RISK FACTORS

External risks

Our business is exposed to the cyclicality of global economic activity and requires significant investments of capital.

As a mining company, we are a supplier of industrial raw materials. Industrial production tends to be the most cyclical and volatile component of global economic activity, which affects demand for minerals and metals. At the same time, investment in mining requires a substantial amount of funds in order to replenish reserves, expand and maintain production capacity, build infrastructure, preserve the environment and minimize social impacts. Sensitivity to industrial production, together with the need for significant long-term capital investments, are important sources of risk for our financial performance and growth prospects.

Adverse economic developments in China could have a negative impact on our revenues, cash flow and profitability.

China has been the main driver of global demand for minerals and metals over the last few years. In 2016, Chinese demand represented 72% of global demand for seaborne iron ore, 52% of global demand for nickel and 48% of global demand for copper. The percentage of our net operating revenues attributable to sales to customers in China was 46.4% in 2016. Therefore, any contraction of China's economic growth could result in lower demand for our products, leading to lower revenues, cash flow and profitability. Poor performance in the Chinese real estate sector, the largest consumer of carbon steel in China, would also negatively impact our results.

Our business may be adversely affected by declines in demand for and prices of the products our customers produce.

Demand for our iron ore, coal and nickel products depends on global demand for steel. Iron ore and iron ore pellets, which together accounted for 71.5% of our 2016 net operating revenues, are used to produce carbon steel. Nickel, which accounted for 11.1% of our 2016 net operating revenues, is used mainly to produce stainless and alloy steels. Demand for steel depends heavily on global economic conditions, but it also depends on a variety of regional and sectorial factors. The prices of different steels and the performance of the global steel industry are highly cyclical and volatile, and these business cycles in the steel industry affect demand and prices for our products. In addition, vertical backward integration of the steel and stainless steel industries and the use of scrap could reduce the global seaborne trade of iron ore and primary nickel. The demand for copper is affected by the demand for copper wire, and a sustained decline in the construction industry could have a negative impact on our copper business.

The prices we charge, including prices for iron ore, nickel, copper and coal, are subject to volatility.

Global prices for metals are subject to significant fluctuations and are affected by many factors, including actual and expected global macroeconomic and political conditions, levels of supply and demand, the availability and cost of substitutes, inventory levels, technological developments, regulatory and international trade matters, investments by commodity funds and others and actions of participants in the commodity markets. Sustained low market prices for the products we sell may result in the suspension of certain of our projects and operations, decrease in our mineral reserves, impairment of assets, and may adversely affect our cash flows, financial position and results of operations.

We are mostly affected by movements in iron ore prices. For example, a price reduction of US$1 per dry metric ton unit ("dmt") in the average iron ore price would have reduced our operating income for the year ended December 31, 2016 by approximately US$325 million. Average iron ore prices significantly changed in the last four years, from US$135 per dmt in 2013 to US$97 per dmt in 2014, US$55.5 per dmt in 2015 and US$58.5 per dmt in 2016, according to the average Platts IODEX (62% Fe CFR China). On February 28, 2017 the year to date average Platts IODEX iron ore price was US$84.8 per dmt. In addition to reduced demand for iron ore, an excess in supply has adversely affected our prices since 2014 and supply may grow with the expected conclusion of certain iron ore projects in coming years.

World nickel prices were adversely affected by lower demand in the first half of 2016, but benefited from increased demand, especially from the Chinese stainless steel sector, in the second half of 2016. Nickel refining in China, primarily using imported nickel ores and related raw materials, increased significantly between 2006 and 2015, with Chinese nickel pig iron production representing 19% of global nickel output. Since 2014, Chinese nickel pig iron production has been adversely affected by export restrictions in feed-producing countries, but the revocation or relaxation of export restrictions in feed producing countries, such as Indonesia, may benefit the production of nickel pig iron in China, which may in turn adversely affect global nickel prices. In January 2017, the Indonesian government issued a ministerial decree allowing for the controlled recommencement of nickel ore exports from Indonesia. For additional information about the average realized prices for the products we sell, see *Operating and financial review and prospects—Overview—Major factors affecting prices*.

We may not be able to adjust production volume in a timely or cost-efficient manner in response to changes in demand.

Lower utilization of capacity during periods of weak demand may expose us to higher unit production costs since a significant portion of our cost structure is fixed in the short-term due to the high capital intensity of mining operations. In addition, efforts to reduce costs during periods of weak demand could be limited by labor regulations or previous labor or government agreements.

Conversely, during periods of high demand, our ability to rapidly increase production capacity is limited, which could prevent us from meeting demand for our products. Moreover, we may be unable to complete expansions and greenfield projects in time to take advantage of rising demand for iron ore, nickel or other products. When demand exceeds our production capacity, we may meet excess customer demand by purchasing iron ore, iron ore pellets or nickel from joint ventures or unrelated parties and reselling it, which would increase our costs and narrow our operating margins. If we are unable to satisfy excess customer demand in this way, we may lose customers. In addition, operating close to full capacity may expose us to higher costs, including demurrage fees due to capacity restraints in our logistics systems.

Changes in exchange rates for the currencies in which we conduct operations could adversely affect our financial condition and results of operations.

A substantial portion of our revenues and our debt is denominated in U.S. dollars, and given that our functional currency is the Brazilian *real*, changes in exchange rates may result in (i) losses or gains on our net U.S. dollar-denominated indebtedness and accounts receivable and (ii) fair value losses or gains on currency derivatives we use to stabilize our cash flow in U.S. dollars. In 2016, we had foreign exchange gains of US$3.3 billion, while in 2015 and 2014 we had foreign exchange losses of US$7.0 billion and US$2.1 billion, respectively. In addition, changing values of the Brazilian *real*, the Canadian dollar, the Australian dollar, the Indonesian rupiah and other currencies against the U.S. dollar affects our results since most of our costs of goods sold is denominated in currencies other than the U.S. dollar, principally the *real* (55% in 2016) and the Canadian dollar (12% in 2016), while our revenues are mostly U.S. dollar-denominated. We expect currency fluctuations to continue to affect our financial income, expense and cash flow generation.

