

LG Chem, Ltd. and Subsidiaries

Consolidated Financial Statements

December 31, 2019 and 2018

LG Chem, Ltd. and Subsidiaries

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December 31, 2019 and 2018

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Independent Auditor's Report

(English Translation of a Report Originally Issued in Korean)

To the Shareholders and Board of Directors of
LG Chem, Ltd.

Opinion

We have audited the accompanying consolidated financial statements of LG Chem, Ltd. and its subsidiaries (collectively referred to as the "Group"), which comprise the consolidated statements of financial position as at December 31, 2019 and 2018, and consolidated statements of profit or loss, consolidated statements of comprehensive income, consolidated statements of changes in equity and consolidated statements of cash flows for the years then ended, and notes to the consolidated financial statements, including a summary of significant accounting policies and other explanatory information.

In our opinion, the accompanying consolidated financial statements present fairly, in all material respects, the consolidated financial position of the Group as at December 31, 2019 and 2018, and its consolidated financial performance and its consolidated cash flows for the years then ended in accordance with International Financial Reporting Standards as adopted by the Republic of Korea (Korean IFRS).

Basis for Opinion

We conducted our audits in accordance with Korean Standards on Auditing. Our responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Consolidated Financial Statements* section of our report. We are independent of the Group in accordance with the ethical requirements of the Republic of Korea that are relevant to our audit of the consolidated financial statements and we have fulfilled our other ethical responsibilities in accordance with the ethical requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Key Audit Matters

Key audit matters are those matters that, in our professional judgment, were of most significance in our audit of the consolidated financial statements of the current period. These matters were addressed in the context of our audit of the consolidated financial statements as a whole, and in forming our opinion thereon, and we do not provide a separate opinion on these matters.

(1) Goodwill impairment assessment for Life Sciences Cash Generating Unit

Why this matter was determined to be a key audit matter

We focused on goodwill impairment assessment due to the significance of size of goodwill balance (₩1,010,534 million as at December 31, 2019) and because the measurement of the recoverable amount of the Group's Cash Generating Units (CGUs) involves management's judgements about the future results of the business, discount rate and adjustments arising from the perspective of market participants. Details are described in Note 12.

In particular, we focused our audit effort on the goodwill recognized in relation to the Life Sciences CGU (₩686,229 million as at December 31, 2019) which is the most significant element among all relevant CGUs with goodwill. The Life Sciences business was acquired by the Group in 2017 and has not recognized impairment on goodwill since then. We focused on this area due to the significance of size of goodwill balance.

How this matter was addressed in our audit

Audit procedures we performed to address this key audit matter include:

- Understanding, evaluation and testing of the design and operating effectiveness of relevant internal controls in place in connection with impairment assessment of goodwill including review and approval by management of future cash flow forecasts and assumptions applied in the assessment.
- Evaluation of valuation model used by management to estimate value-in-use.
- Comparison of future cash flow forecasts to estimate value-in-use with the budgets approved by the management except for the cash flows relating to specific fixed assets adjusted from the perspective of market participants.
- Hindsight review of the future cash flow forecasts by comparing the current year actual results with the prior year forecasts to assess whether management's forecasts included optimistic assumptions.
- Evaluation of management's assumptions used to estimate value-in-use.
 - Comparison of estimated revenue growth rate, operating margin rate and capital expenditures applied to estimate value-in-use with historical performances of the CGU and the current market condition to evaluate whether applied assumptions are consistent.
 - Evaluation of long-term growth rate by considering economic and industry forecasts
 - Comparison of the discount rate used by the management with the discount rate independently calculated by us using observable information in the market.
- Evaluation of identification of CGUs and testing of book values allocated to CGUs
- Evaluation of sensitivity analysis performed by management on the discount rate and terminal growth rate.

Other Matter

Auditing standards and their application in practice vary among countries. The procedures and practices used in the Republic of Korea to audit such financial statements may differ from those generally accepted and applied in other countries

Responsibilities of Management and Those Charged with Governance for the Consolidated Financial Statements

Management is responsible for the preparation and fair presentation of the consolidated financial statements in accordance with Korean IFRS, and for such internal control as management determines is necessary to enable the preparation of consolidated financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the consolidated financial statements, management is responsible for assessing the Group's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Group or to cease operations.

Those charged with governance are responsible for overseeing the Group's financial reporting process.

Auditor's Responsibilities for the Audit of the Consolidated Financial Statements

Our objectives are to obtain reasonable assurance about whether the consolidated financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Korean Standards on Auditing will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these consolidated financial statements.

As part of an audit in accordance with Korean Standards on Auditing, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the consolidated financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or

conditions that may cast significant doubt on the Group's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the consolidated financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Group to cease to continue as a going concern.

- Evaluate the overall presentation, structure and content of the consolidated financial statements, including the disclosures, and whether the consolidated financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
- Obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the Group to express an opinion on the consolidated financial statements. We are responsible for the direction, supervision and performance of the Group audit. We remain solely responsible for our audit opinion.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We also provide those charged with governance with a statement that we have complied with relevant ethical requirements regarding independence, and to communicate with them all relationships and other matters that may reasonably be thought to bear on our independence, and where applicable, related safeguards.

From the matters communicated with those charged with governance, we determine those matters that were of most significance in the audit of the consolidated financial statements of the current period and are therefore the key audit matters. We describe these matters in our auditor's report unless law or regulation precludes public disclosure about the matter or when, in extremely rare circumstances, we determine that a matter should not be communicated in our report because the adverse consequences of doing so would reasonably be expected to outweigh the public interest benefits of such communication.

The engagement partner on the audit resulting in this independent auditor's report is Kibok Lee, Certified Public Accountant.

Seoul, Korea

March 9, 2020

This report is effective as of March 9, 2020, the audit report date. Certain subsequent events or circumstances, which may occur between the audit report date and the time of reading this report, could have a material impact on the accompanying consolidated financial statements and notes thereto. Accordingly, the readers of the audit report should understand that there is a possibility that the above audit report may have to be revised to reflect the impact of such subsequent events or circumstances, if any.

LG Chem, Ltd. and Subsidiaries
Consolidated Statements of Financial Position
December 31, 2019 and 2018

<i>(in millions of Korean won)</i>	Notes	2019	2018
Assets			
Current assets			
Cash and cash equivalents	3, 5, 6	1,888,631	2,513,702
Trade receivables	3, 5, 7, 31	3,738,224	4,381,199
Other receivables	3, 5, 7, 31	266,551	326,093
Other current financial assets	3, 5, 8	10,879	-
Prepaid income taxes		118,349	1,831
Other current assets	13	793,796	573,460
Inventories	9	5,033,721	4,289,463
Assets held for sale	35	19,573	2,764
Total current assets		11,869,724	12,088,512
Non-current assets			
Other receivables	3, 5, 7	172,933	129,251
Other non-current financial assets	3, 5, 8	159,955	93,350
Investments in associates and joint ventures	1, 10, 33	307,577	266,122
Deferred tax assets	28	516,606	408,136
Property, plant and equipment	11	18,593,642	13,839,198
Intangible assets	12	2,206,229	2,006,238
Investment properties	37	53,328	950
Other non-current assets	13	144,432	112,380
Total non-current assets		22,154,702	16,855,625
Total assets		34,024,426	28,944,137
Liabilities			
Current liabilities			
Trade payables	3, 5, 31	2,379,711	2,165,969
Other payables	3, 5, 31	4,142,953	2,551,476
Borrowings	3, 5, 14	1,356,097	1,613,146
Other current financial liabilities	3, 5, 8	-	18,477
Provisions	15	472,129	119,366
Income tax payables	28	84,713	247,787
Other current liabilities	17	505,926	557,313
Total current liabilities		8,941,529	7,273,534
Non-current liabilities			
Other payables	3, 5	10,951	9,984
Borrowings	3, 5, 14	7,058,171	3,708,001
Other non-current financial liabilities	3, 5, 8	930	30,384
Provisions	15	264,599	218,287
Net defined benefit liabilities	16	179,160	227,544
Deferred tax liabilities	28	51,812	57,856
Other non-current liabilities	17	133,485	96,419
Total non-current liabilities		7,699,108	4,348,475
Total liabilities		16,640,637	11,622,009

LG Chem, Ltd. and Subsidiaries
Consolidated Statements of Financial Position
December 31, 2019 and 2018

<i>(in millions of Korean won)</i>	Notes	2019	2018
Equity			
Share capital	1, 19	391,406	391,406
Capital surplus		2,274,620	2,274,623
Other components of equity	21	(374,243)	(374,243)
Accumulated other comprehensive income		(85,496)	(202,994)
Retained earnings	20	14,798,690	14,994,252
Equity attributable to owners of the Parent Company		<u>17,004,977</u>	<u>17,083,044</u>
Non-controlling interest		378,812	239,084
Total equity		<u>17,383,789</u>	<u>17,322,128</u>
Total liabilities and equity		<u>34,024,426</u>	<u>28,944,137</u>

The above consolidated statements of financial position should be read in conjunction with the accompanying notes.

LG Chem, Ltd. and Subsidiaries
Consolidated Statements of Profit or Loss
Years Ended December 31, 2019 and 2018

(in millions of Korean won, except per share amounts)

	Notes	2019	2018
Revenue	31, 33	28,625,042	28,183,013
Cost of sales	23, 31	<u>(23,779,235)</u>	<u>(22,836,816)</u>
Gross profit		4,845,807	5,346,197
Selling and administrative expenses	22, 33, 31	<u>(3,950,159)</u>	<u>(3,100,127)</u>
Operating profit	33	895,648	2,246,070
Finance income	5, 25	290,797	210,375
Finance costs	5, 25	(436,809)	(367,497)
Share of net profit of associates and joint ventures accounted for using the equity method	10	22,211	5,085
Other non-operating income	5, 26	552,851	377,193
Other non-operating expenses	5, 27	<u>(764,138)</u>	<u>(531,179)</u>
Profit before income tax	32	560,560	1,940,047
Income tax expense	28	<u>(184,456)</u>	<u>(420,735)</u>
Profit for the year		<u>376,104</u>	<u>1,519,312</u>
Profit is attributable to:			
Owners of the Parent Company		313,365	1,472,608
Non-controlling interests		62,739	46,704
Earnings per share attributable to the equity holders of the Parent Company (in won)	29		
Basic earnings per ordinary share		4,085	19,217
Basic earnings per preferred share		4,135	19,267
Diluted earnings per ordinary share		3,882	19,057
Diluted earnings per preferred share		3,932	19,107

The above consolidated statements of profit or loss should be read in conjunction with the accompanying notes.

LG Chem, Ltd. and Subsidiaries
Consolidated Statements of Comprehensive Income
Years Ended December 31, 2019 and 2018

<i>(in millions of Korean won)</i>	Notes	2019	2018
Profit for the year		<u>376,104</u>	<u>1,519,312</u>
Other comprehensive income			
<i>Items that will not be reclassified to profit or loss</i>			
Remeasurements of net defined benefit liability	16	(65,806)	(76,019)
Gain on valuation of financial assets at fair value		35,331	(7,903)
Shares of remeasurements of net defined benefit liabilities of associates		(132)	(609)
Income tax relating to these items		8,544	22,999
<i>Items that may be subsequently reclassified to profit or loss</i>			
Exchange differences on translation of foreign operations		67,216	(12,974)
Cash flow hedge		39,848	(18,477)
Shares of other comprehensive income of associates and joint ventures		(2,075)	(306)
Income tax relating to these items		(10,510)	6,812
Other comprehensive income for the year, net of tax		<u>72,416</u>	<u>(86,477)</u>
Total comprehensive income for the year		<u>448,520</u>	<u>1,432,835</u>
Total comprehensive income for the year is attributable to:			
Owners of the Parent Company		383,185	1,387,802
Non-controlling interest		65,335	45,033

The above consolidated statements of comprehensive income should be read in conjunction with the accompanying notes.

LG Chem, Ltd. and Subsidiaries
Consolidated Statements of Changes in Equity
Years Ended December 31, 2019 and 2018

(in millions of Korean won)

Notes	Attributable to owners of the Parent Company						Non-controlling interests	Total equity
	Share capital	Capital surplus	Other components of equity	Accumulated other comprehensive income	Retained earnings	Total		
Balance at January 1, 2018	391,406	2,274,386	(362,676)	(173,839)	14,039,250	16,168,527	170,050	16,338,577
Comprehensive income								
Profit for the year	-	-	-	-	1,472,608	1,472,608	46,704	1,519,312
Remeasurements of net defined benefit liability	16	-	-	-	(55,205)	(55,205)	-	(55,205)
Exchange differences on translation of foreign operations	-	-	-	(9,572)	-	(9,572)	(1,671)	(11,243)
Gain on valuation of financial assets at fair value through other comprehensive income	-	-	-	(5,718)	-	(5,718)	-	(5,718)
Cash flow hedge	-	-	-	(13,396)	-	(13,396)	-	(13,396)
Others	-	-	-	(306)	(609)	(915)	-	(915)
Total comprehensive income (loss) for the year	-	-	-	(28,992)	1,416,794	1,387,802	45,033	1,432,835
Transactions with owners:								
Dividends	30	-	-	-	(460,058)	(460,058)	(33,822)	(493,880)
Equity transactions within the Group	-	237	(11,567)	-	-	(11,330)	11,600	270
Establishment of subsidiaries	-	-	-	-	-	-	46,893	46,893
Others	30	-	-	(163)	(1,734)	(1,897)	(670)	(2,567)
Total transactions with owners	-	237	(11,567)	(163)	(461,792)	(473,285)	24,001	(449,284)
Balance at December 31, 2018	391,406	2,274,623	(374,243)	(202,994)	14,994,252	17,083,044	239,084	17,322,128
Balance at January 1, 2019	391,406	2,274,623	(374,243)	(202,994)	14,994,252	17,083,044	239,084	17,322,128
Comprehensive income								
Profit for the year	-	-	-	-	313,365	313,365	62,739	376,104
Remeasurements of net defined benefit liability	16	-	-	-	(47,546)	(47,546)	-	(47,546)
Exchange differences on translation of foreign operations	-	-	-	65,068	-	65,068	2,596	67,664
Gain on valuation of financial assets at fair value through other comprehensive income	-	-	-	25,615	-	25,615	-	25,615
Cash flow hedge	-	-	-	28,890	-	28,890	-	28,890
Others	-	-	-	(2,075)	(132)	(2,207)	-	(2,207)
Total comprehensive income for the year	-	-	-	117,498	265,687	383,185	65,335	448,520
Transactions with owners:								
Dividends	30	-	-	-	(460,058)	(460,058)	(23,852)	(483,910)
Increase in paid-in capital of a subsidiary	-	-	-	-	-	-	98,642	98,642
Others	-	(3)	-	-	(1,191)	(1,194)	(397)	(1,591)
Total transactions with owners	-	(3)	-	-	(461,249)	(461,252)	74,393	(386,859)
Balance at December 31, 2019	391,406	2,274,620	(374,243)	(85,496)	14,798,690	17,004,977	378,812	17,383,789

The above consolidated statements of changes in equity should be read in conjunction with the accompanying notes.

LG Chem, Ltd. and Subsidiaries
Consolidated Statements of Cash Flows
Years Ended December 31, 2019 and 2018

<i>(in millions of Korean won)</i>	Notes	2019	2018
Cash flows from operating activities	32		
Cash generated from operations		3,836,461	2,887,846
Interest received		58,479	47,570
Interest paid		(209,256)	(131,780)
Dividends received		12,130	10,010
Income taxes paid		(576,713)	(688,677)
Net cash inflow from operating activities		<u>3,121,101</u>	<u>2,124,969</u>
Cash flows from investing activities			
Decrease in other receivables		207,398	1,016,425
Decrease in other non-current receivables		53,405	51,325
Proceeds from disposal of investments in associates		16,149	21,116
Proceeds from disposal of financial instruments		3,014	12,469
Proceeds from disposal of property, plant and equipment		79,602	442,030
Proceeds from disposal of intangible assets		20,074	2,637
Government grants received		348,053	15,946
Proceeds from transfer of business		6,861	-
Increase in other receivables		(169,916)	(535,972)
Increase in other non-current receivables		(114,705)	(42,135)
Acquisition of investments in associates and joint ventures		(47,170)	(34,992)
Acquisition of financial assets		(23,186)	(89,240)
Acquisition of property, plant and equipment		(6,238,203)	(4,219,355)
Acquisition of intangible assets		(252,288)	(110,281)
Business combination		(529)	(169,019)
Net cash outflow from investing activities		<u>(6,111,441)</u>	<u>(3,639,046)</u>
Cash flows from financing activities			
Proceeds from borrowings		3,987,118	2,989,606
Capital contribution from non-controlling interests		98,642	46,893
Repayments of borrowings		(1,301,205)	(748,112)
Dividends paid		(483,910)	(493,880)
Purchase of a subsidiary's treasury shares		-	(659)
Net cash inflow from financing activities		<u>2,300,645</u>	<u>1,793,848</u>
Net increase (decrease) in cash and cash equivalents		(689,695)	279,771
Cash and cash equivalents at the beginning of the year		2,513,702	2,249,341
Effects of exchange rate changes on cash and cash equivalents		64,624	(15,410)
Cash and cash equivalents at the end of the year in the consolidated statement of financial position		<u>1,888,631</u>	<u>2,513,702</u>

The above consolidated statements of cash flows should be read in conjunction with the accompanying notes.

LG Chem, Ltd. and Subsidiaries

Notes to the Consolidated Financial Statements

December 31, 2019 and 2018

1. General Information

1.1 The Parent Company

The Parent Company was spun off on April 1, 2001, from LG Chem Investment Ltd. (now LG Corp., formerly LG Chemical Ltd.).

As at December 31, 2019, the Parent Company has its manufacturing facilities in Yeosu, Daesan, Ochang, Cheongju, Ulsan, Naju, Iksan, Paju, Osong, Onsan and Gimcheon.

The Parent Company is authorized to issue 292 million shares of ordinary shares with par value of ₩ 5,000 per share. As at December 31, 2019, the Parent Company has issued and outstanding 70,592,343 ordinary shares (₩ 352,962 million) and 7,688,800 preferred shares (₩ 38,444 million). The largest shareholder of the Parent Company is LG Corp., which owns 33.34% of the Parent Company's ordinary shares. Preferred shareholders have no voting rights but are entitled to receive dividends at a rate 1% more than those paid to ordinary shareholders.

