.

Tom Parris, Vice President, iSciences LLC, USA.

Kavita Prakash-Mani, former Vice President, Client Services, Sustainability, UK.

Simla Tokgoz, International Grain and Ethanol Analyst, Food and Agricultural Policy Research Institute (FAPRI), USA.

Ron Yachnin, Principal, Yachnin and Associates, Canada.

Notes

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10 G Street, NE
Suite 800
Washington, DC 20002
www.wri.org

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