Significant volatility in currency prices may also result in disruption of foreign exchange markets, which could limit our ability to transfer or to convert certain currencies into U.S. dollars and other currencies for the purpose of making timely payments of interest and principal on our indebtedness. The central banks and governments of the countries in which we operate may institute restrictive exchange rate policies in the future and impose taxes on foreign exchange transactions.

Financial risks

Lower cash flows, resulting from decreased prices of our products, have adversely affected our credit ratings and the cost and availability of financing.

Lower prices of our products may adversely affect our future cash flows, credit ratings and our ability to secure financing at attractive rates. It may also negatively affect our ability to fund our capital investments, pay dividends and comply with the financial covenants in some of our long-term debt instruments.

Also, certain Canadian provinces where we operate require us to provide financial assurances, such as letters of credit, surety bonds or cash collateral, to cover certain closure and remediation costs after we conclude our operations. We may be required to increase the amount of these financial assurances if our credit ratings are downgraded below certain levels. If we are unable to provide these financial assurances, we would need to have discussions with the relevant jurisdictions about other options and ultimately it could affect our ability to operate in these jurisdictions.

We may not be able to implement our strategy with respect to divestments and strategic partnerships.

In the past few years, we have entered into agreements to dispose of assets and to make strategic partnerships, in order to optimize our business portfolio and implement our financing strategy and capital expenditure plans. We may continue to seek opportunities for divestments and strategic partnerships in the future. We are exposed to a number of risks in connection with these transactions, including imposition of regulatory conditions, inability to satisfy conditions for completion or for receipt of additional payments, and negative market reactions. If we are unable to complete our dispositions or strategic partnerships, particularly the sale of our fertilizer business or our partnership in our coal assets in Mozambique, we may have to revise our business and financing strategy and incur additional costs, which could in turn adversely affect our results of operations, financial conditions or reputation.

Risks relating to legal proceedings and Samarco dam failure

We are involved in legal proceedings that could have a material adverse effect on our business in the event of unfavorable outcomes.

We are involved in legal proceedings in which adverse parties have claimed substantial amounts, including several legal proceedings and investigations relating to the failure of Samarco's Fundão tailings dam. Although we are vigorously contesting them, the outcomes of these proceedings are uncertain and may result in obligations that could materially adversely affect our business and the value of the securities issued by Vale and its subsidiaries. For additional information, see *Additional information—Legal proceedings*.

Our obligations and potential liabilities arising from the failure of a tailings dam owned by Samarco Mineração S.A. ("Samarco") in Minas Gerais could negatively impact our business, our financial conditions and our reputation.

In November 2015, the Fundão tailings dam owned by Samarco failed, causing environmental damage in the surrounding area. The failure of Samarco's tailings dam has adversely affected and will continue to affect our business, but the full impact is still uncertain and cannot be estimated. Below is a discussion of the main effects of the dam failure on our business.

- *Legal proceedings.* We are involved in multiple legal proceedings and investigations relating to the failure of the Fundão tailings dam, and other proceedings and investigations may arise in the future. These proceedings include purported securities class actions in the United States against us and some of our officers, a criminal proceeding in Brazil, public civil actions brought by Brazilian authorities and multiple proceedings involving claims for significant amounts of damages and remediation measures. Adverse results in these proceedings may adversely impact our liquidity and our financial condition. See *Additional information—Legal proceedings*.

- *Reparation obligations and other undertakings.* In March 2016, Samarco and its shareholders, Vale and BHP Billiton Brasil Ltda. ("BHPB"), a Brazilian subsidiary of BHP Billiton plc, entered into a framework agreement (the "Framework Agreement") with certain governmental authorities, pursuant to which Samarco, Vale and BHPB agreed to create a foundation to develop and implement long-term remediation and compensation programs. Also, in January 2017, Samarco, Vale and BHPB entered into preliminary agreements with the federal prosecution office (the "MPF") providing for, among other things, the appointment of experts selected by the MPF to review and monitor the remediation programs provided under the Framework Agreement, the provision of collateral to secure certain remediation obligations, and a timetable for negotiation of a final agreement. See *Business overview—Failure of Samarco's tailings dam in Minas Gerais.* As Samarco is currently unable to resume its activities, we and BHPB have been funding the foundation and also providing funds directly to Samarco, to preserve its operations and to support certain remediation measures undertaken by Samarco. If Samarco is unable to resume operations or to generate sufficient cash flows to fund the remediation measures required under these agreements, we will be required to continue funding these remediation measures, which in turn may adversely affect our financial conditions and results of operations.

- *Risk of additional environmental damages.* Samarco continues to reinforce and improve its dams to contain the remaining tailings. Failure to contain the remaining tailings could cause additional environmental damages, additional impacts on our operations, and additional claims, fines and proceedings against Samarco and against us. Failure to contain the remaining tailings could also impact the feasibility and timing for the restart of Samarco's operations.

- *Other impacts.* We may encounter delays in the receipt of environmental operating license for other tailings dams, and Brazilian authorities may impose more stringent conditions in connection with the licensing process of our projects and operations. Also, as one of Samarco's shareholders, our reputation has been adversely affected by the failure of Samarco's tailings dam.

Political, economic, social and regulatory risks

Political, economic and social conditions in the countries in which we have operations or projects could adversely impact our business.

Our financial performance may be negatively affected by regulatory, political, economic and social conditions in countries in which we have significant operations or projects. In many of these jurisdictions, we are exposed to various risks such as political instability, bribery, extortion, corruption, robbery, sabotage, kidnapping, civil strife, acts of war, guerilla activities, piracy in international shipping routes and terrorism. These issues may adversely affect the economic and other conditions under which we operate in ways that could have a materially negative effect on our business. As an example, sections of our Carajás railroad (EFC) in the Brazilian state of Pará and other railways worldwide are subject to interruptions that can harm our operations and adversely affect our business.