1.2 Business Overview

The Group is engaged in Petrochemicals, Energy solutions, and Advanced materials business, and also engaged in Life Sciences business acquired through a merger with LG Life Sciences, Ltd. in January 2017. In addition, the Parent Company acquired 100% shares of FarmHannong Co., Ltd., in April 2016, which is engaged to manufacture crop protection products, seeds, fertilizers and others.

The Petrochemical business includes production of olefin petrochemicals, such as ethylene, propylene, butadiene from Naphtha, and aromatic petrochemicals such as benzene. It also includes production of synthetic resin and synthetic components from olefin, and aromatic petrochemicals. This business bears characteristics of a large-volume process industry. The Group's major products are PE, PP, BPA, ABS, EP, PVC, plasticizers, acrylic, SAP, synthetic rubber, a special resin, and others.

The Energy solutions business manufactures and supplies batteries ranging from IT & New application batteries for mobile phones and laptop computers, to automotive batteries for electric vehicles and ESS batteries. Demand of small sized batteries for new applications such as electric tools and electric driving devices as well as traditional IT devices is increasing recently and the automotive battery business is also expected to expand rapidly due to an increasing demand of the batteries in associated with enhanced environment regulation in developed countries. Demand for ESS is expanding with an increasing importance of efficient usage of electricity and generation of renewable energy.

The Advanced material business manufactures and supplies various kinds of IT materials such as polarizer, automotive material, glass substrate, OLED film, semiconductor materials and display and battery materials for LCD Photoresist, OLED materials, battery materials and others and RO membranes, which will be the next growth engine for future.

The Life Sciences business manufactures and supplies pharmaceutical products, such as human growth hormone 'Eutropin', diabetes drug 'Zemiglo', bovine somatotropin 'Boostin', hyaluronic acid filler 'YVOIRE' and others, as well as fine chemical products, such as herbicide 'PYANCHOR' for rice farming and others.

LG Chem, Ltd. and Subsidiaries

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FarmHannong Co., Ltd., subsidiary of the Parent Company, manufactures and sells crop protection products, seeds, fertilizers and others. The crop protection business provides high value products such as environmentally-friendly pesticide. The fertilizer business leads developing a next generation fertilizers such as eco-friendly organic and functional fertilizers, and potting soil. The seed business puts priority on retaining various genetic resources and developing rare breeds with high profit in order to remain competitive in a future food industry.

1.3 Consolidated Subsidiaries, Associates and Joint Ventures

	2019			
	Percentage of ownership (%)	Business location	Closing month	Business activities
Consolidated subsidiaries				
Ningbo LG Yongxing Chemical Co., Ltd. ¹	75	China	December	ABS/SBL manufacturing and sales
Ningbo Zhenhai LG Yongxing Trade Co., Ltd. ¹	75	China	December	ABS sales
LG Chem America, Inc. ²	100	USA	December	Sales and trading
LG Chemical India Pvt. Ltd. ³	100	India	December	Synthetic resin manufacturing and sales
LG Polymers India Pvt. Ltd. ³	100	India	December	PS manufacturing and sales
LG Chemical (Guangzhou) Engineering Plastics Co., Ltd.	100	China	December	EP manufacturing and sales
LG Chem (Nanjing) Information & Electronics Materials Co., Ltd. ⁴	100	China	December	Battery/ Polarizer manufacturing and sales
LG Chem (Taiwan), Ltd.	100	Taiwan	December	Polarizer manufacturing and sales
LG Chem Display Materials (Beijing) Co., Ltd.	100	China	December	Polarizer manufacturing and sales
Tianjin LG Bohai Chemical Co., Ltd.	75	China	December	PVC, VCM, EDC manufacturing and sales
Tianjin LG BOTIAN Chemical Co., Ltd.	58	China	December	SBS manufacturing and sales
LG Chem (China) Investment Co., Ltd. ⁵	100	China	December	China holding company
LG Chem (Tianjin) Engineering Plastics Co., Ltd.	100	China	December	EP manufacturing and sales
LG Chem Europe GmbH	100	Germany	December	Sales and trading
LG Chem Poland Sp. z o.o.	100	Poland	December	EP manufacturing and sales
LG Chem Michigan Inc. ²	100	USA	December	Automotive battery research and manufacturing
LGC Petrochemical India Private Ltd.	100	India	December	Synthetic resin manufacturing and sales
HAENGBOKNURI CO., LTD.	100	Korea	December	Facility management and general cleaning
LG CHEM TK Kimya SANAYI VE TIC. Ltd. STI.	100	Turkey	December	Sales and trading
LG Chem Japan Co., Ltd.	100	Japan	December	Sales and trading
LG NanoH2O, LLC ²	100	USA	December	Water processing membrane sales
Nanjing LG Chem New Energy Battery Co., Ltd. ⁶	50	China	December	Automotive battery manufacturing and sales
LG Chem (Chongqing) Engineering Plastics Co., Ltd.	100	China	December	EP manufacturing and sales
LG Chem Wroclaw Energy sp. z o.o. ⁷	100	Poland	December	Automotive battery manufacturing and sales
LG Chem(HUIZHOU) Petrochemical Co., Ltd.	70	China	December	ABS manufacturing and sales
FarmHannong Co., Ltd. ⁸	100	Korea	December	Agricultural pesticide manufacturing and sales
Farm Hannong (Heilongjiang) Chemical Co., Ltd. ⁸	100	China	December	Agricultural pesticide manufacturing
LG Chem Life Sciences India Pvt. Ltd.	100	India	December	Pharmaceutical products sales
LG Chem Life Sciences (Beijing) Co., Ltd.	100	China	December	Pharmaceutical products sales
LG Chem Life Sciences (Thailand) Ltd.	100	Thailand	December	Pharmaceutical products sales
Farmhannong America, Inc. ⁸	100	USA	December	Agricultural pesticide sales
LG Chem Hai Phong Vietnam Co., Ltd.	100	Vietnam	December	Polarizer manufacturing and sales

LG Chem, Ltd. and Subsidiaries

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LG Chem Australia Pty Ltd.	100	Australia	December	ESS sales
LG Chem Mexico S.A. de C.V.	100	Mexico	December	Sales and trading
FarmHannong(Thailand) Ltd. ⁸	100	Thailand	December	Research and development on seeds
LG Chem Hai Phong engineering Plastics LLC.	100	Vietnam	December	EP manufacturing and sales
LG Chem (Guangzhou) Information & Electronics Materials Co.,Ltd. ⁹	100	China	December	Polarizer manufacturing and sales
LEYOU NEW ENERGY MATERIALS(WUXI) Co.,LTD ¹⁰	51	China	December	Battery materials manufacturing and sales
LG Chem Fund I LLC ¹¹	100	USA	December	Investments in venture companies
Ugimag Korea Co., Ltd ¹²	100	Korea	December	Electronic parts manufacturing and sales
Uniseal,Inc. ^{2,13}	100	USA	December	Adhesive manufacturing and sales
Uniseal Europe Ltd. ¹³	80	England	December	Adhesive manufacturing and sales
LG Chem Nanjing Energy Solution Co., Ltd. ¹⁴	100	China	December	Battery manufacturing and sales
LG Chem Life Science Innovation Center, Inc. ^{2,15}	100	USA	December	Pharmaceutical products research
FARMHANNONG(MALAYSIA) SDN. BHD. ^{8,16}	100	Malaysia	December	Agricultural pesticide licensing
Associates				
LG Holdings (HK) Ltd. ¹⁷	26	Hong Kong	December	Sales and trading
TECHWIN Co., Ltd.	21	Korea	December	Environment solution and construction of chemical plant
LG Chem BRASIL INTERMEDIACAO DE NEGOCIOS DO SETOR QUIMICO LTDA. ¹⁸	100	Brazil	December	Sales and trading
LG Chem Malaysia SDN.BHD. ¹⁸	100	Malaysia	December	Sales and trading
FJ Composite Material Co., Ltd.	33	Japan	May	Heat diffuser research and manufacturing
WUXI CL New Energy Technology Ltd.	30	China	December	ESS manufacturing and sales
LG Chem Life Sciences Poland Ltd. ¹⁸	100	Poland	December	Pharmaceutical products sales
Combustion Synthesis Co., Ltd.	30	Japan	December	Nitride-based ceramic powder production
HUAJIN NEW ENERGY MATERIALS(QUZHOU)CO., LTD. ¹⁹	49	China	December	Battery materials manufacturing and sales
VINFAST LITHIUM BATTERY PACK LLC. ²⁰	35	Vietnam	December	Battery manufacturing and sales
Joint ventures				
LG VINA Chemical Co., Ltd.	50	Vietnam	December	DOP production and sales
HL Greenpower Co., Ltd.	49	Korea	December	Automotive battery manufacturing and sales
SEETEC Co., Ltd.	50	Korea	December	Plant utility and distribution, research assistance service

¹ As at December 31, 2019, Ningbo LG Yongxing Chemical Co., Ltd. owns 100% of Ningbo Zhenhai LG Yongxing Trading Co., Ltd.'s shares.

² During the year ended December 31, 2019, the Parent Company acquired additional shares of LG Chem Michigan Inc. for ₩ 1,128 million. In addition, LG Chem Michigan Inc. owns 100% of LG Chem America, Inc., LG NanoH2O, Inc., Uniseal, Inc. and LG Chem Life Science Innovation Center, Inc. 's shares.

³ As at December 31, 2019, LG Chemical India Pvt. Ltd. owns 100% of LG Polymers India Pvt. Ltd.'s shares.

⁴ As at December 31, 2019, the Group acquired additional shares of LG Chem (Nanjing) Information & Electronics Materials Co.,Ltd. for ₩ 356,464 million.

⁵ During the year ended December 31, 2019, the Parent Company acquired additional shares of LG Chem (China) Investment Co.,Ltd. for ₩ 68,591 million.

⁶ Although the Parent Company owns less than 50% of the voting rights of Nanjing LG Chem New Energy Battery Co., Ltd., the Parent Company is considered to have control over the investee as the Parent Company can exercise the majority voting rights in its decision-making process in accordance with the shareholders' agreement.

⁷ During the year ended December 31, 2019, the Parent Company acquired additional shares of LG Chem Wroclaw Energy sp. z o.o for ₩ 800,800 million.

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- ⁸ As at December 31, 2019, FarmHannong Co., Ltd. owns 100% of Farm Hannong (Heilongjiang) Chemical Co., Ltd., Farmhannong America, Inc., FarmHannong(Thailand) Ltd., and FARMHANNONG(MALAYSIA) SDN.BHD.
- ⁹ During the year ended December 31, 2019, the Parent Company acquired additional shares of LG Chem (Guangzhou) Information & Electronics Materials Co.,Ltd. for ₩ 56,739 million.
- ¹⁰ During the year ended December 31, 2019, the Parent Company acquired additional shares of LEYOU NEW ENERGY MATERIALS(WUXI) Co.,LTD for ₩ 102,666 million.
- ¹¹ During the year ended December 31, 2019, The Parent Company acquired additional shares LG CHEM FUND I LLC for ₩ 16,182 million.
- ¹² During the year ended December 31, 2019, the Parent Company acquired additional shares of Ugimag Korea Co., Ltd for ₩ 4,500 million, and recognized ₩ 11,615 million of impairment losses.
- ¹³ Uniseal,Inc. holds 80% of Uniseal Europe Ltd.
- ¹⁴ During the year ended December 31, 2019, the Parent Company acquired additional shares of LG Chem Nanjing Energy Solution Co., Ltd. for ₩ 161,465 million.
- ¹⁵ LG Chem Life Science Innovation Center, Inc. was newly established during the year ended December 31, 2019, and the Group acquired 100% shares of LG Chem Life Science Innovation Center, Inc. for ₩ 1,128 million.
- ¹⁶ FARMHANNONG(MALAYSIA) SDN.BHD. was newly established during the year ended December 31, 2019, and the Group acquired 100% shares of FARMHANNONG(MALAYSIA) SDN.BHD. for ₩ 143 million.
- ¹⁷ During the year ended December 31, 2019, LG Holdings (HK) Ltd. has completed its equal capital reduction for ₩ 15,788 million.
- ¹⁸ Classified as an investment in associate due to its small size.
- ¹⁹ During the year ended December 31, 2019, the Parent Company acquired additional shares of HUAJIN NEW ENERGY MATERIALS(QUZHOU)CO., LTD for ₩ 41,202 million.
- ²⁰ VINFAST LITHIUM BATTERY PACK LLC. was newly established during the year ended December 31, 2019, and the Parent Company acquired 35% shares of VINFAST LITHIUM BATTERY PACK LLC. for ₩ 5,323 million.

1.4 Summarized Financial Information of Subsidiaries, Associates and Joint Ventures

Summarized financial information (before elimination of intercompany transactions and adjustments for differences in accounting policies) of subsidiaries, associates and joint ventures is as follows:

(in millions of Korean won)

	2019				
	Assets	Liabilities	Equity	Revenue	Profit (loss) for the period
Subsidiaries					
Ningbo LG Yongxing Chemical Co., Ltd.	781,530	174,627	606,903	1,788,258	137,332
Ningbo Zhenhai LG Yongxing Trade Co., Ltd.	5,956	1,472	4,484	19,640	462
LG Chem HK Ltd.	-	-	-	-	25
LG Chem America, Inc.	311,718	285,645	26,073	799,045	3,910
LG Chemical India Pvt. Ltd.	32,758	17	32,741	-	37
LG Polymers India Pvt. Ltd.	122,078	37,794	84,284	222,831	6,312
LG Chemical (Guangzhou) Engineering Plastics Co., Ltd.	103,530	42,832	60,698	206,281	10,063
LG Chem (Nanjing) Information & Electronics Materials Co., Ltd.	3,685,798	1,785,288	1,900,510	3,844,469	165,269
LG Chem (Taiwan), Ltd.	101,804	34,195	67,609	137,779	3,331
LG Chem Display Materials (Beijing) Co., Ltd.	41,729	11,486	30,243	93,218	5,155
Tianjin LG Bohai Chemical Co., Ltd.	244,047	81,853	162,194	512,294	52,738
Tianjin LG BOTIAN Chemical Co., Ltd.	43,473	28,726	14,747	146,675	11,383
LG Chem (China) Investment Co., Ltd.	934,186	630,040	304,146	64,873	40,099

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LG Chem (Tianjin) Engineering Plastics Co., Ltd.	45,380	7,448	37,932	65,895	(1,110)
LG Chem Europe GmbH	330,807	286,252	44,555	822,405	9,467
LG Chem Poland Sp. z o.o.	63,814	26,005	37,809	115,275	1,705
LG Chem Michigan Inc.	709,715	448,675	261,040	398,498	(37,766)
LGC Petrochemical India Private Ltd.	3,762	708	3,054	4,359	540
HAENGBOKNURI CO., LTD.	3,716	1,837	1,879	10,547	325
LG CHEM TK Kimya SANAYI VE TIC. Ltd. STI.	9,807	8,601	1,206	38,705	326
LG Chem Japan Co., Ltd.	5,638	1,138	4,500	6,528	574
LG NanoH2O, Inc. ¹	23,684	5,219	18,465	28,967	3,668
NanoH2O (Jiangsu) Water Processing Technology Co. Ltd.	-	-	-	-	1,350
Nanjing LG Chem New Energy Battery Co., Ltd.	1,002,457	845,483	156,974	1,163,760	33,573
LG Chem (Chongqing) Engineering Plastics Co., Ltd.	33,009	10,480	22,529	35,333	(2,328)
LG Chem Wroclaw Energy sp. z o.o.	4,330,353	3,211,121	1,119,232	2,285,190	(202,085)
LG Chem(HUIZHOU) Petrochemical Co., Ltd.	364,406	288,234	76,172	595,646	(1,481)
FarmHannong Co., Ltd. ^{1, 2}	1,022,865	652,462	370,403	590,412	(19,510)
LG Chem Life Sciences India Pvt. Ltd.	2,774	3,322	(548)	6,940	(652)
LG Chem Life Sciences (Beijing) Co., Ltd.	1,878	585	1,293	1,398	79
LG Chem Life Sciences (Thailand) Ltd.	26,245	15,190	11,055	40,645	4,534
LG Chem Hai Phong Vietnam Co., Ltd.	17,152	10,502	6,650	36,292	1,958
LG Chem Australia Pty Ltd.	2,595	1,471	1,124	2,884	422
LG Chem Mexico S.A. de C.V.	930	152	778	1,434	213
LG Chem Hai Phong engineering Plastics LLC.	22,794	9,053	13,741	3,470	(2,325)
LG Chem (Guangzhou) Information & electronics Materials Co.,Ltd.	570,429	402,793	167,636	238,179	(17,884)
LEYOU NEW ENERGY MATERIALS(WUXI) Co.,LTD	348,722	54,207	294,515	-	900
LG Chem Fund I LLC	18,317	63	18,254	-	(3,491)
Ugimag Korea Co., Ltd ¹	39,082	32,563	6,519	21,110	(7,109)
Uniseal, Inc. ^{1, 2}	36,013	6,218	29,795	62,650	1,862
LG Chem Nanjing Energy Solution Co., Ltd.	807,952	550,770	257,182	8,365	(13,643)
LG Chem Life Science Innovation Center, Inc.	3,558	2,281	1,277	2,467	123
Associates					
LG Holdings (HK) Ltd.	196,270	40,724	155,546	49,483	15,356
TECHWIN Co., Ltd.	173,997	81,803	92,194	284,209	35,430
LG Chem BRASIL INTERMEDIACAO DE NEGOCIOS DO SETOR QUIMICO LTDA.	410	108	302	1,730	229
LG Chem Malaysia SDN.BHD.	409	2	407	858	104
LG Fuel Cell Systems Inc.	-	-	-	265	(3,714)
FJ Composite Material Co., Ltd.	8,393	4,692	3,701	1,228	169
WUXI CL New Energy Technology Ltd.	3,701	4,617	(916)	(2,306)	(5,385)
LG Chem Life Sciences Poland Ltd.	178	87	91	261	18
Combustion Synthesis Co., Ltd.	971	79	892	58	(696)
HUAJIN NEW ENERGY MATERIALS(QUZHOU)CO., LTD.	203,635	66,725	136,910	-	508
VINFAST LITHIUM BATTERY PACK LLC.	28,283	14,413	13,870	5,652	(544)
Joint ventures					
LG VINA Chemical Co., Ltd.	34,259	27,559	6,700	54,935	(623)
HL Greenpower Co., Ltd.	401,313	353,936	47,377	1,086,634	5,427
SEETEC Co., Ltd.	351,935	59,732	292,203	596,824	13,959

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¹ Fair value adjustments due to business combination recorded in the consolidated financial statements are not included in the above information.

²Included its subsidiaries' financial information from an intermediate parent perspective.

(in millions of Korean won)

	2018				
	Assets	Liabilities	Equity	Revenue	Profit (loss) for the year
Subsidiaries					
Ningbo LG Yongxing Chemical Co., Ltd.	759,966	204,733	555,233	2,085,097	137,434
Ningbo Zhenhai LG Yongxing Trade Co., Ltd.	5,599	1,642	3,957	23,230	495
LG Chem HK Ltd.	17,884	42	17,842	328,009	29
LG Chem America, Inc.	225,686	204,163	21,523	828,900	1,167
LG Chemical India Pvt. Ltd.	32,705	19	32,686	-	30
LG Polymers India Pvt. Ltd.	118,542	41,852	76,690	246,369	799
LG Chemical (Guangzhou) Engineering Plastics Co., Ltd.	95,906	46,013	49,893	223,231	(15,180)
LG Chem (Nanjing) Information & Electronics Materials Co., Ltd.	3,073,898	1,706,052	1,367,846	3,319,589	(17,786)
LG Chem (Taiwan), Ltd.	129,680	63,300	66,380	170,550	5,952
LG Chem Display Materials (Beijing) Co., Ltd.	44,617	18,580	26,037	84,610	1,493
Tianjin LG Bohai Chemical Co., Ltd.	281,710	173,408	108,302	548,895	19,487
Tianjin LG BOTIAN Chemical Co., Ltd.	45,562	42,030	3,532	152,638	1,402
LG Chem (China) Investment Co., Ltd.	405,664	174,737	230,927	58,958	4,112
LG Chem (Tianjin) Engineering Plastics Co., Ltd.	60,467	22,165	38,302	89,708	(7,267)
LG Chem Europe GmbH	336,761	302,034	34,727	699,445	5,620
LG Chem Poland Sp. z o.o.	75,187	39,958	35,229	126,760	2,316
LG Chem Michigan Inc.	675,367	377,280	298,087	325,578	12,140
LGC Petrochemical India Private Ltd.	2,950	463	2,487	4,273	469
HAENGBOKNURI CO., LTD.	2,755	1,201	1,554	8,762	248
LG CHEM TK Kimya SANAYI VE TIC. Ltd. STI.	7,757	6,791	966	34,426	(151)
LG Chem Japan Co., Ltd.	4,261	518	3,743	5,640	540
LG NanoH2O, Inc. ¹	19,577	5,255	14,322	26,482	4,577
NanoH2O (Jiangsu) Water Processing Technology Co. Ltd.	4,155	1,167	2,988	-	78
Nanjing LG Chem New Energy Battery Co., Ltd.	786,416	664,865	121,551	643,405	19,788
LG Chem (Chongqing) Engineering Plastics Co., Ltd.	35,967	11,599	24,368	38,068	(5,062)
LG Chem Wroclaw Energy sp. z o.o.	1,555,511	1,056,111	499,400	472,019	(82,867)
LG Chem(HUIZHOU) Petrochemical Co., Ltd.	287,824	211,589	76,235	407,812	(5,803)
FarmHannong Co., Ltd. ^{1, 2}	1,075,222	687,757	387,465	599,756	(49,988)
LG Chem Life Sciences India Pvt. Ltd.	4,164	4,056	108	10,299	(1,989)
LG Chem Life Sciences (Beijing) Co., Ltd.	1,237	44	1,193	1,119	25
LG Chem Life Sciences (Thailand) Ltd.	17,432	11,799	5,633	27,548	2,017
LG Chem Hai Phong Vietnam Co. Ltd.	23,134	18,420	4,714	27,050	1,378
LG Chem Australia Pty Ltd.	768	85	683	1,677	176
LG Chem Mexico S.A. de C.V.	646	99	547	904	138
LG Chem Hai Phong engineering Plastics Ltd.	15,574	115	15,459	-	(176)
LG Chem (Guangzhou) Information & electronics Materials Co.,Ltd.	147,413	20,119	127,294	-	1,825
LEYOU NEW ENERGY MATERIALS(WUXI) Co.,LTD	106,817	11,904	94,913	-	249
LG Chem Fund I LLC	5,598	-	5,598	-	(2,238)
Ugimag Korea Co., Ltd ¹	40,344	31,214	9,130	4,206	(2,275)
Uniseal, Inc. ^{1, 2}	38,503	11,596	26,907	15,694	38
LG Chem Nanjing Energy Solution Co., Ltd.	131,144	20,293	110,851	-	(2,109)

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Associates

LG Holdings (HK) Ltd.	245,651	42,181	203,470	49,373	15,495
TECWIN Co., Ltd.	79,106	32,206	46,900	106,404	8,619
LG Chem BRASIL INTERMEDIACAO DE NEGOCIOS DO SETOR QUIMICO LTDA.	172	93	79	1,599	44
LG Chem Malaysia SDN.BHD.	305	17	288	633	44
LG Fuel Cell Systems Inc.	11,845	5,182	6,663	7,897	(53,409)
FJ Composite Material Co., Ltd.	6,393	2,916	3,477	2,029	(238)
WUXI CL New Energy Technology Ltd.	6,714	2,407	4,307	-	(747)
LG Chem Life Sciences Poland Ltd.	158	155	3	221	10
Combustion Synthesis Co., Ltd.	991	28	963	104	(492)
HUAJIN NEW ENERGY MATERIALS(QUZHOU)CO., LTD.	55,749	2,444	53,305	-	570

Joint ventures

LG VINA Chemical Co., Ltd.	28,668	19,862	8,806	60,755	597
HL Greenpower Co., Ltd.	314,328	274,399	39,929	418,871	2,049
SEETEC Co., Ltd.	346,423	48,187	298,236	529,680	18,738

¹ Fair value adjustments due to business combination recorded in the consolidated financial statements are not included in the above information.

² Represent financial information of intermediate parent company consolidating its subsidiaries.

1.5 Changes in Scope for Consolidation

Subsidiaries newly included in the consolidation for the year ended December 31, 2019, are as follows:

Subsidiary	Reason
LG Chem Life Science Innovation Center, Inc.	Newly established
FARMHANNONG(MALAYSIA) SDN. BHD.	Newly established

Subsidiaries excluded from the consolidation for the year ended December 31, 2019, are as follows:

Subsidiary	Reason
LG Chem HK Ltd.	Liquidated
NanoH2O (Jiangsu) Water Processing Technology Co. Ltd.	Liquidated

LG Chem, Ltd. and Subsidiaries

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2. Summary of Significant Accounting Policies

The principal accounting policies applied in the preparation of these consolidated financial statements are set out below. These policies have been consistently applied to all the years presented, unless otherwise stated.

2.1 Basis of Preparation

The Group maintains its accounting records in Korean won and prepares statutory financial statements in the Korean language (Hangul) in accordance with International Financial Reporting Standards as adopted by the Republic of Korea (Korean IFRS). The accompanying consolidated financial statements have been condensed, restructured and translated into English from the Korean language financial statements.

The consolidated financial statements of the Group have been prepared in accordance with Korean IFRS. These are the standards, subsequent amendments and related interpretations issued by the International Accounting Standards Board (IASB) that have been adopted by the Republic of Korea.

The financial statements have been prepared on a historical cost basis, except for the following:

- Certain financial assets and liabilities (including derivative instruments) - measured at fair value
- assets held for sale – measured at fair value less costs to sell, and
- defined benefit pension plans – plan assets measured at fair value.

The preparation of financial statements requires the use of critical accounting estimates. Management also needs to exercise judgement in applying the Group's accounting policies. The areas involving a higher degree of judgment or complexity, or areas where assumptions and estimates are significant to the consolidated financial statements are disclosed in Note 4.

2.2 Changes in Accounting Policy and Disclosures

(a) New and amended standards adopted by the Group

The Group has applied the following standards and amendments for the first time for their annual reporting period commencing January 1, 2019.

- Enactment of Korean IFRS 1116 *Leases*

Under the new standard, with implementation of a single lease model, lessee is required to recognize assets and liabilities for all lease which lease term is over 12 months and underlying assets are not low value assets. A lessee is required to recognize a right-of-use asset and a lease liability representing its obligation to make lease payments.

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With implementation of Korean IFRS 1116 Lease, the Group has changed accounting policy. The Group has adopted Korean IFRS 1116 retrospectively, as permitted under the specific transitional provisions in the standard, and recognized the cumulative impact of initially applying the standard as at January 1, 2019, the date of initial application. The Group has not restated comparatives for the 2018 reporting period. The impact of the adoption of the leasing standard and the new accounting policies are disclosed in Note 11.

- Amendment to Korean IFRS 1109 *Financial Instruments – Prepayment Features with Negative Compensation*

The narrow-scope amendments made to Korean IFRS 1109 Financial Instruments enable entities to measure certain prepayable financial assets with negative compensation at amortized cost. When a modification of a financial liability measured at amortized cost that does not result in the derecognition, a modification gain or loss shall be recognized in profit or loss. The amendment does not have a significant impact on the financial statements.

- Amendments to Korean IFRS 1019 *Employee Benefits – Amendment, Curtailment or Settlement of the Plan*

The amendments require that an entity shall calculate current service cost and net interest for the remainder of the reporting period after a plan amendment, curtailment or settlement based on updated actuarial assumptions from the date of the change. The amendments also require that a reduction in a surplus must be recognized in profit or loss even if that surplus was not previously recognized because of the impact of the asset ceiling. The amendment does not have a significant impact on the financial statements.

- Amendments to Korean IFRS 1028 *Investments in Associates and Joint Ventures – Long-term Interests in Associates and Joint Ventures*

The amendments clarify that an entity shall apply Korean IFRS 1109 to financial instruments in an associate or joint venture to which the equity method is not applied. These include long-term interests that, in substance, form part of the entity's net investment in an associate or joint venture. The amendment does not have a significant impact on the financial statements.

- Enactment to Interpretation of Korean IFRS 2123 *Uncertainty over Income Tax Treatments*

The Interpretation explains how to recognize and measure deferred and current income tax assets and liabilities where there is uncertainty over a tax treatment, and includes guidance on how to determine whether each uncertain tax treatment is considered separately or together. It also presents examples of circumstances where a judgement or estimate is required to be reassessed. The amendment does not have a significant impact on the financial statements.

- Annual Improvements to *Korean IFRS 2015 – 2017 Cycle*:

- Amendments to Korean IFRS 1103 *Business Combination*

The amendments clarify that when a party to a joint arrangement obtains control of a business that is a joint operation, and had rights to the assets and obligations for the liabilities relating to that joint operation immediately before the acquisition date, the transaction is a business combination achieved in stages. In such cases, the acquirer shall remeasure its entire previously held interest in the joint operation. The amendment does not have a significant impact on the financial statements.

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- Amendments to Korean IFRS 1111 *Joint Agreements*

The amendments clarify that when a party that participates in, but does not have joint control of, a joint operation might obtain joint control of the joint operation in which the activity of the joint operation constitutes a business. In such cases, previously held interests in the joint operation are not remeasured. The amendment does not have a significant impact on the financial statements.

- Amendments to Paragraph 57A of Korean IFRS 1012 *Income Tax*

The amendment is applied to all the income tax consequences of dividends and requires an entity to recognize the income tax consequences of dividends in profit or loss, other comprehensive income or equity according to where the entity originally recognized those past transactions or events. The amendment does not have a significant impact on the financial statements.

- Korean IFRS 1023 *Borrowing Costs*

The amendments clarify that if a specific borrowing remains outstanding after the related qualifying asset is ready for its intended use (or sale), it becomes part of general borrowings. The amendment does not have a significant impact on the financial statements.

(b) New standards and interpretations not yet adopted by the Group

The following new accounting standards and interpretations have been published that are not mandatory for December 31, 2019 reporting periods and have not been early adopted by the Group.

- Amendments to Korean IFRS 1001 *Presentation of Financial Statements and Korean IFRS 1008 Accounting policies, changes in accounting estimates and errors – Definition of Material*

The amendments clarify the explanation of the definition of material and amended Korean IFRS 1001 and Korean IFRS 1008 in accordance with the clarified definitions. Materiality is assessed by reference to omission or misstatement of material information as well as effects of immaterial information, and to the nature of the users when determining the information to be disclosed by the Group. These amendments should be applied for annual periods beginning on or after January 1, 2020, and earlier application of permitted. The Group does not expect that these amendments have a significant impact on the financial statements.

- Amendments to Korean IFRS 1103 *Business Combination – Definition of a Business*

To consider the integration of the required activities and assets as a business, the amended definition of a business requires an acquisition to include an input and a substantive process that together significantly contribute to the ability to create outputs and excludes economic benefits from the lower costs. An entity can apply a concentration test, an optional test, where substantially all of the fair value of gross assets acquired is concentrated in a single asset or a group of similar assets, the assets acquired would not represent a business. These amendments should be applied for annual periods beginning on or after January 1, 2020, and earlier application of permitted. The Group does not expect that these amendments have a significant impact on the financial statements.

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2.3 Consolidation

The Group has prepared the consolidated financial statements in accordance with Korean IFRS 1110 *Consolidated Financial Statements*.

(a) Subsidiaries

Subsidiaries are all entities over which the Group has control. The Group controls an entity when the Group is exposed to, or has rights to, variable returns from its involvement with the entity and has the ability to affect those returns through its power to direct the activities of the entity. Subsidiaries are fully consolidated from the date on which control is transferred to the Group. They are deconsolidated from the date that control ceases.

The acquisition method of accounting is used to account for business combinations by the Group. The consideration transferred is measured at the fair values of the assets transferred, and identifiable assets acquired and liabilities and contingent liabilities assumed in a business combination are measured initially at their fair values at the acquisition date. The Group recognizes any non-controlling interest in the acquired entity on an acquisition-by-acquisition basis either at fair value or at the non-controlling interest's proportionate share of the acquired entity's net identifiable assets. All other non-controlling interests are measured at fair values, unless otherwise required by other standards. Acquisition-related costs are expensed as incurred.

The excess of consideration transferred, amount of any non-controlling interest in the acquired entity and acquisition-date fair value of any previous equity interest in the acquired entity over the fair value of the net identifiable assets acquired is recoded as goodwill. If those amounts are less than the fair value of the net identifiable assets of the business acquired, the difference is recognized directly in the profit or loss as a bargain purchase.

Intercompany transactions, balances and unrealized gains on transactions between group companies are eliminated. Unrealized losses are also eliminated unless the transaction provides evidence of an impairment of the transferred asset. Accounting policies of subsidiaries have been changed where necessary to ensure consistency with the policies adopted by the Group.

(b) Associates

Associates are entities over which the Group has significant influence but not control or joint control. Investments in associates are accounted for using the equity method of accounting, after initially being recognized at cost. Unrealized gains on transactions between the Group and its associates are eliminated to the extent of the Group's interest in the associates. If there is objective evidence of impairment for the investment in the associate, the Group recognizes the difference between the recoverable amount of the associate and its carrying amount as impairment loss.

(c) Joint Arrangements

A joint arrangement, wherein two or more parties have joint control, is classified as either a joint operation or a joint venture. A joint operator recognizes its direct right to the assets, liabilities, revenues and expenses of joint operations and its share of any jointly held or incurred assets, liabilities, revenues and expenses. Interests in joint ventures are accounted for using the equity method, after initially being recognized at cost in the consolidated statement of financial position.

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2.4 Segment Reporting

Information of each operating segment is reported in a manner consistent with the business segment reporting provided to the chief operating decision-maker (Note 33). The chief operating decision-maker, who is responsible for allocating resources and assessing performance of the operating segments, has been identified as the Corporate Management Committee that makes strategic decisions.

2.5 Foreign Currency Translation

(a) Functional and presentation currency

Items included in the financial statements of each of the Group's entities are measured using the currency of the primary economic environment in which each entity operates (the "functional currency"). The consolidated financial statements are presented in Korean won, which is the Parent Company's functional and presentation currency.

(b) Transactions and balances

Foreign currency transactions are translated into the functional currency using the exchange rates at the dates of the transactions. Foreign exchange gains and losses resulting from the settlement of such transactions and from the translation of monetary assets and liabilities denominated in foreign currencies at year end exchange rates are generally recognized in profit or loss. They are recognized in other comprehensive income if they relate to qualifying cash flow hedges and qualifying effective portion of net investment hedges, or are attributable to monetary part of the net investment in a foreign operation.

Foreign exchange gains and losses that relate to borrowings are presented in the statement of profit or loss, within finance costs. All other foreign exchange gains and losses are presented in the statement of profit or loss within 'other income or other expenses'.

Translation differences on equities held at fair value through other comprehensive income are recognized in other comprehensive income.

(c) Translation into the presentation currency

The results and financial position of foreign operations that have a functional currency different from the presentation currency are translated into the presentation currency as follows:

- i) assets and liabilities for each statement of financial position presented are translated at the closing rate at the end of the reporting period;
- ii) income and expenses for each statement of income are translated at monthly average exchange rates; and
- iii) equity is translated at the historical exchange rate; and
- iv) all resulting exchange differences are recognized in other comprehensive income.

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2.6 Cash and Cash Equivalents

Cash and cash equivalents include cash in hand, deposits held at call with banks, other short-term highly liquid investments with original maturities of three months or less.

2.7 Financial Assets

(a) Classification

The Group classifies its financial assets in the following measurement categories:

- those to be measured subsequently at fair value through (either through other comprehensive income, or through profit or loss), and
- those to be measured at amortized cost.

The classification depends on the Group's business model for managing the financial assets and the contractual terms of the cash flows.

For financial assets measured at fair value, gains and losses will either be recorded in profit or loss or other comprehensive income. For investments in debt instruments, this will depend on the business model in which the investment is held. The Group reclassifies debt investments when, and only when its business model for managing those assets changes.

For investments in equity instruments that are not held for trading, this will depend on whether the Group has made an irrevocable election at the time of initial recognition to account for the equity investment at fair value through other comprehensive income.