Political and economic instability in Brazil could adversely impact our business and the market price of our securities.

The Brazilian federal government's economic policies may have important effects on Brazilian companies, including us, and on market conditions and prices of securities of Brazilian companies. Our financial condition and results of operations may be adversely affected by the following factors and the Brazilian federal government's response to these factors:

- exchange rate movements and volatility;
- inflation and high interest rates;
- financing of the current account deficit;
- liquidity of domestic capital and lending markets;
- tax policy;
- political instability resulting from allegations of corruption involving political parties, elected officials or other public officials; and
- other political, diplomatic, social and economic developments in or affecting Brazil.

Historically, the country's political situation has influenced the performance of the Brazilian economy, and political crises have affected the confidence of investors and the general public, which resulted in economic deceleration and heightened volatility in the securities issued abroad by Brazilian companies. In August 2016, the Brazilian Congress approved the impeachment of the Brazilian president. Also, ongoing corruption investigations have led to charges against public officials, members of several political parties and directors and officers of many Brazilian companies. Political instability may aggravate economic uncertainties in Brazil and increase volatility of securities of Brazilian issuers.

In 2015 and 2016, Brazil faced an economic recession, adverse fiscal developments and political instability, which may continue in 2017. Brazilian GDP declined by 3.6% in 2016 and by 3.85% in 2015, while unemployment increased to 11.5% in 2016 from 6.9% in 2015. Inflation, as reported by the consumer price index (IPCA), was 6.29% in 2016, 10.67% in 2015 and 6.41% in 2014. The Brazilian Central Bank's base interest rate (SELIC) was 13.75% on December 31, 2016, 14.25% on December 31, 2015 and 11.75% on December 31, 2014. Future economic, social and political developments in Brazil may impair our business, financial condition or results of operations, or cause the market value of our securities to decline.

Disagreements with local communities in which we operate could adversely impact our business and reputation.

Disputes with communities where we operate may arise from time to time. In some instances, our operations and mineral reserves are located on or near lands owned or used by indigenous people or other groups of stakeholders. Some of our mining and other operations are located in territories where title may be subject to disputes or uncertainties, or in areas claimed for agriculture or land reform purposes, which may lead to disagreements with landowners, organized social movements, local communities and the government. We may be required to consult and negotiate with these groups as part of the process to obtain licenses required to operate, to mitigate impact on our operations or to obtain access to their lands.

Disagreements or disputes with local groups, including indigenous groups, organized social movements and local communities, could cause delays or interruptions to our operations, adversely affect our reputation or otherwise hamper our ability to develop our reserves and conduct our operations. Protesters have taken actions to disrupt our operations and projects, and they may continue to do so in the future, which may harm our operations and could adversely affect our business.

We could be adversely affected by changes in government policies or by trends such as resource nationalism, including the imposition of new taxes or royalties on mining activities.

Mining is subject to government regulation, including taxes and royalties, which can have a significant financial impact on our operations. In the countries where we are present, we are subject to potential renegotiation, nullification or forced modification of existing contracts and licenses, expropriation or nationalization of property, foreign exchange controls, changes in local laws and regulations and policies. We are also subject to new taxes or raising of existing taxes and royalty rates, reduction of tax exemptions and benefits, renegotiation of tax stabilization agreements or changes on the basis on which taxes are calculated in a manner that is unfavorable to us. Governments that have committed to provide a stable taxation or regulatory environment may alter those commitments or shorten their duration. We also face the risk of having to submit to the jurisdiction of a foreign court or arbitration panel or having to enforce a judgment against a sovereign nation within its own territory.

We are also required to meet domestic beneficiation requirements in certain countries, such as local processing rules, export taxes or restrictions or charges on unprocessed ores. The imposition of or increase in such requirements, taxes or charges can significantly increase the risk profile and costs of operations in those jurisdictions. We and the mining industry are subject to rising trends of resource nationalism in certain countries in which we operate that can result in constraints on our operations, increased taxation or even expropriations and nationalizations.

Concessions, authorizations, licenses and permits are subject to expiration, limitation on renewal and various other risks and uncertainties.

Our operations depend on authorizations and concessions from governmental regulatory agencies in the countries in which we operate. We are subject to laws and regulations in many jurisdictions that can change at any time, and changes in laws and regulations may require modifications to our technologies and operations and result in unanticipated capital expenditures.

Some of our mining concessions are subject to fixed expiration dates and might only be renewed a limited number of times for a limited period of time. Apart from mining concessions, we may need to obtain various authorizations, licenses and permits from governmental or other regulatory bodies in connection with the planning, maintenance, operation and closure of our mines and related logistics infrastructure, which may be subject to fixed expiration dates or periodic review or renewal. There is no assurance that renewals will be granted as and when sought, and there is no assurance that new conditions will not be imposed in connection with renewal. Fees for mining concessions might increase substantially due to the passage of time from the original issuance of each individual exploration license. If so, the costs of holding or renewing our mining concessions may render our business objectives not viable. Accordingly, we need to continually assess the mineral potential of each mining concession, particularly at the time of renewal, to determine if the costs of maintaining the concession are justified by the results of operations to date, and we might elect to let some of our concessions lapse. There can be no assurance that concessions will be obtained on terms favorable to us, or at all, for our future intended mining or exploration targets.

In a number of jurisdictions where we have exploration projects, we may be required to retrocede to the state a certain portion of the area covered by the exploration license as a condition to renewing the license or obtaining a mining concession. This requirement can lead to a substantial loss of part of the mineral deposit originally identified in our feasibility studies. For more information on mining concessions and other similar rights, see *Information on the Company—Regulatory matters*.

Operational risks

Our projects are subject to risks that may result in increased costs or delay in their implementation

We are investing to maintain and further increase our production capacity and logistics capabilities. We regularly review the economic viability of our projects. As a result of this review, we may decide to postpone, suspend or interrupt the implementation of certain projects. Our projects are also subject to a number of risks that may adversely affect our growth prospects and profitability, including the following:

- We may not be able to obtain financing at attractive rates.
- We may encounter delays or higher than expected costs in obtaining the necessary equipment or services and in implementing new technologies to build and operate a project.
- Our efforts to develop projects on schedule may be hampered by a lack of infrastructure, including reliable telecommunications services and power supply.
- Suppliers and contractors may fail to meet their contractual obligations to us.
- We may face unexpected weather conditions or other force majeure events.
- We may fail to obtain or renew the required permits and licenses to build a project, or we may experience delays or higher than expected costs in obtaining or renewing them.
- Changes in market conditions or regulations may make a project less profitable than expected at the time we initiated work on it.
- There may be accidents or incidents during project implementation.
- We may face shortages of skilled personnel.

Operational problems could materially and adversely affect our business and financial performance.

Ineffective project management and operational breakdowns might require us to suspend or curtail operations, which could generally reduce our productivity. Operational breakdowns could entail failure of critical plant and machinery. There can be no assurance that ineffective project management or other operational problems will not occur. Any damages to our projects or delays in our operations caused by ineffective project management or operational breakdowns could materially and adversely affect our business and results of operations. Our business is subject to a number of operational risks that may adversely affect our results of operations, such as:

- Unexpected weather conditions or other force majeure events.
- Adverse mining conditions delaying or hampering our ability to produce the expected quantity of minerals and to meet specifications required by customers, which can trigger price adjustments.
- Accidents or incidents involving our mines, industrial facilities and related infrastructure, such as dams, plants, railway and railway bridges, ports and ships.
- Delays or interruptions in the transportation of our products, including with railroads, ports and ships.
- Tropical diseases, HIV/AIDS and other contagious diseases in regions where some of our operations or projects are located, which pose health and safety risks to our employees.
- Labor disputes that may disrupt our operations from time to time.

- Changes in market conditions or regulations may affect the economic prospects of an operation and make it inconsistent with our business strategy.
- Failure to obtain the renewal of required permits and licenses, or delays or higher than expected costs in obtaining them.
- Disruptions to or unavailability of critical information technology systems or services resulting from accidents or malicious acts.

Our business could be adversely affected by the failure of our counterparties to perform their obligations.

Customers, suppliers, contractors, financial institutions, joint venture partners and other counterparties may fail to perform existing contracts and obligations, which may unfavorably impact our operations and financial results. The ability of suppliers and customers to perform their obligations may be adversely affected in times of financial stress and economic downturn.

We currently operate important parts of our iron ore, pelletizing, nickel, coal, copper, fertilizers, bauxite and steel businesses through joint ventures. Important parts of our electricity investments and projects are operated through consortia or joint ventures. Our forecasts and plans for these joint ventures and consortia assume that our partners will observe their obligations to make capital contributions, purchase products and, in some cases, provide skilled and competent managerial personnel. If any of our partners fails to observe its commitments, the affected joint venture or consortium may not be able to operate in accordance with its business plans, or we may have to increase the level of our investment to implement these plans.

Some of our investments are controlled by partners or have separate and independent management. These investments may not fully comply with our standards, controls and procedures, including our health, safety, environment and community standards. Failure by any of our partners or joint ventures to adopt adequate standards, controls and procedures could lead to higher costs, reduced production or environmental, health and safety incidents or accidents, which could adversely affect our results and reputation.

We may not have adequate insurance coverage for some business risks.

Our businesses are generally subject to a number of risks and hazards, which could result in damage to, or destruction of, properties, facilities and equipment. The insurance we maintain against risks that are typical in our business may not provide adequate coverage. Insurance against some risks (including liabilities for environmental pollution or certain hazards or interruption of certain business activities) may not be available at a reasonable cost, or at all. Even when it is available, we may self-insure where we determine that is more cost-effective to do so. As a result, accidents or other negative developments involving our mining, production or transportation facilities could have a material adverse effect on our operations.

Labor disputes may disrupt our operations from time to time.

A substantial number of our employees, and some of the employees of our subcontractors, are represented by labor unions and are covered by collective bargaining or other labor agreements, which are subject to periodic negotiation. Strikes and other labor disruptions at any of our operations could adversely affect the operation of facilities and the timing of completion and cost of our capital projects. For more information about labor relations, see *Management and employees—Employees*. Moreover, we could be adversely affected by labor disruptions involving unrelated parties that may provide us with goods or services.

Higher energy costs or energy shortages would adversely affect our business.

Costs of fuel oil, gas and electricity are a significant component of our cost of production, representing 10.9% of our total cost of goods sold in 2016. To fulfill our energy needs, we depend on the following sources: oil byproducts, which represented 36% of total energy needs in 2016, electricity (32%), natural gas (15%), coal (15%) and other energy sources (2%).

Electricity costs represented 3.9% of our total cost of goods sold in 2016. If we are unable to secure reliable access to electricity at acceptable prices, we may be forced to curtail production or may experience higher production costs, either of which would adversely affect our results of operations. We face the risk of energy shortages in the countries where we have operations and projects, especially Brazil, due to lack of infrastructure or weather conditions, such as floods or droughts. Future shortages, and government efforts to respond to or prevent shortages, may adversely impact the cost or supply of electricity for our operations.

Failures in our information technology systems or difficulties in integrating new enterprise resource planning software may interfere with the normal functioning of our business.

We rely on information technology ("IT") systems for the operation of many of our business processes. Failures in our IT systems, whether caused by accident or malicious acts, may result in the disclosure or theft of sensible information, misappropriation of funds and disruptions to our business operations.

Health, safety and environmental risks

Our business is subject to environmental, health and safety incidents.