(b) Measurement

At initial recognition, the Group measures a financial asset at its fair value plus, in the case of a financial asset not at fair value through profit or loss, transaction costs that are directly attributable to the acquisition of the financial asset. Transaction costs of financial assets carried at fair value through profit or loss are expensed in profit or loss. Financial assets with embedded derivatives are considered in their entirety when determining whether their cash flows are solely payment of principal and interest.

A. Debt instruments

Subsequent measurement of debt instruments depends on the Group's business model for managing the asset and the cash flow characteristics of the asset. The Group classifies its debt instruments into one of the following three measurement categories:

- **Amortized cost:**
Assets that are held for collection of contractual cash flows where those cash flows represent solely payments of principal and interest are measured at amortized cost. A gain or loss on a debt investment that is subsequently measured at amortized cost and is not part of a hedging relationship is recognized in profit or loss when the asset is derecognized or impaired. Interest income from these financial assets is included in 'finance income' using the effective interest rate method.

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- Fair value through other comprehensive income:
Assets that are held for collection of contractual cash flows and for selling the financial assets, where the assets' cash flows represent solely payments of principal and interest, are measured at fair value through other comprehensive income. Movements in the carrying amount are taken through other comprehensive income, except for the recognition of impairment loss (reversal of impairment loss), interest income and foreign exchange gains and losses which are recognized in profit or loss. When the financial asset is derecognized, the cumulative gain or loss previously recognized in other comprehensive income is reclassified from equity to profit or loss. Interest income from these financial assets is included in 'finance income' using the effective interest rate method. Foreign exchange gains and losses are presented in 'finance income / costs or other non-operating income / expenses' and impairment losses are presented in 'other non-operating expenses'.
- Fair value through profit or loss:
Assets that do not meet the criteria for amortized cost or fair value through other comprehensive income are measured at fair value through profit or loss. A gain or loss on a debt investment that is subsequently measured at fair value through profit or loss and is not part of a hedging relationship is recognized in profit or loss and presented net in the statement of profit or loss within 'finance income / costs or other non-operating income / expenses' in the year in which it arises.

B. Equity instruments

The Group subsequently measures all equity investments at fair value. Where the Group's management has elected to present fair value gains and losses on equity investments in other comprehensive income, there is no subsequent reclassification of fair value gains and losses to profit or loss following the derecognition of the investment. Dividend income from such investments continue to be recognized in profit or loss as 'finance income' when the right to receive payments is established. Changes in the fair value of financial assets at fair value through profit or loss are recognized in 'financial income or expenses' in the statement of profit or loss as applicable. Impairment loss (reversal of impairment loss) on equity investments measured at fair value through other comprehensive income are not reported separately from other changes in fair value.

(c) Impairment

The Group assesses on a forward looking basis the expected credit losses associated with its debt instruments carried at amortized cost and fair value through other comprehensive income. The impairment methodology applied depends on whether there has been a significant increase in credit risk. For trade receivables, the Group applies the simplified approach, which requires expected lifetime credit losses to be recognized from initial recognition of the receivables.

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(d) Recognition and Derecognition

Regular way purchases and sales of financial assets are recognized or derecognized on trade-date, the date on which the Group commits to purchase or sell the asset. Financial assets are derecognized when the rights to receive cash flows from the financial assets have expired or have been transferred and the Group has transferred substantially all the risks and rewards of ownership.

If a transfer does not result in derecognition because the Group has retained substantially all the risks and rewards of ownership of the transferred asset, the Group continues to recognize the transferred asset in its entirety and recognizes a financial liability for the consideration received. The Group classified the financial liability as 'borrowings' in the statement of financial position.

2.8 Derivative Financial Instruments

Derivatives are initially recognized at fair value on the date a derivative contract is entered into and are subsequently remeasured to their fair value at the end of each reporting period. The accounting for subsequent changes in fair value depends on whether the derivative is designated as a hedging instrument, and if so, the nature of the item being hedged. The Group has hedge relationships and designates certain derivatives as either:

- hedges of the fair value of recognized assets or liabilities or a firm commitment (fair value hedges)
- hedges of a particular risk associated with the cash flows of recognized assets and liabilities and highly probable forecast transactions (cash flow hedges), or
- hedges of a net investment in a foreign operation (net investment hedges)

At inception of the hedge relationship, the Group documents the economic relationship between hedging instruments and hedged items including whether changes in the cash flows of the hedging instruments are expected to offset changes in the cash flows of hedged items.

The full fair value of a hedging derivative is classified as a non-current asset or liability when the remaining maturity of the hedged item is more than 12 months; it is classified as a current asset or liability when the remaining maturity of the hedged item is less than 12 months. A non-derivative financial asset and a non-derivative financial liability is classified as a current or non-current based on its expected maturity and its settlement, respectively.

Cash flow hedge

The effective portion of changes in the fair value of derivatives that are designated and qualify as cash flow hedges is recognized in the cash flow hedge reserve within equity, limited to the cumulative change in fair value (present value) of the hedged item (the present value of the cumulative change in the future expected cash flows of the hedged item) from the inception of the hedge. The ineffective portion is recognized in 'other non-operating income (expenses)'.

When option contracts are used to hedge forecast transactions, the Group designates only the intrinsic value of the option contract as the hedging instrument. Gains or losses relating to the effective portion of the change in intrinsic value of the option contracts are recognized in the cash flow hedge reserve within equity. The changes in the time value of the option contracts that relate to the hedged item ('aligned time value') are recognized within the costs of hedging in other comprehensive income within equity.

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When forward contracts are used to hedge forecast transactions, the Group generally designates only the change in fair value of the forward contract related to the spot element as the hedging instrument. Gains or losses relating to the effective portion of the change in the spot element of the forward contracts are recognized in the cash flow hedge reserve within equity. The change in the forward element of the contract that relates to the hedged item is recognized within other comprehensive income within equity. In some cases, the Group may designate the full change in fair value of the forward contract (including forward points) as the hedging instrument. In such cases, the gains or losses relating to the effective portion of the change in fair value of the entire forward contract are recognized in the cash flow hedge reserve within equity.

Amounts accumulated in equity are reclassified in the periods when the hedged item affects profit or loss, as follows:

- Where the hedged item subsequently results in the recognition of a non-financial asset (such as inventory), both the deferred hedging gains and losses and the deferred time value of the option contracts or deferred forward points, if any, are included within the initial cost of the asset. The deferred amounts are ultimately recognized in profit or loss as the hedged item affects profit or loss (for example through cost of sales).
- The gain or loss relating to the effective portion of the interest rate swaps hedging variable rate borrowings is recognized in profit or loss within 'finance cost' at the same time as the interest expense on the hedged borrowings.

When a hedging instrument expires, or is sold, terminated, exercised, or when a hedge no longer meets the criteria for hedge accounting, any accumulated cash flow hedge reserve at that time remains in equity until the forecast transaction occurs, resulting in the recognition of a non-financial asset such as inventory. When the forecast transaction is no longer expected to occur, the cash flow hedge reserve and deferred costs of hedging that were reported in equity are immediately reclassified to profit or loss.

Changes in the fair value of any derivative instrument that does not qualify for hedge accounting are recognized immediately in profit or loss within 'other non-operating income (expenses)' or 'finance income (costs)' based on the nature of transactions.

2.9 Trade Receivables

At initial recognition, trade receivables are measured at the amount of unconditional consideration, unless the trade receivables contain a significant financing component. Trade receivables are subsequently measured at amortized cost using the effective interest method, less loss allowance.

2.10 Inventories

Inventories are stated at the lower of cost and net realizable value. Cost is determined using weighted average cost method, except for goods in transit which is determined using the specific identification method.

2.11 Assets Held for sale

Assets are classified as held for sale when their carrying amount will be recovered principally through a sale transaction rather than through continuing use and a sale is considered highly probable. The assets are measured at the lower amount between their carrying amount and the fair value less costs to sell.

2.12 Property, Plant and Equipment

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Property, plant and equipment are stated at historical cost less accumulated depreciation and accumulated impairment losses. Historical cost includes expenditure that is directly attributable to the acquisition of the items.

Depreciation of all property, plant and equipment, except for land, is calculated using the straight-line method to allocate their cost or revalued amounts, net of their residual values, over their estimated useful lives as follows:

	Useful lives
Buildings	25 - 50 years
Structures	15 - 50 years
Machinery	4 - 15 years
Others	1 - 15 years

The assets' depreciation method, residual values and useful lives are reviewed, and adjusted if appropriate, at the end of each reporting period.

2.13 Investment Property

Investment property is property held to earn rentals or for capital appreciation or both. An investment property is measured initially at its cost. An investment property is measured after initial measurement at depreciated cost (less any accumulated impairment losses). The Group depreciates investment properties, except for land, using the straight-line method over their useful lives of 25 ~ 50 years.

2.14 Borrowing Costs

General and specific borrowing costs that are directly attributable to the acquisition, construction or production of a qualifying asset are capitalized during the period of time that is required to complete and prepare the asset for its intended use or sale. Investment income earned on the temporary investment of specific borrowings pending their expenditure on qualifying assets is deducted from the borrowing costs eligible for capitalization. Other borrowing costs are expensed in the period in which they are incurred.

2.15 Government Grants

Grants from the government are recognized at their fair value where there is a reasonable assurance that the grant will be received and the Group will comply with all attached conditions. Government grants related to assets are presented in the statement of financial position by deducting the grant in arriving at the carrying amount of the asset, and government grants related to income are deferred and later deducted from the related expense.

2.16 Intangible Assets

The excess of consideration transferred and amount of acquisition-date fair value of any previous equity interest in the acquired entity over the fair value of the net identifiable assets acquired is recorded as goodwill. Goodwill is carried at its cost less accumulated impairment losses. Impairment losses on goodwill are not reversed.

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Intangible assets, except for goodwill, are initially recognized at its historical cost and carried at its cost less accumulated amortization and accumulated impairment losses.

Development costs that are directly attributable to internally generated by the Group are recognized when the criteria; such as, technically feasible, generate probable future economic benefits and other, are met. Membership rights that have an indefinite useful life are not subject to amortization because there is no foreseeable limit to the period over which the assets are expected to be utilized. The Group amortizes intangible assets with a limited useful life using the straight-line method over the following periods:

	Useful lives
Development costs	3 - 15 years
Industrial property rights	5 - 15 years
Others	6 - 20 years

2.17 Research and Development

Costs associated with research are recognized as an expense as incurred. Costs that are identifiable, controllable and directly attributable to development projects are recognized as intangible asset when the following criteria are met:

- It is technically feasible to complete the development project so that it will be available for use;
- Management intends to complete the development project for its own use or selling;
- There is an ability to use or sell the development project;
- It can be demonstrated how the development project will generate probable future economic benefits;
- Adequate technical, financial resources and other resources to complete the development and to use or sell the development project are available; and
- The expenditure attributable to the development project during its development can be reliably measured.

Generally, internally generated development projects have the following stages; formulation and selection of a project, verification of idea and technology, development and testing, decision of commercialization, test of final application. Expenditures can be capitalized as intangible assets only after the decision of commercialization. Expenditures incurred in other stages are recognized as expenses on the research phase.

Internally generated development projects in the Life Sciences business have the following stages; formulation of potential candidates, preclinical research, clinical researches such as phase 1, 2 and 3 trials, approval of regulatory body and new product launch. Expenditures incurred from new drug development project are recognized as expensed on the research phase. However, expenditures incurred during clinical phase 1~3 trials from development projects for generic drugs or biosimilars are recognized as intangible assets depending on the nature of the products.

Expenditures incurred from technology license agreement with the third parties are recognized as intangible assets.

Development costs previously recognized as an expense are not recognized as an asset in a subsequent period. Capitalized development costs that are recognized as intangible assets are amortized using the straight-line method over their estimated useful lives when the assets are available for use and are tested for impairment.

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2.18 Impairment of Non-financial Assets

Goodwill and intangible assets that have an indefinite useful life are not subject to amortization and are tested annually for impairment, or more frequently if events or changes in circumstances indicate that they might be impaired. Other assets are tested for impairment whenever events or changes in circumstances indicate that the carrying amount may not be recoverable. An impairment loss is recognized for the amount by which the asset's carrying amount exceeds its recoverable amount. The recoverable amount is the higher of an asset's fair value less costs of disposal and value in use. Non-financial assets other than goodwill that suffered an impairment are reviewed for possible reversal of the impairment at the end of each reporting period.

2.19 Trade and Other Payables

Trade and other payables represent unpaid liabilities for goods and services provided to the Group prior to the end of reporting period. Trade and other payables are presented as current liabilities, unless payment is due after 12 months from the end of reporting period. They are recognized initially at their fair value and subsequently measured at amortized cost using the effective interest method.

2.20 Financial Liabilities

(a) Classification and measurement

The Group's financial liabilities at fair value through profit or loss are financial instruments held for trading. A financial liability is held for trading if it is incurred principally for the purpose of repurchasing in the near term. A derivative that is not a designated as hedging instruments and an embedded derivative that is separated are also classified as held for trading.

The Group classifies non-derivative financial liabilities, except for financial liabilities at fair value through profit or loss, financial guarantee contracts and financial liabilities that arise when a transfer of financial assets does not qualify for derecognition, as financial liabilities carried at amortized cost and present as 'trade payables', 'borrowings', and 'other payables' in the statement of financial position.

(b) Derecognition

Financial liability is removed from the statement of financial position when, and only when, the obligation specified in the contract is discharged or cancelled or expired or when the terms of an existing financial liability are substantially modified. The difference between the carrying amount of a financial liability extinguished or transferred to another party and the consideration paid (including any non-cash assets transferred or liabilities assumed) is recognized in profit or loss.

2.21 Financial Guarantee Contracts

Financial guarantee contract is recognized as a financial liability at the time the guarantee is issued. The liability is initially measured at fair value, subsequently recognized in the statement of financial position within 'other financial liabilities' at the higher of the following.

- the amount determined in accordance with the expected credit loss model under Korean IFRS 1109 *Financial Instruments* and
- the amount initially recognized less, where appropriate, the cumulative amount of income recognized in accordance with Korean IFRS 1115 *Revenue from Contracts with Customers*

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2.22 Compound Financial Instruments

Compound financial instruments are convertible notes that can be converted into equity instruments at the option of the holder.

The liability component of a compound financial instrument is recognized initially at the fair value of a similar liability that does not have an equity conversion option, and subsequently recognized at amortized cost until extinguished on conversion or maturity of the bonds. The equity component is recognized initially on the difference between the fair value of the compound financial instrument as a whole and the fair value of the liability component. Any directly attributable transaction costs are allocated to the liability and equity components in proportion to their initial carrying amounts.

2.23 Current and Deferred Tax

The tax expense for the period consists of current and deferred tax. Current and deferred tax is recognized in profit or loss, except to the extent that it relates to items recognized in other comprehensive income or directly in equity. In this case, the tax is also recognized in other comprehensive income or directly in equity, respectively.

The current income tax expense is measured at the amount expected to be paid to the taxation authorities, using the tax rates (and tax laws) that have been enacted or substantively enacted by the end of the reporting period. Management periodically evaluates positions taken in tax returns with respect to situations in which applicable tax regulation is subject to interpretation. The Group recognizes current income tax on the basis of amounts expected to be paid to the tax authorities.

Deferred income tax is provided in full, using the liability method, on temporary differences arising between the tax bases of assets and liabilities and their carrying amounts in the consolidated financial statements. However, deferred income tax is not accounted for if it arises from initial recognition of an asset or liability in a transaction other than a business combination that at the time of the transaction affects neither accounting nor taxable profit or loss.

Deferred tax assets are recognized only if it is probable that future taxable amounts will be available to utilize those temporary differences and losses.

The Group recognizes a deferred tax liability all taxable temporary differences associated with investments in subsidiaries, associates, and interests in joint arrangements, except to the extent that the Group is able to control the timing of the reversal of the temporary difference and it is probable that the temporary difference will not reverse in the foreseeable future. In addition, The Group recognizes a deferred tax asset for all deductible temporary differences arising from such investments to the extent that it is probable the temporary difference will reverse in the foreseeable future and taxable profit will be available against which the temporary difference can be utilized.

Deferred tax assets and liabilities are offset when there is a legally enforceable right to offset current tax assets and liabilities and when the deferred tax balances relate to the same taxation authority. Current tax assets and tax liabilities are offset when the Group has a legally enforceable right to offset and intends either to settle on a net basis, or to realize the assets and settle the liability simultaneously.

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2.24 Provisions

Provisions for warranties, site restorations, and legal claims are recognized when the Group has a present legal or constructive obligation as a result of past events, it is probable that an outflow of resources will be required to settle the obligation and the amount can be reliably estimated. Provisions are measured at the present value of management's best estimate of the expenditure required to settle the present obligation at the end of the reporting period, and the increase in the provision due to the passage of time is recognized as interest expense.

2.25 Greenhouse Gas Emissions Permits and Obligations

With enforcement of *The Act on the Allocation and Trading of Greenhouse Gas Emission Permits*, the permits that are received free of charge from the government are measured at zero while permits purchased are measured at acquisition cost and stated net of accumulated impairment loss. Emissions obligations are measured as the sum of the carrying amount of the allocated permits that will be submitted to the government and the best estimate of expenditure required to settle the obligation at the end of reporting period for any excess emission. The permits and emissions obligations are classified as intangible assets and provisions, respectively, in the consolidated statement of financial position.

2.26 Employee Benefits

(a) Post-employment benefits

The Group operates both defined contribution and defined benefit pension plans. For defined contribution plans, the Group pays contribution to publicly or privately administered pension insurance plans on mandatory, contractual or voluntary basis. The Group has no further payment obligation once the contribution have been paid. The contribution are recognized as employee benefit expense when they are due. A defined benefit plan is a pension plan that is not a defined contribution plan.

Generally, post-employment benefits are payable after the completion of employment, and the benefit amount depended on the employee's age, periods of service or salary levels. The liability recognized in the statement of financial position in respect of defined benefit pension plans is the present value of the defined benefit obligation at the end of the reporting period less the fair value of plan assets. The defined benefit obligation is calculated annually by independent actuaries using the projected unit credit method. The present value of the defined benefit obligation is determined by discounting the estimated future cash outflows using interest rates of high-quality corporate bonds that are denominated in the currency in which the benefits will be paid, and that have terms approximating to the terms of the related obligation. Remeasurement gains and losses arising from experience adjustments and changes in actuarial assumptions are recognized in the period in which they occur, directly in other comprehensive income.

Changes in the present value of the defined benefit obligation resulting from plan amendments or curtailments are recognized immediately in profit or loss as past service costs.