Our operations involve the use, handling, storage, discharge and disposal of hazardous substances into the environment and the use of natural resources, and the mining industry is generally subject to significant risks and hazards, including fire, explosion, toxic gas leaks, spilling of polluting substances or other hazardous materials, rockfalls, incidents involving dams, failure of other operational structures and incidents involving mobile equipment, vehicles or machinery. This could occur by accident or by breach of operating and maintenance standards, and could result in a significant environmental and social impacts, damage to or destruction of mineral properties or production facilities, personal injury, illness or death of employees, contractors or community members close to operations, environmental damage, delays in production, monetary losses and possible legal liability. Additionally, in remote localities, our employees may be exposed to tropical and contagious diseases that may affect their health and safety. Notwithstanding our standards, policies and controls, our operations remain subject to incidents or accidents that could adversely affect our business, stakeholders or reputation.

Our business may be adversely affected by environmental and health and safety regulation, including regulations pertaining to climate change.

Nearly all aspects of our activities, products, services and projects around the world are subject to environmental regulations and health and safety regulations, which may expose us to increased liability or increased costs. These regulations require us to have environmental licenses, permits and authorizations for our operations and projects, and to conduct environmental and social impact assessments in order to get approval for our projects and permission for initiating construction. Significant changes to existing operations are also subject to these requirements. Difficulties in obtaining or renewing permits may lead to construction delays, cost increases, and may adversely impact our production volumes. Environmental and health and safety regulations also impose standards and controls on activities relating to mineral research, mining, pelletizing activities, railway and marine services, ports, decommissioning, refining, distribution and marketing of our products. Such regulation may give rise to significant costs and liabilities. Litigation relating to these or other matters may adversely affect our financial condition or cause harm to our reputation.

Environmental and health and safety regulation in many countries in which we operate has become stricter in recent years, and it is possible that more regulation or more aggressive enforcement of existing regulations will adversely affect us by imposing restrictions on our activities and products, creating new requirements for the issuance or renewal of environmental licenses, raising our costs or requiring us to engage in expensive reclamation efforts. For example, changes in Brazilian legislation for the protection of caves have required us to conduct extensive technical studies and to negotiate compensatory measures with Brazilian environmental regulators in order to continue to operate in certain sites. It is possible that in certain of our iron ore mining operations or projects, we may be required to limit or modify our mining plans or to incur additional costs to preserve caves or to compensate for the impact on them, with potential consequences for production volumes, costs or reserves in our iron ore business. For more information about Brazilian environmental regulations related to caves, see *Information on the Company—Regulatory matters—Environmental regulations*.

In response to the failure of Samarco's tailings dam in Minas Gerais, additional environmental and health and safety laws and regulations may be forthcoming in Brazil and authorities may impose more stringent conditions in connection with the licensing process of our projects and operations. Also, we may encounter delays in the receipt of environmental operating license for other tailings dams.

National policies and international regulations regarding climate change may affect a number of our businesses in various countries. The ratification of the Paris Agreement in 2016 increased international pressure for the establishment of a global carbon price, and on companies to adopt carbon pricing strategies. The pricing of greenhouse gas emissions may impact our operational costs, mainly through higher price for fossil fuels as mining is an energy intensive industry. Consumption of coal, one of the products we sell, in particular, is facing pressure from international institutions due to its carbon intensity.

Regulatory initiatives at the national and international levels that affect our shipping practices could increase our costs or require us to make new capital expenditures.

Natural disasters may cause severe damage to our operations and projects in the countries where we operate and may have a negative impact on our sales to countries affected by such disasters.

Natural disasters, such as wind storms, droughts, floods, earthquakes and tsunamis may adversely affect our operations and projects in the countries where we operate, and may cause a contraction in sales to countries adversely affected due to, among other factors, power outages and the destruction of industrial facilities and infrastructure. The physical impact of climate change on our business remains uncertain, but we are likely to experience changes in rainfall patterns, increased temperatures, water shortages, rising sea levels, increased storm frequency and intensity as a result of climate change, which may adversely affect our operations. On some occasions in recent years, we have determined that *force majeure* events have occurred due to effect of severe weather on our mining and logistics activities.

Risks relating to our mining reserves

Our reserve estimates may materially differ from mineral quantities that we are actually able to recover; our estimates of mine life may prove inaccurate; and market price fluctuations and changes in operating and capital costs may render certain ore reserves uneconomical to mine.

Our reported reserves are estimated quantities of ore and minerals that we have determined can be economically mined and processed under present and assumed future conditions. There are numerous uncertainties inherent in estimating quantities of reserves and in projecting potential future rates of mineral production, including factors beyond our control. Reserve reporting involves estimating deposits of minerals that cannot be measured in an exact manner, and the accuracy of any reserve estimate is a function of the quality of available data, engineering and geological interpretation and judgment. As a result, no assurance can be given that the indicated amount of ore will be recovered or that it will be recovered at the rates we anticipate. Reserve estimates and estimates of mine life may require revisions based on actual production experience, projects, updated exploration drilling data and other factors. For example, lower market prices of minerals and metals, reduced recovery rates or increased operating and capital costs due to inflation, exchange rates, changes in regulatory requirements or other factors may render proven and probable reserves uneconomic to exploit and may ultimately result in a reduction of reserves. Such a reduction could affect depreciation and amortization rates and have an adverse effect on our financial performance.

We may not be able to replenish our reserves, which could adversely affect our mining prospects.

We engage in mineral exploration, which is highly uncertain in nature, involves many risks and frequently is non-productive. Our exploration programs, which involve significant expenditures, may fail to result in the expansion or replacement of reserves depleted by current production. If we do not develop new reserves, we will not be able to sustain our current level of production beyond the remaining lives of our existing mines.

The feasibility of new mineral projects may change over time.

Once mineral deposits are discovered, it can take a number of years from the initial phases of drilling until production is possible, during which the economic feasibility of production may change. Substantial time and expenditures are required to:

- establish mineral reserves through drilling;
- determine appropriate mining and metallurgical processes for optimizing the recovery of metal contained in ore;
- obtain environmental and other licenses;
- construct mining, processing facilities and infrastructure required for greenfield properties; and
- obtain the ore or extract the minerals from the ore.

If a project proves not to be economically feasible by the time we are able to exploit it, we may incur substantial losses and be obliged to take write-downs. In addition, potential changes or complications involving metallurgical and other technological processes arising during the life of a project may result in delays and cost overruns that may render the project not economically feasible.

We face rising extraction costs or investment requirements over time as reserves deplete.

Reserves are gradually depleted in the ordinary course of a given open pit or underground mining operation. As mining progresses, distances to the primary crusher and to waste deposits become longer, pits become steeper, mines may move from being open pit to underground, and underground operations become deeper. In addition, for some types of reserves, mineralization grade decreases and hardness increases at greater depths. As a result, over time, we usually experience rising unit extraction costs with respect to each mine, or we may need to make additional investments, including adaptation or construction of processing plants and expansion or construction of tailings dams. Several of our mines have been operating for long periods, and we will likely experience rising extraction costs per unit in the future at these operations in particular.

Risks relating to our corporate structure

Our controlling shareholder has significant influence over Vale and the Brazilian Government has certain veto rights.

As of March 31, 2017, Valepar S.A. ("Valepar") owned 53.9% of our outstanding common stock and 33.7% of our total outstanding capital. As a result of its share ownership, Valepar can elect the majority of our board of directors and control the outcome of some actions that require shareholder approval. The shareholders of Valepar are party to a shareholders' agreement that governs Valepar's actions in its capacity as a shareholder of Vale. The existing shareholders' agreement will expire on May 9, 2017, and certain Valepar shareholders have entered into a new shareholders' agreement that will become effective on May 10, 2017, for a period of six months or until the merger of Valepar into Vale. The new shareholders' agreement contemplates a proposal to change our governance structure and the execution of a shareholders' agreement at the Vale level, binding with respect to 20% of our common shares, which will continue to give significant influence to these shareholders. For a description of our ownership structure and of the shareholders' agreements, see *Share ownership and trading—Major shareholders*.

The Brazilian government owns 12 golden shares of Vale, granting it limited veto power over certain company actions, such as changes to our name, the location of our headquarters and our corporate purpose as it relates to mining activities. For a detailed description of the Brazilian government's veto powers, see *Additional information—Memorandum and articles of association—Common shares and preferred shares*.

The implementation of a change in our capital structure and governance, and any potential benefits, are subject to uncertainty and may not lead to the benefits that we expect.

Pursuant to the new shareholder's agreement of Valepar, which will become effective on May 10, 2017, Valepar is expected to submit a proposal to simplify our shareholding structure and corporate governance, with the purpose of eventually enabling Vale to be listed on BM&FBOVESPA's *Novo Mercado* special segment and making Vale a company without defined control. For a description of our ownership structure and the proposed changes to the Valepar shareholders' agreements pursuant to the Proposal, see *Share ownership and trading—Major shareholders*.

The implementation of the proposal to simplify our shareholding structure is subject to, among other requirements, (i) the approval of the proposal, including the merger of Valepar into Vale, by our shareholders and the executive officers and board of directors of Vale and Valepar, and (ii) the acceptance by at least 54.09% of class A preferred shares of the voluntary conversion into common shares, within 45 days from the shareholders' meeting decision on the matter. We cannot predict how long it will take to implement all the necessary steps or whether they will be successfully implemented at all. Finally, we cannot predict whether or when we will migrate to the *Novo Mercado* segment of the BM&FBOVESPA, as the listing is subject to conversion of all of our preferred shares into common shares.

The uncertainty in the timing and effective implementation may delay or limit our ability to achieve certain benefits that might derive from the simplified corporate ownership structure and eventual migration to the *Novo Mercado*, such as increased liquidity for shareholders. We cannot guarantee that these benefits will be fully realized, and any failure to achieve those benefits may affect the value of our shares and ADSs.

Our governance and compliance processes may fail to prevent regulatory penalties and reputational harm.

We operate in a global environment, and our activities extend over multiple jurisdictions and complex regulatory frameworks with increased enforcement activities worldwide. Our governance and compliance processes, which include the review of internal control over financial reporting, may not prevent future breaches of legal, accounting or governance standards. We may be subject to breaches of our Code of Ethics and Conduct, anti-corruption policies and business conduct protocols and to instances of fraudulent behavior, corrupt practices and dishonesty by our employees, contractors or other agents. Our failure to comply with applicable laws and other standards could subject us to fines, loss of operating licenses and reputational harm.

It could be difficult for investors to enforce any judgment obtained outside Brazil against us or any of our associates.

Our investors may be located in jurisdictions outside Brazil and could seek to bring actions against us or our directors or officers in the courts of their home jurisdictions. We are a Brazilian company, and the majority of our officers and directors are residents of Brazil. The vast majority of our assets and the assets of our officers and directors are likely to be located in jurisdictions other than the home jurisdictions of our foreign investors. It might not be possible for investors outside Brazil to effect service of process within their home jurisdictions on us or on our officers or directors who reside outside their home jurisdictions. In addition, a final conclusive foreign judgment will be enforceable in the courts of Brazil without a re-examination of the merits only if previously confirmed by the Brazilian Superior Court of Justice (STJ—*Superior Tribunal de Justiça*), and confirmation will only be granted if the foreign judgment: (a) fulfills all formalities required for its enforceability under the laws of the country where it was issued; (b) was issued by a competent court after due service of process on the defendant, as required under applicable law; (c) is not subject to appeal; (d) does not conflict with a final and unappealable decision issued by a Brazilian court; (e) was authenticated by a Brazilian consulate in the country in which it was issued or is duly apostilled in accordance with the Convention for Abolishing the Requirement of Legalization for Foreign Public Documents and is accompanied by a sworn translation into Portuguese, unless this procedure was exempted by an international treaty entered into by Brazil; (f) it does not cover matters subject to the exclusive jurisdiction of the Brazilian courts; and (g) is not contrary to Brazilian national sovereignty, public policy or good morals. Therefore, investors might not be able to recover against us or our directors and officers on judgments of the courts of their home jurisdictions predicated upon the laws of such jurisdictions.