(b) Other long-term employee benefits

Certain entities within the Group provide long-term employee benefits that are entitled to employees with service period for ten years and above. The expected costs of these benefits are accrued over the period of employment using the same accounting methodology as used for defined benefit pension plans. The Group recognizes service cost, net interest on other long-term employee benefits and remeasurements as profit or loss for the years. These liabilities are valued annually by an independent qualified actuary.

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2.27 Revenue Recognition

(a) Identify performance obligation

With regard to the contract of selling products to the customer, the Group identifies the services provided separately to the customer as a different performance obligation. When the Group makes a sales contract with the customer, the standard warranty period for each product and customer is set up considering the legal warranty period. Even though the standard warranty period has been expired, the warranties are recognized as a revenue and is identified as a separate performance obligation when the Group provides additional warranties for the quality of product or when the customer has an option to purchase additional warranties separately.

(b) A performance obligation satisfied at a point in time

The revenue from the sale of goods is recognized at the time they are delivered to the customer. Delivery occurs when the products have been shipped to the specific location, the risks of obsolescence and loss have been transferred to the customer, and either the customer has accepted the products in accordance with the sales contract, the acceptance provisions have lapsed, or the group has objective evidence that all criteria for acceptance have been satisfied.

The goods are often sold with volume discounts, and it is the group's policy to sell its products to the customer with a right of return. Accumulated experience is used to estimate for the discounts and the refund, and the volume discounts is calculated based on the periodical forecast sales. The warranty provision for the sales and refund is reasonably estimated and recognized properly.

(c) Sales return

A gross contract liability for the expected refunds to customers is recognized as adjustment to revenue, and the Group has a right to recover the product from the customer where the customer exercises his right of return and recognizes an asset and a corresponding adjustment to cost of sales. A right to recover the products is measured at former carrying amount of the product less the costs to recover the products.

(d) Significant financing component

As a practical expedient, the Group need not adjust the promised amount of consideration for the effects of a significant financing component as the period between when the entity transfers a promised good or service to a customer and when the customer pays for that good or service is generally one year or less.

2.28 Lease

As explained in Note 2.2 above, the Group has changed its accounting policy for leases. The impact of the new accounting policies is disclosed in Note 11.

Lease activities and accounting policies of the Group

As at December 31, 2018, leases where the Group, as lessee, has substantially all the risks and rewards of ownership are classified as finance leases. Finance leases are capitalized at the lease's inception at the fair value of the leased property or, if lower, the present value of the minimum lease payments. The corresponding rental obligations, net of finance charges, are included in other short-term and long-term payables. Each lease payment is allocated between the liability and finance cost. The finance charge is allocated to each period during the lease term so as to produce a constant periodic rate of interest on the remaining balance of the liability. If there is reasonable certainty that the lessee will obtain ownership by the end of the lease term, the

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period of expected use is the useful life of the asset; otherwise, the asset is fully depreciated over the shorter of the lease term and its useful life.

A lease other than a finance lease is classified as an operating lease. Lease income from operating leases is recognized in income on a straight-line basis over the lease term.

Lease income from operating leases where the Group is a lessor is recognized in income on a straight-line basis over the lease term. Initial direct costs incurred in obtaining an operating lease are added to the carrying amount of the underlying asset and recognized as expense over the lease term on the same basis as lease income. The respective leased assets are included in the statement of financial position based on their nature. The Group did not need to make any adjustments to the accounting for assets held as lessor as a result of adopting the new leasing standard.

The Group leases various machinery, real estate and cars. Lease contracts are typically made for fixed periods, but may have extension options. Lease terms are negotiated on an individual basis and contain a wide range of different terms and conditions. The lease agreements do not impose any covenants, but leased assets may not be used as security for borrowing purposes.

Contracts may contain both lease and non-lease components. The Group allocates the consideration in the contract to the lease and non-lease components based on their relative stand-alone prices. However, for leases of real estate for which the Group is lessee, the Group applies the practical expedient which has elected not to separate lease and non-lease components and instead accounts for these as a single lease component.

Until the 2018 financial year, leases of property, plant and equipment were classified as either finance or operating leases. Payments made under operating leases (net of any incentives received from the lessor) were charged to profit or loss on a straight-line basis over the period of the lease.

From January 1, 2019, leases are recognized as a right-of-use asset and a corresponding liability at the date at which the leased asset is available for use by the Group. Each lease payment is allocated between the liability and finance cost. The finance cost is charged to profit or loss over the lease period so as to produce a constant periodic rate of interest on the remaining balance of the liability for each period. The right-of-use asset is depreciated over the shorter of the asset's useful life and the lease term on a straight-line basis.

Assets and liabilities arising from a lease are initially measured on a present value basis. Lease liabilities include the net present value of the following lease payments:

- Fixed payments (including in-substance fixed payments), less any lease incentives receivable
- Variable lease payment that are based on an index or a rate, initially measured using the index or rate as at the commencement date
- Amounts expected to be payable by the Group (the lessee) under residual value guarantees
- The exercise price of a purchase option if the Group (the lessee) is reasonably certain to exercise that option, and
- Payments of penalties for terminating the lease, if the lease term reflects the Group (the lessee) exercising that option

If the Group is reasonably certain to exercise a purchase option, the right-of-use asset is

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depreciated over the useful life of the underlying asset.

The lease payments are discounted using the interest rate implicit in the lease. If that rate cannot be determined, the lessee's incremental borrowing rate is used, being the rate that the lessee would have to pay to borrow the funds necessary to obtain an asset of similar value in a similar economic environment with similar terms and conditions.

Right-of-use assets are measured at cost comprising the following:

- the amount of the initial measurement of lease liability
- any lease payments made at or before the commencement date less any lease incentives received
- any initial direct costs, and
- restoration costs

Payments associated with short-term leases or leases of low-value assets are recognized on a straight-line basis as an expense in profit or loss. Short-term leases are leases with a lease term of 12 months or less. Low-value assets comprise IT-equipment and small items of office furniture.

(a) Variable lease payments

Some property leases contain variable payment terms that are linked to sales generated from a warehouse. Variable lease payments that depend on usage are recognized in profit or loss in the period in which the condition that triggers those payments occurs.

(b) Extension and termination options

Extension and termination options are included in a number of leases across the Group. These terms are used to maximize operational flexibility in terms of managing contracts. The majority of extension and termination options held are exercisable only by the Group and not by the respective lessor.

The Group determines the lease term as the non-cancellable period of a lease within the period for which the contract is enforceable, together with both (a) periods covered by an option to extend the lease if the lessee is reasonably certain to exercise that option; and (b) periods covered by an option to terminate the lease if the lessee is reasonably certain not to exercise that option. When both lessee and lessor have the right to terminate the lease without permission from the other party, the Group considers the contractual termination payments in determining the period for which the contract is enforceable.

3. Financial Risk Management

3.1 Financial Risk Factors

The Group's activities expose it to a variety of financial risks: market risk, credit risk and liquidity risk. The Group's overall risk management program focuses on the unpredictability of financial markets and seeks to minimize potential adverse effects on the financial performance of the Group. The Group uses derivative financial instruments to hedge certain risk exposures.

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Risk management is carried out by the Group's finance team under policies approved by the Corporate Management Committee. The finance team identifies, evaluates and hedges financial risks in close co-operation with the Group's operating units. The Corporate Management Committee reviews and approves written principles for overall risk management, as well as written policies covering specific areas, such as foreign exchange risk, interest rate risk, and credit risk, use of derivative financial instruments and non-derivative financial instruments, investment of excess liquidity.

(a) Market risk

1) Foreign exchange risk

The Group operates internationally and is exposed to foreign exchange risk arising from foreign currency exposures, primarily with respect to the US dollar. Foreign exchange risk arises from future commercial transactions, recognized assets and liabilities.

Management has set up a policy to require group companies to manage their foreign exchange risk against their functional currency. The Group manages maximum loss for currency risk exposures within acceptable range by using currency risk management model and hires employees who are exclusively responsible for currency risk management.

The Group has certain investments in foreign operations, whose net assets are exposed to foreign currency translation risk. Currency exposure arising from the net assets of the Group's foreign operations is managed primarily through borrowings denominated in the relevant foreign currencies.

As at December 31, 2019 and 2018, the Group's monetary assets and liabilities denominated in currencies other than its functional currency, are as follows:

<i>(in millions of Korean won)</i>	2019		2018	
	Assets	Liabilities	Assets	Liabilities
USD	2,681,402	3,321,586	2,458,886	2,396,650
EUR	275,799	3,157,509	197,975	892,963
JPY	30,081	208,998	27,849	114,399
CNY and others	693,284	8,231	128,392	6,085

As at December 31, 2019 and 2018, if the Group's functional currency had weakened / strengthened by 10% against the US dollar with all other variables held constant, profit before income tax would have been affected as follows:

<i>(in millions of Korean won)</i>	2019		2018	
	10% Increase	10% Decrease	10% Increase	10% Decrease
USD	(64,018)	64,018	6,224	(6,224)

The above sensitivity analysis has been performed for monetary assets and liabilities denominated in foreign currencies other than the Group's functional currency at the reporting date.

2) Price risk

The Group is exposed to equity securities price risk arises from investments held by the Group and classified in the consolidated interim statement of financial position as non-current financial assets. The Group's equity investments are publicly traded and are related to the KOSDAQ, NASDAQ and

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HSI index.

The table below summarizes the impact of increases/decreases of the listed stock price index on the Group's equity before tax effects as at December 31, 2019 and 2018. The analysis is based on the assumption that the equity index has increased/decreased by 10% with all other variables held constant, and that all the Group's equity instruments moved in line with the index.

(in millions of Korean won)

	2019		2018	
	10% Increase	10% Decrease	10% Increase	10% Decrease
KOSDAQ	676	(676)	315	(315)
NASDAQ	819	(819)	168	(168)
HSI	7,944	(7,944)	7,798	(7,798)
Total	9,439	(9,439)	8,281	(8,281)

3) Interest rate risk

Interest rate risk is defined as the risk that the interest income or expenses arising from deposits and borrowings will fluctuate because of changes in future market interest rate. The interest rate risk mainly arises through floating rate deposits and borrowings. The objective of interest rate risk management lies in maximizing corporate value by minimizing uncertainty in interest rates fluctuations and net interest expense.

The Group adequately minimizes risks from interest rate fluctuations through various policies, such as sharing excess cash within the Group (internal cash sharing) to minimize external borrowings, avoiding high rate borrowings, reforming capital structure, managing an appropriate ratio of fixed rate borrowings and floating rate borrowings, monitoring a fluctuation of domestic and foreign interest rates daily, weekly and monthly, establishing alternatives, and balancing floating rate short-term borrowings with floating rate deposits.

The table below summarizes the impact of increases/decreases of interest rate on the Group's equity and post-tax profit for the year. The analysis is based on the assumption that the interest rate has increased/decreased by 1% (100 basis points) with all other variables held constant.

(in millions of Korean won)

	Impact on post-tax profit		Impact on equity	
	2019	2018	2019	2018
Increase	(22,265)	(19,316)	(22,265)	(19,316)
Decrease	22,265	19,316	22,265	19,316

(b) Credit risk

Credit risk arises from trade receivables and that the Group holds, as well as debt instruments at amortized cost or fair value through other comprehensive income.

A. Trade receivables

The Group applies the simplified approach to measuring expected credit losses which uses a lifetime expected loss allowance for trade receivables. To measure the expected credit losses, trade receivables have been grouped based on shared credit risk characteristics and the days past due. The loss allowance provision as at December 31, 2019, is as follows. Expected credit losses include forward-looking information.

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<i>(in millions of Korean won)</i>	Receivables not past due ¹	Receivables past due but not impaired ¹	Impaired receivables ²	Total
December 31, 2019 (trade receivables)				
Gross carrying amount	3,005,591	729,226	9,237	3,744,054
Expected loss rate	0.1%	0.1%	31.3%	0.2%
Loss allowance provision	2,111	829	2,890	5,830

<i>(in millions of Korean won)</i>	Receivables not past due ¹	Receivables past due but not impaired ¹	Impaired receivables ²	Total
December 31, 2018 (trade receivables)				
Gross carrying amount	4,115,060	268,488	5,561	4,389,109
Expected loss rate	0.1%	0.4%	78.0%	0.2%
Loss allowance provision	2,512	1,063	4,335	7,910

¹ See Note 7 for aging analysis.

² Impaired receivables are those for which impairment indicators have been confirmed, such as significant lack of collectability.

Movements in the loss allowance provision for trade receivables for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	Trade receivables	
	2019	2018
Beginning balance	7,910	7,552
Business combination (Note 34)	-	23
Increase in loss allowance recognized in profit or loss during the year	(903)	701
Receivables written off during the year as uncollectible	(1,164)	(333)
Exchange differences	(13)	(33)
Ending balance	<u>5,830</u>	<u>7,910</u>

As at December 31, 2019, the carrying amount of trade receivables representing the maximum exposure to credit risk amounts to ₩ 3,744,054 million (2018: ₩ 4,389,109 million).

B. Other financial assets at amortized cost

Movements in loss allowance provision for other financial assets at amortized cost for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
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Beginning balance	2,726	959
Increase in loss allowance recognized as 'other non-operating expenses' in profit or loss during the year	(630)	1,783
Exchange differences	13	(16)
Ending balance	<u>2,109</u>	<u>2,726</u>

All of the financial assets at amortized costs are considered to have low credit risk, and the loss allowance recognized during the period was, therefore, limited to 12 months expected losses.

The Group has established the following policies and procedures to manage credit risks.

To manage credit risks relating to trade receivables, the Group evaluates the credit rating of customers and determines credit limit for each customer based on the information provided by credit rating agencies and other available financial information before commencing business with new customers. The credit risks relating to trade receivables are also mitigated by insurance contracts, collateral as well as payment guarantees.

The Group has entered into export bond insurance contracts with Korea Trade Insurance Corporation to mitigate credit risks relating to export trade receivables to overseas customers. The Group is also provided with collateral by customers depending on their credit rating or payment guarantees from the customers' financial institutions if necessary.

The Group has deposited its cash and cash equivalents and other long-term deposits in several financial institutions, such as Woori Bank and others. The Group has also entered into derivative contract with several financial institutions. The Group maintains business relationship with those financial institutions with high credit ratings evaluated by independent credit rating agencies and accordingly, credit risks associated with these financial institutions are limited.

(c) Liquidity risk

Finance team of the Group monitors rolling forecasts of the Group's liquidity requirements to ensure it has sufficient cash to meet operational needs while maintaining sufficient headroom on its undrawn committed borrowing facilities at all times so that the Group does not breach borrowing limits or covenants (where applicable) on any of its borrowing facilities. The Group's liquidity management policy involves projecting cash flows in major currencies and considering the level of liquid assets necessary to meet these, monitoring balance sheet liquidity ratios against internal and external regulatory requirements and maintaining debt financing plans.

The table below analyzes the Group's non-derivative financial liabilities into relevant maturity groupings based on the remaining period at the reporting period to the contractual maturity date. Cash flows presented below are gross cash flows before discount, and includes cash flows for interests.

(in millions of Korean won)

	2019			
	Less than 1 year	Between 1-2 years	Between 2-5 years	Over 5 years
Borrowings (excluding lease liabilities)	1,463,659	1,445,986	4,060,071	1,976,074
Lease liabilities	64,481	41,132	79,703	114,050
Trade and other payables ¹	6,522,664	10,787	43	121

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Total	8,050,804	1,497,905	4,139,817	2,090,245
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¹ Included ₩ 862,452 millions of financial liabilities due to a financial institution relating to reverse factoring arrangement. The Parent Company has entered into reverse factoring arrangement (interest rate CD 91 days + 0.75~0.95%) with a financial institution whereby suppliers receive payments from the financial institution on the due date of each invoice and the Parent Company pays to the financial institution at the end of extended credit period as agreed in the reverse factoring arrangement.

(in millions of Korean won)

	2018			
	Less than 1 year	Between 1-2 years	Between 2-5 years	Over 5 years
Borrowings (excluding financial lease liabilities)	1,694,761	840,260	2,250,480	910,985
Finance lease liabilities	5,177	5,177	15,887	5,000
Trade and other payables	4,717,445	6,710	3,177	97
Total	6,417,383	852,147	2,269,544	916,082

As at December 31, 2019, the Group has entered into swap contracts for which cash flow hedge accounting is applied, to avoid market price fluctuation of raw materials.

(in millions of Korean won)

	2019				
	Purpose of the contracts	Hedged items	Financial institution	Maturity	Fair value
Merchandise (raw materials) swap ¹	Cashflow hedge	Non-ferrous metal	Citi bank	~2021. 12	21,371

Details of derivative assets and liabilities as at December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019		2018	
	Assets	Liabilities	Assets	Liabilities
Merchandise (raw materials) swap ¹	21,371	-	-	18,477
Total	21,371	-	-	18,477

¹ Gain (loss) resulting from the contracts to avoid cash flow fluctuation risk of expected future transaction is accounted for as accumulated other comprehensive income (Note 5).

3.2 Capital Risk Management

The Group's objectives when managing capital are to safeguard the Group's ability to continue as a going concern, so the Group can continue to provide returns for shareholders and benefits for other stakeholders, and to maintain an optimal capital structure to reduce the cost of capital.

Consistent with others in the industry, the Group monitors capital on the basis of the gearing ratio. This ratio is calculated as net debt divided by total capital. Net debt is calculated as total borrowings less cash and cash equivalents. Total capital is calculated as 'equity' as shown in the

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consolidated statement of financial position plus net debt.