Risks relating to our depositary shares

If ADR holders exchange ADSs for the underlying shares, they risk losing the ability to remit foreign currency abroad.

The custodian for the shares underlying our ADSs maintains a registration with the Central Bank of Brazil entitling it to remit U.S. dollars outside Brazil for payments of dividends and other distributions relating to the shares underlying our ADSs or upon the disposition of the underlying shares. If an ADR holder exchanges its ADSs for the underlying shares, it will be entitled to rely on the custodian's registration for only five business days from the date of exchange. Thereafter, an ADR holder may not be able to obtain and remit foreign currency abroad upon the disposition of, or distributions relating to, the underlying shares unless it obtains its own registration under applicable regulation, which permits qualifying institutional foreign investors to buy and sell securities on the BM&FBOVESPA. For more information regarding these exchange controls, see *Additional information—Exchange controls and other limitations affecting security holders*. If an ADR holder attempts to obtain its own registration, it may incur expenses or suffer delays in the application process, which could delay the receipt of dividends or other distributions relating to the underlying shares or the return of capital in a timely manner.

The custodian's registration or any registration obtained could be affected by future legislative changes, and additional restrictions applicable to ADR holders, the disposition of the underlying shares or the repatriation of the proceeds from disposition could be imposed in the future.

ADR holders may be unable to exercise preemptive rights relating to the shares underlying their ADSs.

The ability of ADR holders to exercise preemptive rights is not assured, particularly if the applicable law in the holder's jurisdiction (for example, the Securities Act in the United States) requires that either a registration statement be effective or an exemption from registration be available with respect to those rights, as is in the case in the United States. We are not obligated to extend the offer of preemptive rights to holders of ADRs, to file a registration statement in the United States, or to make any other similar filing in any other jurisdiction, relating to preemptive rights or to undertake steps that may be needed to make exemptions from registration available, and we cannot assure holders that we will file any registration statement or take such steps.

ADR holders may encounter difficulties in the exercise of voting rights.

ADR holders do not have the rights of shareholders. They have only the contractual rights set forth for their benefit under the deposit agreements. ADR holders are not permitted to attend shareholders' meetings, and they may only vote by providing instructions to the depositary. In practice, the ability of a holder of ADRs to instruct the depositary as to voting will depend on the timing and procedures for providing instructions to the depositary either directly or through the holder's custodian and clearing system. With respect to ADSs for which instructions are not received, the depositary may, subject to certain limitations, grant a proxy to a person designated by us.

The legal protections for holders of our securities differ from one jurisdiction to another and may be inconsistent, unfamiliar or less effective than investors anticipate.

We are a global company with securities traded in several different markets and investors located in many different countries. The legal regime for the protection of investors varies around the world, sometimes in important ways, and investors in our securities should recognize that the protections and remedies available to them may be different from those to which they are accustomed in their home markets. We are subject to securities legislation in several countries, which have different rules, supervision and enforcement practices. The only corporate law applicable to our parent company is the law of Brazil, with its specific substantive rules and judicial procedures. We are subject to corporate governance rules in several jurisdictions where our securities are listed, but as a foreign private issuer, we are not required to follow many of the corporate governance rules that apply to U.S. domestic issuers with securities listed on the New York Stock Exchange, and we are not subject to the U.S. proxy rules.

SELECTED FINANCIAL DATA

The tables below present selected consolidated financial information as of and for the periods indicated. You should read this information together with our consolidated financial statements in this annual report. The comparative information for 2012 to 2015 has been re-presented to report our fertilizers segment as discontinued operations.

Consolidated statement of income data

	For the year ended December 31,				
	2012	2013	2014	2015	2016
	(US$ million)				
Net operating revenues	42,983	43,953	35,124	23,384	27,488
Cost of goods sold and services rendered	(22,407)	(21,668)	(22,790)	(18,751)	(17,650)
Selling, general, administrative and other operating expenses, net	(1,954)	(1,101)	(2,059)	(819)	(774)
Research and evaluation expenses	(1,356)	(748)	(662)	(395)	(319)
Pre-operating and operational stoppage	(3,495)	(2,375)	(975)	(942)	(453)
Impairment of non-current assets and onerous contracts	(4,023)	(182)	(99)	(8,769)	(1,174)
Results on measurement or sales of non-current assets	(377)	(215)	(167)	61	(66)
Operating income (loss)	9,371	17,664	8,372	(6,231)	7,052
Non-operating income (expenses):					
Financial income (expenses), net	(3,976)	(8,314)	(6,018)	(10,654)	1,843
Equity results in associates and joint ventures	645	469	501	(445)	309
Impairment and other results in associates and joint ventures	(1,941)	14	(61)	(349)	(1,220)
Net income (loss) before income taxes	4,099	9,833	2,794	(17,679)	7,984
Income taxes	(32)	(6,889)	(1,603)	5,249	(2,781)
Net income (loss) from continuing operations	4,067	2,944	1,191	(12,430)	5,203
Loss attributable to non-controlling interests	(311)	(191)	(308)	(501)	(8)
Net income (loss) from continuing operations attributable to Vale's stockholders	4,378	3,135	1,499	(11,929)	5,211
Net income (loss) from discontinued operations attributable to Vale's stockholders	1,076	(2,551)	(842)	(200)	(1,229)
Net income (loss) attributable to Vale's stockholders	5,454	584	657	(12,129)	3,982
Loss attributable to non-controlling interests	(257)	(178)	(304)	(491)	(6)
Net income (loss)	5,197	406	353	(12,620)	3,976
Total cash paid to stockholders(1)	6,000	4,500	4,200	1,500	250

(1) Consists of total cash paid to stockholders during the period, whether classified as dividends or interest on stockholders' equity.

Earnings (loss) per share

	For the year ended December 31,				
	2012	2013	2014	2015	2016
	(US$, except as noted)				
Earnings (loss) per share from continuing operations:					
Per common share	0.86	0.61	0.29	(2.31)	1.01
Per preferred share	0.86	0.61	0.29	(2.31)	1.01
Earnings (loss) per share from discontinued operations:					
Per common share	0.20	(0.50)	(0.16)	(0.04)	(0.24)
Per preferred share	0.20	(0.50)	(0.16)	(0.04)	(0.24)
Earnings (loss) per share:					
Per common share	1.06	0.11	0.13	(2.35)	0.77
Per preferred share	1.06	0.11	0.13	(2.35)	0.77
Weighted average number of shares outstanding (in thousands)(1):					
Common shares	3,172,179	3,185,653	3,185,653	3,185,653	3,185,653
Preferred shares	1,933,491	1,967,722	1,967,722	1,967,722	1,967,722
Total	5,105,670	5,153,375	5,153,375	5,153,375	5,153,375
Distributions to stockholders per share(2):					
Expressed in US$	1.17	0.87	0.81	0.29	0.05
Expressed in R$	2.26	1.81	1.89	0.98	0.17

(1) Each common ADS represents one common share and each preferred ADS represents one preferred share.
(2) Our distributions to shareholders may be classified as either dividends or interest on shareholders' equity. In many years, part of each distribution has been classified as interest on shareholders' equity and part has been classified as dividends. For information about distributions paid to shareholders, see *Share ownership and trading—Distributions*.

Balance sheet data

	2012	2013	2014	2015	2016
	As of December 31,				
	(US$ million)				
Current assets	22,069	20,611	16,594	11,429	13,978
Non-current assets held for sale	457	3,766	3,640	4,044	8,589
Property, plant and equipment, net and intangible assets	94,093	88,536	84,942	59,426	62,290
Investments in associated companies and joint ventures	6,384	3,584	4,133	2,940	3,696
Non-current assets	7,574	8,100	7,180	10,653	10,461
Total assets	130,577	124,597	116,489	88,492	99,014
Current liabilities	12,402	9,164	10,626	10,438	10,142
Liabilities associated with non-current assets held for sale	169	448	111	107	1,090
Long-term liabilities(1)	16,380	22,379	22,043	15,896	19,096
Long-term debt(2)	26,799	27,670	27,388	26,347	27,662
Total liabilities	55,750	59,661	60,168	52,788	57,990
Stockholders' equity:					
Capital stock	60,578	60,578	61,614	61,614	61,614
Additional paid-in capital	(552)	(552)	(601)	(854)	(851)
Retained earnings and revenue reserves	13,213	3,299	(5,891)	(27,171)	(21,721)
Total Vale shareholders' equity	73,239	63,325	55,122	33,589	39,042
Non-controlling interests	1,588	1,611	1,199	2,115	1,982
Total stockholders' equity	74,827	64,936	56,321	35,704	41,024
Total liabilities and stockholders' equity	130,577	124,597	116,489	88,492	99,014

(1) Excludes long-term debt.
(2) Excludes current portion of long-term debt.

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I. INFORMATION ON THE COMPANY

BUSINESS OVERVIEW

Summary

We are one of the largest metals and mining companies in the world, based on market capitalization. We are the world's largest producer of iron ore and iron ore pellets and the world's largest producer of nickel. We also produce manganese ore, ferroalloys, metallurgical and thermal coal, copper, platinum group metals (PGMs), gold, silver and cobalt. We are engaged in greenfield mineral exploration in six countries around the globe. We operate large logistics systems in Brazil and other regions of the world, including railroads, maritime terminals and ports, which are integrated with our mining operations. In addition, we have a portfolio of maritime freight assets, floating transfer stations and distribution centers to support the delivery of iron ore worldwide. Directly and through affiliates and joint ventures, we also have investments in energy and steel businesses.

The following table presents the breakdown of total net operating revenues attributable to each of our lines of business of continuing operations.

	Year ended December 31,					
	2014		2015		2016	
	US$ million	% of total	US$ million	% of total	US$ million	% of total
Ferrous minerals:						
Iron ore	19,301	55.0%	12,330	52.7%	15,784	57.4%
Pellets	5,263	15.0	3,600	15.4	3,827	13.9
Ferroalloys and manganese	392	1.1	162	0.7	302	1.1
Other ferrous products and services	741	2.1	470	2.0	438	1.6
Subtotal	25,697	73.2	16,562	70.8	20,351	74.0
Coal	739	2.1	526	2.3	839	3.1
Base metals: Nickel and other products(1)	6,241	17.8	4,693	20.1	4,472	16.3
Copper(2)	1,451	4.1	1,470	6.3	1,667	6.0
Subtotal	7,692	21.9	6,163	26.4	6,139	22.3
Other(3)	996	2.8	133	0.5	159	0.6
Total net operating revenues from continuing operations	35,124	100.0%	23,384	100.0%	27,488	100.0%

(1) Includes nickel coproducts (copper) and byproducts (precious metals, cobalt and others).
(2) Does not include copper produced in our nickel operations.
(3) Includes energy.

Ferrous minerals:

- *Iron ore and iron ore pellets.* We operate four systems in Brazil for producing and distributing iron ore, which we refer to as the Northern, Southeastern, Southern and Midwestern Systems. The Northern and the Southeastern Systems are fully integrated, consisting of mines, railroads, maritime terminals and a port. The Southern System consists of three mining complexes and two maritime terminals. We also have iron ore pellet operations in several locations, some of which are conducted through joint ventures. We operate 11 pellet plants in Brazil and two in Oman. The operations of three of our pellet plants in Brazil have been suspended since 2012 in response to market conditions, and their capacity was partially replaced by Tubarão VIII, a more efficient plant. In response to market conditions, we plan to re-start operations at one of our pellet plants in 2018. We also have a 50% stake in Samarco and 25% stakes in two pellet companies in China.