The gearing ratio and debt-to-equity ratio as at December 31, 2019 and 2018, were as follows:

<i>(in millions of Korean won, except for ratios)</i>	2019	2018
Total borrowings (Note 14) (A)	8,414,268	5,321,147
Less: cash and cash equivalents (B)	<u>(1,888,631)</u>	<u>(2,513,702)</u>
Net debt (C=A+B)	<u>6,525,637</u>	<u>2,807,445</u>
Total liabilities (D)	16,640,637	11,622,009
Total equity (E)	<u>17,383,789</u>	<u>17,322,128</u>
Total capital (F=C+E)	<u>23,909,426</u>	<u>20,129,573</u>
Gearing ratio (C/F)	27.3%	13.9%
Debt-to-equity ratio (D/E)	95.7%	67.1%

3.3 Fair Value

(a) Carrying amount and fair value of financial instruments by category as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019		2018	
	Carrying amount	Fair value	Carrying amount	Fair value
Financial assets (current)				
Cash and cash equivalents	1,888,631	1	2,513,702	1
Deposits held by financial institutions	32,515	1	42,902	1
Trade receivables	3,738,224	1	4,381,199	1
Other receivables (excluding deposits held by financial institutions)	234,036	1	283,191	1
Current derivative financial assets	10,879	10,879	-	-
Financial assets (non-current)				
Deposits held by financial institutions	107,434	1	64,331	1
Other receivables (excluding deposits held by financial institutions)	65,499	1	64,919	1
Other non-current financial assets (carried at fair value)				
Marketable financial assets	83,174	83,174	49,214	49,214
Non-marketable financial assets ²	66,289	66,289	44,136	44,136
Non-current derivative financial assets	10,492	10,492	-	-
Financial liabilities (current)				
Trade and other payables	6,522,664	1	4,717,445	1
Current borrowings (excluding lease liabilities)	1,300,989	1	1,608,138	1
Current lease liabilities	55,108	3	5,008	1
Current derivative financial liabilities	-	-	18,477	18,477
Financial liabilities (non-current)				
Non-current borrowings (excluding lease liabilities)	6,836,034	7,042,233	3,684,765	3,740,154
Non-current lease liabilities	222,137	3	23,236	24,689

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	2019		2018	
	Carrying amount	Fair value	Carrying amount	Fair value
Other non-current payables	10,951	1	9,984	1
Other non-current financial liabilities (Conversion rights)	930	930	30,384	30,384

¹ These financial assets and liabilities are not included in the disclosure above as their carrying amount is a reasonable approximation of the fair value.

² Acquisition costs of these financial assets approximate their fair values.

³ Fair values for these financial assets and liabilities are not disclosed above in accordance with related Korean IFRS.

(b) Fair value for measurement and disclosure are determined based on the following method:

Fair values of financial liabilities (non-current) are based on cash outflows discounted by using Korean won currency note yield in the same credit grade with the Parent Group (AA+), and the applied discount rates as at December 31, 2019 and 2018, are as follows:

(in percentage)

	2019	2018
Discount rate	1.63%~2.24%	2.01%~2.53%

(c) Fair value hierarchy

Items that are measured at fair value are categorized by the fair value hierarchy levels, and the defined levels are as follows:

- Quoted prices (unadjusted) in active markets for identical assets or liabilities that an entity can access at the measurement date (Level 1).
- All inputs other than quoted prices included in level 1 that are observable (either directly that is, prices, or indirectly that is, derived from prices) for the asset or liability (Level 2).
- Unobservable inputs for the asset or liability (Level 3).

Fair value hierarchy classifications of the financial instruments that are measured at fair value or its fair value is disclosed as at December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019			
	Level 1	Level 2	Level 3	Total
Financial assets/liabilities measured at fair value				
Other non-current financial assets (marketable financial assets)	83,174	-	-	83,174
Other non-current financial assets (non-marketable financial assets)	-	-	66,289	66,289
Current derivative financial assets	-	10,879	-	10,879
Non-current derivative financial assets	-	10,492	-	10,492
Non-current financial liabilities (conversion rights)	-	-	930	930
Financial assets/liabilities not measured at fair value				
Non-current borrowings	-	6,390,480	651,753	7,042,233

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(excluding finance lease liabilities)

(in millions of Korean won)

	2018			
	Level 1	Level 2	Level 3	Total
Financial assets/liabilities measured at fair value				
Other non-current financial assets (marketable financial assets)	49,214	-	-	49,214
Other non-current financial assets (non-marketable financial assets)	-	-	44,136	44,136
Other current financial liabilities (derivative instruments)	-	18,477	-	18,477
Other non-current financial liabilities (conversion rights)	-	-	30,384	30,384
Financial assets/liabilities not measured at fair value				
Non-current borrowings (excluding finance lease liabilities)	-	3,120,475	619,679	3,740,154
Non-current finance lease liabilities	-	24,689	-	24,689

(d) Valuation Technique and the Inputs

Valuation techniques and inputs used in level 3 fair value measurements are as follows:

(in millions of Korean won)

	2019				
	Fair value	Level	Valuation Technique	Inputs	Coverage of Level 3 inputs
Financial liabilities – Convertible Bond					
Convertible Bond	651,753	3	Binominal option pricing model	Annual rates of credit volatility	-0.5%p ~ +0.5%p
Equity Conversion Option	930	3	Binominal option pricing model	Annual rates of credit volatility Underlying asset (equity) volatility	-0.5%p ~ +0.5%p -5% ~ +5%

(in millions of Korean won)

	2018				
	Fair value	Level	Valuation Technique	Inputs	Coverage of Level 3 inputs
Financial liabilities – Convertible Bond					
Convertible Bond	619,679	3	Binominal option pricing model	Annual rates of credit volatility	-0.5%p ~ +0.5%p
Equity Conversion Option	30,384	3	Binominal option pricing model	Annual rates of credit volatility Underlying asset (equity) volatility	-0.5%p ~ +0.5%p -5% ~ +5%

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(e) Sensitivity analysis for Recurring Fair Value Measurements Categorized Within Level 3

Sensitivity analysis of financial instruments is performed to measure favorable and unfavorable changes in the fair value of financial instruments which are affected by the unobservable parameters, using a statistical technique. When the fair value is affected by more than two input parameters, the most favorable or most unfavorable amounts are presented.

The results of the sensitivity analysis for the effect on profit or loss from changes in inputs for convertible notes categorized as level 3 and subject to sensitivity analysis, are as follows:

<i>(in millions of Korean won)</i>	2019	
	The effect on profit	The effect on loss
Financial liabilities		
– Convertible Bond		
Annual rates of credit volatility	4,130	(4,177)
Financial liabilities		
– Equity Conversion Option		
Annual rates of credit volatility	112	(107)
Underlying asset (equity) volatility	497	(580)
 <i>(in millions of Korean won)</i>		
	2018	
	The effect on profit	The effect on loss
Financial liabilities		
– Convertible Bond		
Annual rates of credit volatility	6,899	(7,011)
Financial liabilities		
– Equity Conversion Option		
Annual rates of credit volatility	985	(966)
Underlying asset (equity) volatility	3,237	(3,434)

4. Critical Accounting Estimates and Assumptions

The preparation of financial statements requires the Group to make estimates and assumptions concerning the future. Management also needs to exercise judgement in applying the Group's accounting policies. Estimates and assumptions are continually evaluated and are based on historical experience and other factors, including expectations of future events that are believed to be reasonable under the circumstances. The resulting accounting estimates may differ from the related actual results. The estimates and assumptions that have a significant risk of causing a material adjustment to the carrying amounts of assets and liabilities within the next financial year are discussed below.

(a) Impairment test of goodwill

The Group tests whether goodwill has suffered any impairment on an annual basis. The recoverable amount of a cash generating unit (CGU) is determined based on value-in-use or fair value less cost of disposal calculations (Note 12).

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(b) Income taxes

The Group's taxable income generated from these operations are subject to income taxes based on tax laws and interpretations of tax authorities in numerous jurisdictions. There are many transactions and calculations for which the ultimate tax determination is uncertain. If certain portion of the taxable income is not used for investments or increase in wages or dividends in accordance with the Tax System for Recirculation of Corporate Income, the Group is liable to pay additional income tax calculated based on the tax laws. The new tax system is effective for three years from 2015. Accordingly, the measurement of current and deferred income tax is affected by the tax effects from the new tax system. As the Group's income tax is dependent on the investments, increase in wages and dividends, there is an uncertainty measuring the final tax effects.

(c) Provisions

The Group recognizes provisions for product warranties as explained in Note 15. These provisions are estimated based on past experience.

(d) Fair value of financial instruments

The fair value of financial instruments that are not traded in an active market is determined by using valuation techniques. The Group uses its judgment to select a variety of methods and make assumptions that are mainly based on market conditions existing at the end of each reporting period (Note 3.3).

(e) Impairment of financial assets

The provision for impairment for financial assets are based on assumptions about risk of default and expected loss rates. The Group uses judgement in making these assumptions and selecting the inputs to the impairment calculation based on the Group's past history, existing market conditions as well as forward looking estimates at the end of each reporting period (Note 3.1.(b)).

(f) Net defined benefit liability

The present value of net defined benefit liability depends on a number of factors that are determined on an actuarial basis using a number of assumptions including the discount rate (Note 16).

(g) Lease

In determining the lease term, management considers all facts and circumstances that create an economic incentive to exercise an extension option, or not exercise a termination option. Extension options (or periods after termination options) are only included in the lease term if the lease is reasonably certain to be extended (or not terminated).

When both lessee and lessor have the right to terminate the lease without permission from the other party, the Group considers the contractual termination payments in determining the period for which the contract is enforceable.

The lease term is reassessed if an option is actually exercised (or not exercised) or the Group becomes obliged to exercise (or not exercise) it. The assessment of reasonable certainty is only revised if a significant event or a significant change in circumstances occurs, which affects this assessment, and that is within the control of the lessee.

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5. Financial Instruments by Category

Categorizations of financial instruments as at December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

Financial assets	2019				Total
	Financial assets at amortized cost	Financial assets at fair value through profit or loss	Financial assets at fair value through other comprehensive income	Other financial assets ¹	
Cash and cash equivalents	1,888,631	-	-	-	1,888,631
Trade receivables	3,114,376	-	623,848	-	3,738,224
Other receivables	259,204	-	7,347	-	266,551
Other non-current receivables	172,933	-	-	-	172,933
Other current financial assets	-	-	-	10,879	10,879
Other non-current financial assets	-	24,613	124,850	10,492	159,955
Total	5,435,144	24,613	756,045	21,371	6,237,173

(in millions of Korean won)

Financial liabilities	2019			Total
	Financial liabilities at fair value through profit or loss	Financial liabilities at amortized cost	Other financial liabilities ²	
Trade payables	-	2,379,711	-	2,379,711
Other payables	-	4,142,953	-	4,142,953
Borrowings (current)	-	1,300,989	55,108	1,356,097
Other non-current financial liabilities	930	-	-	930
Other non-current payables	-	10,951	-	10,951
Borrowings (non-current)	-	6,836,034	222,137	7,058,171
Total	930	14,670,638	277,245	14,948,813

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(in millions of Korean won)

Financial assets	2018			Total
	Financial assets at amortized cost	Financial assets at fair value through profit or loss	Financial assets at fair value through other comprehensive income	
Cash and cash equivalents	2,513,702	-	-	2,513,702
Trade receivables	4,046,171	-	335,028	4,381,199
Other receivables	266,597	-	59,496	326,093
Other non-current receivables	129,251	-	-	129,251
Other non-current financial assets	-	16,077	77,273	93,350
Total	6,955,721	16,077	471,797	7,443,595

(in millions of Korean won)

Financial liabilities	2018			Total
	Financial liabilities at fair value through profit or loss	Financial liabilities at amortized cost	Other financial liabilities ²	
Trade payables	-	2,165,969	-	2,165,969
Other payables	-	2,551,476	-	2,551,476
Borrowings (current)	-	1,608,138	5,008	1,613,146
Other current financial liabilities	-	-	18,477	18,477
Other non-current financial liabilities	30,384	-	-	30,384
Other non-current payables	-	9,984	-	9,984
Borrowings (non-current)	-	3,684,765	23,236	3,708,001
Total	30,384	10,020,332	46,721	10,097,437

¹ Other financial assets include derivative assets that are not subject to the categorizations.

² Other financial liabilities include lease liabilities and derivative liabilities that are not subject to the categorizations.

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Net gains or losses on each category of financial instruments for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Dividend income		
Financial assets at fair value through other comprehensive income	1,724	123
Interest income		
Financial assets at amortized cost	45,316	47,837
Interest expense		
Financial assets at amortized cost ¹	(4,247)	(5,664)
Financial assets at fair value through other comprehensive income ¹	(8,308)	(10,544)
Financial liabilities at amortized cost	(220,346)	(139,196)
Other financial liabilities	(3,593)	(1,014)
Gain (loss) on valuation		
Financial assets at fair value through profit or loss	16	73
Financial assets at fair value through other comprehensive income	35,398	(5,737)
Derivative instruments	69,303	(15,721)
Loss on redemption of debentures		
Financial liabilities at amortized cost	-	(13)
Loss on disposal		
Financial assets at fair value through other comprehensive income	-	(1,542)
Exchange differences		
Financial assets at amortized cost	72,083	109,367
Financial liabilities at amortized cost	(76,050)	(178,162)
Other financial liabilities	190	(739)

¹ Fees paid to financial institutions for factoring.

6. Cash and Cash Equivalents

Details of cash and cash equivalents as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Bank deposits and cash on hand	902,764	872,337
Deposits held by financial institutions and others	985,867	1,641,365
Total	<u>1,888,631</u>	<u>2,513,702</u>

As at December 31, 2019, cash and cash equivalents include ₩ 3,120 million which is subject to a restriction on the use in association with the national R&D projects.

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7. Trade and Other Receivables

Trade and other receivables and its provisions for impairment as at December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019		
	Gross amount	Provision for impairment	Carrying amount
Trade receivables	3,744,054	(5,830)	3,738,224
Other current receivables	268,660	(2,109)	266,551
Other non-current receivables	172,933	-	172,933
Total	4,185,647	(7,939)	4,177,708

(in millions of Korean won)

	2018		
	Gross amount	Provision for impairment	Carrying amount
Trade receivables	4,389,109	(7,910)	4,381,199
Other current receivables	328,819	(2,726)	326,093
Other non-current receivables	129,251	-	129,251
Total	4,847,179	(10,636)	4,836,543

Details of other receivables as at December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019	2018
Current		
Non-trade receivables	195,182	242,740
Deposits held by financial institutions	32,515	42,902
Accrued income	2,317	3,533
Guarantee deposits provided	36,537	36,918
	<u>266,551</u>	<u>326,093</u>
Non-current		
Non-trade receivables	-	7,030
Deposits held by financial institutions ¹	107,434	64,331
Loans	677	312
Guarantee deposits provided	64,822	57,578
	<u>172,933</u>	<u>129,251</u>
Total	439,484	455,344

¹ As at December 31, 2019, ₩ 106,600 million (2018: ₩ 63,400 million) is restricted from being withdrawn in relation to large, small and medium-sized companies cooperation agreement and others. In addition, ₩ 808 million is restricted from withdrawal in connection with maintaining checking accounts (2018: ₩ 931 million).

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The aging analysis of trade and other receivables as at December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019		2018	
	Trade receivables	Other receivables	Trade receivables	Other receivables
Receivables not past due	3,005,591	378,107	4,115,060	445,357
Past due but not impaired				
Up to 3 months	554,620	43,891	247,287	6,850
Between 3-6 months	153,457	7,107	5,631	1,907
Over 6 months	21,149	5,578	15,570	1,847
	<u>729,226</u>	<u>56,576</u>	<u>268,488</u>	<u>10,604</u>
Impaired receivables	9,237	6,910	5,561	2,109
Total	<u>3,744,054</u>	<u>441,593</u>	<u>4,389,109</u>	<u>458,070</u>

Movements on the provision for impairment of trade and other receivables for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019			
	Trade receivables		Other receivables	
	Current	Non-current	Current	Non-current
Beginning balance	7,910	-	2,726	-
Business combination (Note 34)	-	-	-	-
Additions (Reversals)	(903)	-	(630)	-
Write-off	(1,164)	-	-	-
Exchange differences	(13)	-	13	-
Ending balance	<u>5,830</u>	<u>-</u>	<u>2,109</u>	<u>-</u>

(in millions of Korean won)

	2018			
	Trade receivables		Other receivables	
	Current	Non-current	Current	Non-current
Beginning balance	7,552	-	959	-
Business combination (Note 34)	23	-	-	-
Additions (Reversals)	701	-	1,783	-
Write-off	(333)	-	-	-
Exchange differences	(33)	-	(16)	-
Ending balance	<u>7,910</u>	<u>-</u>	<u>2,726</u>	<u>-</u>

As at December 31, 2019 and 2018, the carrying amounts of trade and other receivables are approximation of their fair values.

The Group transferred trade and other receivables to financial institutions for ₩ 820,428 million at December 31, 2019, and derecognized the trade and other receivables from the financial statements at the date of disposal, as substantial all the risks and rewards were transferred.

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8. Other Financial Assets and Liabilities

Details of other financial assets and liabilities as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Other financial assets		
Derivative assets (forward contract) (current)	10,879	-
Financial assets at fair value through other comprehensive income (excluding forward contract) (non-current)	124,850	77,273
Derivative assets (forward contract) (non-current)	10,492	-
Financial assets at fair value through profit or loss (excluding forward contract) (non-current)	24,613	16,077
	<u>170,834</u>	<u>93,350</u>
Other financial liabilities		
Derivative liabilities (forward contract) (current)	-	18,477
Financial liabilities at fair value through profit or loss (conversion rights) (non-current)	930	30,384
	<u>930</u>	<u>48,861</u>

Changes in equity securities and debts instruments included in other financial assets for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Beginning balance	93,350	23,782
Acquisitions / Transfer	23,572	89,240
Disposals	(2,873)	(14,009)
Gain (loss) on valuation (before income tax effects) through other comprehensive income	35,398	(5,736)
Gain on valuation (before income tax effects) through profit or loss	16	73
Ending balance	<u>149,463</u>	<u>93,350</u>

During the years ended December 31, 2019 and 2018, the Group did not recognize impairment for other financial assets.

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9. Inventories

Details of inventories as at December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019		
	Gross Amount	Valuation allowance	Carrying amount
Merchandise	179,572	(4,880)	174,692
Finished / Semi-finished products	2,821,981	(134,101)	2,687,880
Work-in-process	11,561	-	11,561
Raw materials	1,213,481	(18,669)	1,194,812
Supplies	177,535	-	177,535
Materials-in-transit	787,241	-	787,241
Total	5,191,371	(157,650)	5,033,721

(in millions of Korean won)

	2018		
	Gross Amount	Valuation allowance	Carrying amount
Merchandise	167,842	(958)	166,884
Finished / Semi-finished products	2,480,102	(125,479)	2,354,623
Work-in-process	15,530	-	15,530
Raw materials	1,111,386	(18,573)	1,092,813
Supplies	154,304	-	154,304
Materials-in-transit	505,309	-	505,309
Total	4,434,473	(145,010)	4,289,463

During the year, the cost of inventories recognized as expense and included in 'cost of sales' amounted to ₩ 17,450,653 million (2018: ₩ 17,684,967 million).

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10. Investments in Associates and Joint Ventures

Changes in investments in associates and joint ventures for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	Beginning balance	Acquisitions / transfer	Dividends	2019			Ending balance
				Share of profit (loss) of associates and joint ventures	Share of other comprehensive income of associates and joint ventures	Others	
LG VINA Chemical Co., Ltd.	4,479	-	-	(348)	272	-	4,403
HL Greenpower Co., Ltd.	19,565	-	-	3,919	-	(118)	23,366
LG Holdings (HK) Ltd.	54,735	-	-	3,993	(1,967)	(15,788)	40,973
TECWIN Co., Ltd.	9,828	-	-	9,563	(15)	-	19,376
SEETEC Co., Ltd.	145,649	-	(10,000)	6,919	-	(14)	142,554
LG Chem BRASIL INTERMEDIACAO DE NEGOCIOS DO SETOR QUIMICO LTDA.	579	-	-	-	-	-	579
LG Chem Malaysia SDN.BHD	150	-	-	-	-	-	150
FJ Composite Materials Co., LTD.	2,315	-	-	(240)	96	-	2,171
WUXI CL New Energy Technology Ltd. ¹	1,288	-	-	(1,336)	48	-	-
LG Life Sciences Poland Ltd.	17	-	-	-	-	-	17
Combustion Synthesis Co., Ltd.	1,397	645	-	(289)	220	69	2,042
HUAJIN NEW ENERGY MATERIALS(QUZHOU) CO., LTD. ²	26,120	41,202	-	222	(486)	-	67,058
VINFAST LITHIUM BATTERY PACK LIMITED LIABILITY COMPANY ³	-	5,323	-	(192)	(243)	-	4,888
	<u>266,122</u>	<u>47,170</u>	<u>(10,000)</u>	<u>22,211</u>	<u>(2,075)</u>	<u>(15,851)</u>	<u>307,577</u>

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	2018						
	Beginning balance	Acquisitions / transfer	Dividends	Share of profit (loss) of associates and joint ventures	Share of other comprehensive income of associates and joint ventures	Others	Ending balance
LG VINA Chemical Co., Ltd	3,327	1,767	(810)	246	(51)	-	4,479
HL Greenpower Co., Ltd.	20,239	-	-	(467)	-	(207)	19,565
LG Holdings (HK) Ltd.	51,028	-	-	4,029	(322)	-	54,735
TECWIN Co., Ltd.	8,010	-	-	1,818	-	-	9,828
SEETEC Co., Ltd.	146,741	-	(10,000)	9,368	-	(460)	145,649
LG Chem BRASIL INTERMEDIACAO DE NEGOCIOS DO SETOR QUIMICO LTDA.	579	-	-	-	-	-	579
LG Chem Malaysia SDN.BHD	150	-	-	-	-	-	150
LG Fuel Cell Systems Inc. ⁴	30,334	5,036	-	(9,647)	718	(26,441)	-
FJ Composite Materials Co., LTD.	2,669	-	-	(198)	(156)	-	2,315
WUXI CL New Energy Technology Ltd.	1,002	559	-	(224)	(49)	-	1,288
LG Life Sciences Poland Ltd.	17	-	-	-	-	-	17
Combustion Synthesis Co., Ltd.	-	1,503	-	(118)	(4)	16	1,397
HUAJIN NEW ENERGY MATERIALS(QUZHOU) CO., LTD.	-	26,129	-	279	(288)	-	26,120
	<u>264,096</u>	<u>34,994</u>	<u>(10,810)</u>	<u>5,086</u>	<u>(152)</u>	<u>(27,092)</u>	<u>266,122</u>

¹ As at December 31, 2019, the Group discontinued recognizing its share of further losses as its share of losses of an associate exceeds the carrying amount of its interest in the associate.

Unrecognized accumulated losses amounted to ₩ 310 million.

² During the year ended December 31, 2019, the Parent Company acquired additional shares of HUAJIN NEW ENERGY MATERIALS(QUZHOU)CO., LTD. for ₩ 41,202 million.

³ During the year ended December 31, 2019, the Parent Company newly acquired 35% shares of VINFAST LITHIUM BATTERY PACK LIMITED LIABILITY COMPANY for ₩ 5,323 million.

⁴ LG Fuel Cell Systems Inc. was liquidated in 2019.

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11. Property, Plant and Equipment

Changes in property, plant and equipment for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019											
	Land	Buildings	Structures	Machinery	Vehicles	Tools	Equipment	Others	Right-of- use assets	Construction -in-progress	Machinery -in-transit	Total
Beginning balance	1,620,153	3,187,757	827,775	4,691,884	12,865	471,130	149,599	115,901	-	2,588,018	174,116	13,839,198
Cost	1,657,105	3,959,198	1,407,903	14,412,619	41,803	1,233,217	420,342	315,049	-	2,641,276	174,116	26,262,628
Accumulated depreciation	-	(735,173)	(566,151)	(9,564,688)	(28,783)	(750,202)	(268,298)	(196,996)	-	-	-	(12,110,291)
Accumulated impairment	(36,952)	(36,268)	(13,977)	(156,047)	(155)	(11,885)	(2,445)	(2,152)	-	(53,258)	-	(313,139)
Changes in accounting policies	-	-	(17,697)	(9,668)	-	-	-	-	175,599	-	-	148,234
Restated beginning balance	<u>1,620,153</u>	<u>3,187,757</u>	<u>810,078</u>	<u>4,682,216</u>	<u>12,865</u>	<u>471,130</u>	<u>149,599</u>	<u>115,901</u>	<u>175,599</u>	<u>2,588,018</u>	<u>174,116</u>	<u>13,987,432</u>
Acquisitions/ Transfer	150,098	841,640	207,263	3,053,495	6,021	311,322	62,487	144,766	180,963	6,767,527	195,797	11,921,378
Disposals/ Transfer	(10,845)	(40,096)	(3,436)	(92,420)	(10,139)	(15,174)	(2,776)	(174)	(3,890)	(5,117,686)	(208,707)	(5,505,344)
Exchange differences	124	18,965	1,666	20,525	29	2,012	615	-	2,379	11,304	-	57,620
Depreciation	-	(114,179)	(55,546)	(1,221,114)	(2,518)	(166,457)	(46,032)	(81,801)	(35,357)	-	-	(1,723,004)
Impairment	-	(3,139)	(2,297)	(74,968)	-	(828)	(429)	(3,571)	(75)	(39,076)	(1,177)	(125,560)
Reversal of impairment	-	12	12	181	2	-	8	-	-	-	-	215
Transfer to assets held for sale	-	-	-	(19,049)	-	(47)	-	-	-	-	-	(19,096)
Ending balance	<u>1,759,529</u>	<u>3,890,961</u>	<u>957,739</u>	<u>6,348,867</u>	<u>6,261</u>	<u>601,958</u>	<u>163,470</u>	<u>175,122</u>	<u>319,620</u>	<u>4,210,088</u>	<u>160,028</u>	<u>18,593,642</u>
Cost	1,796,480	4,769,924	1,583,401	17,044,880	33,056	1,457,840	467,293	378,823	380,813	4,300,789	160,028	32,373,328
Accumulated depreciation	-	(839,904)	(609,283)	(10,486,289)	(26,648)	(843,955)	(301,041)	(197,978)	(61,119)	-	-	(13,366,218)
Accumulated impairment	(36,952)	(39,059)	(16,380)	(209,724)	(147)	(11,927)	(2,782)	(5,723)	(75)	(90,700)	-	(413,468)

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	2018										
	Land	Buildings	Structures	Machinery	Vehicles	Tools	Equipment	Others	Construction -in-progress	Machinery -in-transit	Total
Beginning balance	1,568,295	2,762,588	654,629	4,169,473	13,654	403,522	105,759	73,399	1,317,877	142,286	11,211,482
Cost	1,605,247	3,438,000	1,190,383	13,157,481	39,945	1,085,752	352,106	211,585	1,361,431	142,286	22,584,216
Accumulated depreciation	-	(637,025)	(521,806)	(8,840,809)	(26,143)	(669,189)	(243,973)	(136,034)	-	-	(11,074,979)
Accumulated impairment	(36,952)	(38,387)	(13,948)	(147,199)	(148)	(13,041)	(2,374)	(2,152)	(43,554)	-	(297,755)
Business combination (Note 34)	12,115	13,497	632	22,163	247	1,992	159	-	1,310	-	52,115
Acquisitions/ Transfer	42,589	523,470	222,046	2,336,407	2,235	217,702	86,201	113,754	4,741,547	181,833	8,467,784
Disposals/ Transfer	(2,817)	(5,098)	(1,765)	(792,444)	(183)	(11,304)	(2,624)	(3,485)	(3,461,294)	(150,003)	(4,431,017)
Exchange differences	(29)	(6,950)	(466)	(20,254)	(2)	(138)	320	-	(1,865)	-	(29,384)
Depreciation	-	(95,479)	(47,000)	(986,099)	(3,066)	(139,783)	(40,127)	(67,767)	-	-	(1,379,321)
Impairment	-	(4,295)	(343)	(37,727)	(25)	(862)	(104)	-	(9,557)	-	(52,913)
Reversal of impairment	-	24	42	365	5	1	15	-	-	-	452
Ending balance	1,620,153	3,187,757	827,775	4,691,884	12,865	471,130	149,599	115,901	2,588,018	174,116	13,839,198
Cost	1,657,105	3,959,198	1,407,903	14,412,619	41,803	1,233,217	420,342	315,049	2,641,276	174,116	26,262,628
Accumulated depreciation	-	(735,173)	(566,151)	(9,564,688)	(28,783)	(750,202)	(268,298)	(196,996)	-	-	(12,110,291)
Accumulated impairment	(36,952)	(36,268)	(13,977)	(156,047)	(155)	(11,885)	(2,445)	(2,152)	(53,258)	-	(313,139)

During the year, the Group capitalized ₩ 27,159 million of borrowing costs (2018: ₩ 20,905 million) in relation to acquisition of property, plant and equipment, on property, plant and equipment. The capitalization rate of borrowings used to determine the amount of borrowing costs eligible for capitalization is 1.98% (2018: 2.44%).

Line items including depreciation in the separate statements of profit or loss for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)	2019	2018
Cost of sales	1,559,929	1,257,245
Selling and administrative expenses	158,442	117,200
Others	4,633	4,876
Total	1,723,004	1,379,321

Lease

The Group has applied Korean IFRS 1116 retrospectively with the cumulative effect of initially applying the new lease standard recognized at the date of initial application, as permitted under the specific transitional provisions in the standard. Accordingly, reclassifications and adjustments arising from the new lease standard were recognized in the consolidated statement of financial position as at January 1, 2019.

- Adjustments recognized on adoption of Korean IFRS 1116 Lease

On adoption of Korean IFRS 1116, the Group recognized lease liabilities in relation to leases which had previously been classified as 'operating leases' under the principles of Korean IFRS 1017. These liabilities were measured at the present value of the remaining lease payments, discounted using the lessee's incremental borrowing rate as at January 1, 2019. The weighted average lessee's incremental borrowing rate applied to the lease liabilities on January 1, 2019 was 0.67%~4.9%.

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The Group has also elected not to reassess whether a contract is, or contains a lease at the date of initial application. Instead, for contracts entered into before the transition date, the Group relied on its assessment made applying Korean IFRS 1017 and Interpretation 2104 Determining whether an Arrangement contains a Lease.

For leases previously classified as 'finance leases', the Group recognized the carrying amount of the lease asset and lease liability immediately before the initial application as the carrying amount of the right-of-use asset and the lease liability at the date of initial application.

<i>(in millions of Korean won)</i>	2019
Operating lease commitments disclosed as at December 31, 2018	110,973
Discounted using the lessee's incremental borrowing rate of at the date of initial application	106,969
Add: finance lease liabilities recognized as at December 31, 2018	28,244
Less: short-term leases not recognized as a liability	(30,871)
Less: low-value leases not recognized as a liability	(10,111)
Add: adjustments resulting from accounting differences between an option to extend the lease and an option to terminate the lease	36,468
Lease liabilities recognized as at January 1, 2019	130,699
Current lease liabilities	25,060
Non-current lease liabilities	105,639
	130,699

Right-of use assets were measured at the amount equal to the lease liability, adjusted by the amount of any prepaid or accrued lease payments relating to that lease recognized in the statement of financial position as at December 31, 2018. There were no onerous lease contracts that would have required an adjustment to the right-of-use assets at the date of initial application.

(i) Amounts recognized in the consolidated statement of financial position

The consolidated statement of financial position shows the following amounts relating to leases:

<i>(in millions of Korean won)</i>	December 31, 2019	January 1, 2019
Right-of-use assets ¹		
Real-estate	272,958	124,845
Machinery	23,041	27,301
Vehicles	22,425	21,612
Tools	162	20
Equipment	1,034	1,821
	319,620	175,599

¹ Included in the line item 'Property, plant and equipment' in the consolidated statements of financial position.

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<i>(in millions of Korean won)</i>	December 31, 2019	January 1, 2019
Lease liabilities ¹		
Current	55,108	25,060
Non-current	222,137	105,639
	<u>277,245</u>	<u>130,699</u>

¹ Included in the line item 'borrowings' in the consolidated statements of financial position. In the previous year, the Group only recognized lease liabilities for 'finance leases' under Korean IFRS 1017 Leases. These were presented as part of the Group's borrowings.

(ii) Amounts recognized in the consolidated statement of profit or loss

The consolidated statement of profit or loss shows the following amounts relating to leases:

<i>(in millions of Korean won)</i>	2019
Depreciation of right-of-use assets	
Real-estate	19,390
Machinery	5,142
Vehicles	10,039
Tools	28
Equipment	758
	<u>35,357</u>
Interest expense relating to lease liabilities (included in finance cost)	3,593
Expense relating to short-term leases (included in cost of goods sold and administrative expenses)	60,001
Expense relating to leases of low-value assets that are not short-term leases (included in cost of goods sold and administrative expenses)	10,614
Expense relating to variable lease payments not included in lease liabilities (included in cost of goods sold and administrative expenses)	22

The total cash outflow for leases during year ended December 31, 2019 was ₩ 87,125 million.

Financial line items affected by the initial application of Korea IFRS 1116 in the consolidated statement of financial position as at January 1, 2019, are as follows:

- Property, plant and equipment: decreased by ₩ 27,365 million
- Right-of-use assets: increased by ₩ 175,599 million
- Long-term prepaid expenses: decreased by ₩ 45,779 million
- Lease liabilities: increased by ₩ 102,455 million

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(iii) Finance lease - 2018

Details of property, plant and equipment classified as a finance lease as at December 31, 2018, are as follows:

<i>(in millions of Korean won)</i>	<u>2018</u>
	Machinery
Cost- capitalized finance leases	45,025
Accumulated depreciation	<u>(17,660)</u>
Net book amount	<u>27,365</u>

The Group has entered into non-cancellable finance lease agreements with terms of three to ten years. The ownership of the assets will be transferred to the Group at the end of the lease term.

The total of future minimum lease payments to the lessor at the end of the reporting period are as follows:

<i>(in millions of Korean won)</i>	2018
Total minimum lease payments	
Within one year	5,177
Later than one year but not later than five years	20,710
Later than five years	<u>5,000</u>
	<u>30,887</u>
Unearned finance income	<u>(2,997)</u>
Net minimum lease payments	
Within one year	5,019
Later than one year but not later than five years	18,686
Later than five years	<u>4,185</u>
	<u>27,890</u>

(iv) Operating lease - 2018

The Group leases real-estate, machinery, vehicle, etc. under non-cancellable operating leases with terms of one to fourteen years for the year ended December 31, 2018. The leases have various terms, escalation clauses and renewal rights. On renewal, the terms of the leases are renegotiated.

From January 1, 2019, the Group has recognized right-of-use assets for these leases, except for short-term and low-value leases.

Commitments for minimum lease payments in relation to non-cancellable operating leases are payable as follows:

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<i>(in millions of Korean won)</i>	2018
Operating lease payments	
Within one year	66,852
Later than one year but not later than five years	36,509
Later than five years	7,612
	<u>110,973</u>

(v) Practical expedients applied

In applying Korean IFRS 1116 for the first time, the Group has used the following practical expedients permitted by the standard:

- the use of a single discount rate to a portfolio of leases with reasonably similar characteristics
- reliance on previous assessments on whether leases are onerous
- the accounting for operating leases with a remaining lease term of less than 12 months as at January 1, 2019, as short-term leases
- the exclusion of initial direct costs for the measurement of the right-of-use asset at the date of initial application, and
- the use of hindsight in determining the lease term where the contract contains options to extend or terminate the lease

The Group reviews annually whether there is any indication that an asset may be impaired. In 2019, the Group has performed impairment test for Glass substrate business division, a CGU in Advanced materials segment as the future economic performance was expected not to reach the planned target and recognized ₩ 68,243 million of impairment losses. In addition, the Group has also recognized ₩ 24,974 million of impairment losses for Polio vaccine project in Life Sciences segment as the future economic performance was expected not to reach planned target.

The amount of impairment loss (reversal) recognized as other non-operating (income) expense and key assumptions used for calculation of value in use for the year ended December 31, 2019, are as follows:

<i>(in millions of Korean won)</i>	2019	
	Glass Substrate¹	Polio Vaccine¹
Impaired amount		
Property, plant and equipment	68,243	24,974

¹ The recoverable amount is calculated based on fair value less cost of disposal that is a nonrecurring fair value measured using an observable transaction price. It is categorized as level 2 of the fair value hierarchy.

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12. Intangible Assets

Changes in intangible assets for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019					
	Development costs	Industrial property rights	Goodwill	Memberships	Others	Total
Beginning balance	220,860	405,282	1,017,855	50,885	311,356	2,006,238
Separate acquisitions/ Transfer ¹	134,414	215,545	-	66	63,803	413,828
Additions – internal development	17,170	-	-	-	-	17,170
Disposals/Transfer	(18,372)	(4,456)	-	(3,635)	(12,439)	(38,902)
Exchange differences	260	60	4,294	13	1,888	6,515
Amortization	(52,593)	(43,713)	-	-	(40,564)	(136,870)
Impairment	(32,143)	(3,589)	(11,615)	-	(14,403)	(61,750)
Ending balance	269,596	569,129	1,010,534	47,329	309,641	2,206,229

¹ Intangible assets acquired from Dupont related to S-OLED are included.

(in millions of Korean won)

	2018					
	Development costs	Industrial property rights	Goodwill	Memberships	Others	Total
Beginning balance	192,046	371,381	925,593	50,806	283,329	1,823,155
Business combination ¹	-	4	87,871	-	51,829	139,704
Separate acquisitions/ Transfer	83,049	63,008	-	702	34,750	181,509
Additions – internal development	16,065	-	-	-	-	16,065
Disposals/Transfer	(15,149)	(69)	-	(623)	(23,150)	(38,991)
Exchange differences	(115)	1,433	4,391	-	(120)	5,589
Amortization	(42,276)	(30,475)	-	-	(35,197)	(107,948)
Impairment	(12,760)	-	-	-	(85)	(12,845)
Ending balance	220,860	405,282	1,017,855	50,885	311,356	2,006,238

¹ The Group recognized a goodwill amounting to ₩ 64,851million for the related business combination in the prior year. In 2019, certain intangible assets and goodwill have been subsequently adjusted to reflect the final result of purchase price allocation.

Line items including amortization of intangible assets for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019	2018
Cost of sales	28,666	23,375
Selling and administrative expenses	108,203	84,573
Total	136,870	107,948

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The Group recognized total research and development costs of ₩ 1,095,510 million (2018: ₩ 1,007,831 million) as expenses.

Changes in greenhouse gas emission permits for the years ended December 31, 2019 and 2018, are as follows:

<i>Korean won</i>	2019			
	2018		2019	
	Quantity	Amount	Quantity	Amount
Beginning balance	7,903	7,359	7,546	-
Allocation with nil consideration	245	-	-	-
Purchase/Sale	100	2,790	130	4,375
Borrowings/Carry forwards between years	20	-	(20)	-
Surrendered to the government	(8,268)	(10,149)	-	-
Ending balance	-	-	7,656	4,375

<i>(in thousands of tons and millions of Korean won)</i>	2018					
	2017		2018		2019	
	Quantity	Amount	Quantity	Amount	Quantity	Amount
Beginning balance	7,520	18,635	6,648	-	-	-
Allocation with nil consideration	160	-	897	-	7,546	-
Purchase/Sale	481	11,826	-	-	-	-
Borrowings/Carry forwards between years	(358)	(7,359)	358	7,359	-	-
Surrendered to the government	(7,803)	(23,102)	-	-	-	-
Ending balance	-	-	7,903	7,359	7,546	-

Goodwill is allocated to the Group's CGUs identified for each operating segment. The carrying amounts of goodwill allocation by CGUs as at December 31, 2019 and 2018, are as follows:

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	2019						
	Acquisition of NanoH2O Co., Ltd.	Acquisition of FarmHannong Co., Ltd.	Acquisition of LG Life Sciences, Ltd.	Acquisition of Uniseal, Inc.	Acquisition of Ugimag Korea Co., Ltd.	Others	Total
Petrochemicals							
NCC	-	-	-	-	-	2,639	2,639
ABS	-	-	-	-	-	15,726	15,726
PO	-	-	-	-	-	1,054	1,054
PVC	-	-	-	-	-	808	808
Acrylic	-	-	-	-	-	25,572	25,572
Plasticizer	-	-	-	-	-	53	53
BPA	-	-	-	-	-	467	467
Others ¹	-	-	-	-	-	1,350	1,350
Advanced Materials							
RO ²	108,848	-	-	-	-	-	108,848
PSAA	-	-	-	-	-	4,112	4,112
Rechargeable Battery Materials ²	-	-	-	76,818	-	-	76,818
Life Sciences							
Life sciences	-	-	686,229	-	-	-	686,229
Common and others							
FarmHannong Co.,Ltd.	-	86,858	-	-	-	-	86,858
Total	108,848	86,858	686,229	76,818	-	51,781	1,010,534

¹ Goodwill resulting from the acquisition of Ugimag Korea has been fully impaired and recognized as impairment losses in 2019.

² Included changes resulting from foreign currency translation.

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	2018						
	Acquisition of NanoH2O Co., Ltd.	Acquisition of FarmHannong Co., Ltd.	Acquisition of LG Life Sciences, Ltd.	Acquisition of Uniseal, Inc.	Acquisition of Ugimag Korea Co., Ltd.	Others	Total
Petrochemicals							
NCC	-	-	-	-	-	2,639	2,639
ABS	-	-	-	-	-	15,725	15,725
PO	-	-	-	-	-	1,054	1,054
PVC	-	-	-	-	-	808	808
Acrylic	-	-	-	-	-	25,572	25,572
Plasticizer	-	-	-	-	-	53	53
BPA	-	-	-	-	-	467	467
Others	-	-	-	-	11,615	1,350	12,965
Advanced Materials							
RO ¹	105,117	-	-	-	-	-	105,117
PSAA	-	-	-	-	-	4,112	4,112
Rechargeable Battery Materials ^{1,2}	-	-	-	76,256	-	-	76,256
Life Sciences							
Life sciences	-	-	686,229	-	-	-	686,229
Common and others							
FarmHannong Co.,Ltd.	-	86,858	-	-	-	-	86,858
Total	105,117	86,858	686,229	76,256	11,615	51,780	1,017,855

¹Included changes resulting from foreign currency translation.

²The Group recognized a goodwill amounting to ₩ 64,851million for the related business combination in the prior year. In 2019, certain intangible assets and goodwill have been subsequently adjusted to reflect the final result of purchase price allocation.

The recoverable amounts of CGUs have been determined based on value-in-use or fair value less cost of disposal calculations. Value-in-use calculations use pre-tax cash flow projections based on financial budgets approved by management covering a five-year period. Fair value less cost of disposal reflects expectation of future business and usage pattern of assets from the perspective of market participants. Management determined the estimated pre-tax cash flow based on past performance and its expectations of market development. Discount rates applied by the management are the pre-tax discount rates reflecting specific risks relating to the relevant operating segments.

During 2019, key assumptions used for calculation of value in use and fair value less cost of disposal are as follows:

(in millions of Korean won)

	2019	
	Pre-tax discount rate	Growth rate for subsequent years after five years
Acquisition of LG Petrochemical Co., Ltd.	8.3%	0.0%
Acquisition of SAP business	8.2%	0.0%
Acquisition of NanoH2O, Inc	8.0%	1.0%
Acquisition of FarmHannong	9.5%	1.0%

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Acquisition of PSAA business	8.0%	0.0%
Acquisition of LG Life Sciences	11%	3.0%
Consolidation of LG Chem(HUIZHOU) Petrochemical Co., Ltd	8.7%	0.0%

The results of the sensitivity analysis for the fair value less cost of disposal calculation of Life Sciences CGU are as follows:

<i>(in millions of Korean won)</i>	0.5% Increase	0.5% Decrease
Discount rate		
Increase(decrease) in fair value	(137,900)	162,001
Growth rate		
Increase(decrease) in fair value	122,908	(104,683)

Had the discount rate been 0.5% higher than the management's estimate, the Group should have recognized impairment loss of ₩ 115,689 million for the carrying value of goodwill. Also, had the discount rate been 0.5% lower than the management's estimate, the Group should have recognized impairment loss of ₩ 2,472 million for the carrying value of goodwill.

The results of the sensitivity analysis for the value in use calculation of RO filter CGU are as follows:

<i>(in millions of Korean won)</i>	0.5% Increase	0.5% Decrease
Discount rate		
Increase in value in use	(22,580)	27,085
Growth rate		
Increase(decrease) in value in use	18,833	(15,694)

Had the discount rate been 0.5% higher than the management's estimate, the Group should have recognized impairment loss of ₩ 12,317 million for the carrying value of goodwill. Also, had the discount rate been 0.5% lower than the management's estimate, the Group should have recognized impairment loss of ₩ 5,431 million for the carrying value of goodwill.

Impairment test on intangible assets other than goodwill

The impairment losses for intangible assets other than goodwill that the Group recognized during the year are as follows:

<i>(in millions of Korean won)</i>	2019			
	Development costs	Industrial property rights	Other intangible assets	Total
Glass substrate ¹	91	867	12	970
Pneumonia vaccine ²	-	-	13,056	13,056
Humira ³	28,676	-	1,335	30,011
Polio vaccine ³	135	-	-	135
other	3,241	2,722	-	5,964
	<u>32,143</u>	<u>3,589</u>	<u>14,403</u>	<u>50,135</u>

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¹ During 2019, the Group has performed impairment test for Glass substrate business division, a CGU in Advanced materials segment as the future economic performance was expected not to reach the planned target and recognized ₩ 970 million of impairment losses for intangible assets in the CGU.

² In 2019, the Group decided to discontinue Pneumonia vaccine development project since it is not economically visible. Accordingly, the Group recognized ₩ 13,056 million of impairment loss for development costs capitalized for this project.

³ As a result of impairment test for development costs and other intangible assets related to Humira and Polio vaccine, the recoverable amounts are estimated to be ₩ 7,356 million and ₩ 9,268 million, respectively. Accordingly, the Group recognized ₩ 30,011 million and ₩ 135 million of impairment losses, respectively for the differences between related development costs(include other intangible assets) and carrying amounts of ₩ 37,367 million and ₩ 9,403 million, respectively.

Estimation of recoverable amount

The fair values of the development costs (including other intangible assets) related to Humira and Polio vaccines were measured by market approach method using cash flow forecasts for the next 20 years based on the past 10-year life span of each product group and financial budgets approved by management.

Discount rate used for fair value measurement is 13.5% which is an adjusted weighted average cost of capital with adjustment to reflect asset specific risk.

13. Other Current and Non-Current Assets

Details of other current and non-current assets as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Current		
Prepayments to suppliers and prepaid expenses	106,380	138,502
Prepaid value added tax	545,668	373,187
Others	141,748	61,771
Total	<u>793,796</u>	<u>573,460</u>
Non-current		
Long-term prepayments and long-term prepaid expenses	144,336	112,223
Others	96	157
Total	<u>144,432</u>	<u>112,380</u>

14. Borrowings

Borrowings as at December 31, 2019 and 2018, consist of:

<i>(in millions of Korean won)</i>	2019	2018
Current		

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Short-term borrowings	771,102	1,254,142
Current portion of long-term borrowings of bank loans	309,944	304,004
Current-portion of debentures	219,943	49,992
Current-portion of lease liabilities	55,108	5,008
	<u>1,356,097</u>	<u>1,613,146</u>
Non-current		
Long-term borrowings	1,536,821	981,858
Debentures	5,299,213	2,702,907
Non-current-portion of lease liabilities	222,137	23,236
	<u>7,058,171</u>	<u>3,708,001</u>
Total	<u>8,414,268</u>	<u>5,321,147</u>

Details of short-term borrowings as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	Bank	Latest maturity date	Interest rate(%) as at December 31, 2019	December 31, 2019	December 31, 2018
Bank loans	Nonghyup Bank, others	Nov. 02, 2020	2.60 and others	771,102	1,254,142
Total				<u>771,102</u>	<u>1,254,142</u>

Details of long-term borrowings as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	Bank	2019			
		Annual interest rate (%)	Amount in Korean won	Current	Non-current
Borrowings in Korean won	KDB ¹	(1Y) + 1.45 ~ 1.99	7,607	986	6,621
	Kookmin Bank	24M MOR + 1.89	1,188	-	1,188
Borrowings in foreign currencies	HSBC	USD: 3M LIBOR + 0.95~1.40 CNY: PBOC ×0.95	87,958	14,974	72,984
	SMBC	3M LIBOR + 0.65~1.05	71,822	9,171	62,651
	Agricultural Bank of China	USD: 3M LIBOR + 0.80 CNY: PBOC ×0.90	33,594	10,059	23,535
	Construction Bank of China	PBOC ×0.90	37,146	7,146	30,000
	Communications Bank of China	PBOC ×1.00	38,576	5,800	32,776
	CITI	USD: 3M LIBOR + 0.95 EUR: EURIBOR + 0.65	279,935	43,574	236,361
	Bank of America	3M LIBOR + 0.90	17,367	-	17,367
	ING	6M EURIBOR + 0.70~0.83	155,795	-	155,795
	UOB	6M LIBOR + 1.20	111,664	111,664	-

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Standard Chartered Bank	USD: 3M LIBOR + 1.20 CNY: PBOC x0.95	107,534	12,431	95,103
Mizuho Banking Corporation	3M LIBOR + 0.98	31,180	6,929	24,251
CNOOC Finance	PBOC x0.90	33,148	23,204	9,944
EBRD	6M EURIBOR + 0.62	129,829	-	129,829
Hangseng	3M LIBOR + 1.00	29,483	29,483	-
Bank of China	3M LIBOR + 0.95	18,298	12,487	5,811
MUFG	USD: 3LIBOR + 1.00 EUR:3M EURIBOR + 0.60~0.80	173,165	5,778	167,387
Industrial and Commercial Bank of China	PBOC x1.00	43,579	5,801	37,778
CIMB	3LIBOR + 1.50	57,809	5,781	52,028
KEB Hana Bank	3M EURIBOR + 0.62	259,658	-	259,658
KDB	3LIBOR + 0.93	30,182	3,018	27,164
Deutsche Bank	PBOC x0.84	90,248	1,658	88,590
Total		1,846,765	309,944	1,536,821

¹ Manufacturing facilities are pledged as collateral for the above long-term borrowings (Note 18).

<i>(in millions of Korean won)</i>		2018				
		Bank	Annual interest rate (%)	Amount in Korean won	Current	Non-current
Borrowings in Korean won	KEB Hana Bank ¹		1.75	353	353	-
	KDB ¹		1Y + 1.45 ~ 1.99	8,508	-	8,508
Borrowings in foreign currencies	HSBC		3LIBOR + 1.00 ~ 1.05	240,167	39,097	201,070
	Sumitomo Mitsui Banking Corporation		3LIBOR + 0.98~1.05	94,568	50,265	44,303
	Agricultural Bank of China		USD: 3LIBOR + 0.80 CNY: PBOC x0.90	42,694	8,665	34,029
	Construction Bank of China		PBOC x0.90	23,890	3,750	20,140
	Communications Bank of China		PBOC	40,617	2,751	37,866
	CITI		USD: 3M LIBOR + 0.95 Euro: EURIBOR + 0.70	146,957	-	146,957
	Bank of America		3M LIBOR + 0.90	11,181	11,181	-
	ING BANK		6M EURIBOR + 0.70 ~ 0.83	153,422	-	153,422
	UOB		6M LIBOR + 1.15 ~ 1.55	108,954	53,101	55,853
	Standard Chartered Bank		3M LIBOR + 1.60	26,216	26,216	-
Mizuho Banking Corporation		3M LIBOR + 0.98~1.02	78,154	48,030	30,124	

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BNP	Euro: EURIBOR + 0.99 PLN: WIBOR + 0.55	19,178	19,178	-
CNOOC Finance	PBOC ×0.90	54,850	22,298	32,552
Hangseng	3M LIBOR + 1.00	31,836	3,352	28,484
Bank of China	3M LIBOR + 0.95	29,743	12,065	17,678
MUFG	3M LIBOR + 1.00	44,659	2,791	41,868
ANZ	3M LIBOR + 1.42	111,705	-	111,705
Industrial and Commercial Bank of Chin	PBOC	18,210	911	17,299
Total		<u>1,285,862</u>	<u>304,004</u>	<u>981,858</u>

¹ Other receivables and manufacturing facilities are pledged as collateral for the above long-term borrowings (Note 18).

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Details of debentures as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>		2019				
Financial institution	Annual interest rate (%)	Latest maturity date	Amount in Korean won	Current	Non-current	
50-1st Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	1.95	2020.05.19	120,000	120,000	-
50-2nd Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.28	2022.05.19	400,000	-	400,000
50-3rd Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.53	2024.05.19	280,000	-	280,000
51-1st Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.56	2021.02.20	190,000	-	190,000
51-2nd Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.88	2023.02.20	240,000	-	240,000
51-3rd Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	3.07	2025.02.20	270,000	-	270,000
51-4th Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	3.29	2028.02.20	300,000	-	300,000
52-1st Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.02	2022.03.13	160,000	-	160,000
52-2nd Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.11	2024.03.13	240,000	-	240,000
52-3rd Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.21	2026.03.13	200,000	-	200,000
52-4th Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.40	2029.03.13	400,000	-	400,000
1-1st USD Overseas Convertible bonds¹	Credit Suisse	-	2021.04.16	254,716	-	254,716
1-2nd EUR Overseas Convertible bonds²	Credit Suisse	-	2021.04.16	408,950	-	408,950
USD foreign currency debenture with maturity in 2024	CITI and others	3.25	2024.10.15	578,900	-	578,900
USD foreign currency debenture with maturity in 2029	CITI and others	3.63	2029.04.15	578,900	-	578,900
EUR foreign currency debenture with maturity in 2023	CITI and others	0.50	2023.04.15	648,715	-	648,715
Debentures in Korean won (non-guaranteed)	NH Investment & Securities Co., Ltd. and others	1.93	2020.02.16	100,000	100,000	-
	NH Investment & Securities Co., Ltd. and others	2.26	2022.02.16	100,000	-	100,000
	NH Investment & Securities Co., Ltd. and others	2.71	2021.03.02	50,000	-	50,000
	NH Investment & Securities Co., Ltd. and others	3.00	2023.03.02	40,000	-	40,000
Less: discount on debentures				(41,025)	(57)	(40,968)
Total				<u>5,519,156</u>	<u>219,943</u>	<u>5,299,213</u>

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	Financial institution	2018		Amount in Korean won	Current	Non-current
		Annual interest rate (%)	Latest maturity date			
48 th Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	3.77	2019.02.21	50,000	50,000	-
50-1 st Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	1.95	2020.05.19	120,000	-	120,000
50-2 nd Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.28	2022.05.19	400,000	-	400,000
50-3 rd Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.53	2024.05.19	280,000	-	280,000
51-1 st Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.56	2021.02.20	190,000	-	190,000
51-2 nd Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	2.88	2023.02.20	240,000	-	240,000
51-3 rd Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	3.07	2025.02.20	270,000	-	270,000
51-4 th Debenture (non-guaranteed/public)	NH Investment & Securities Co., Ltd. and others	3.29	2028.02.20	300,000	-	300,000
1-1 st USD Overseas Convertible bonds ¹	Credit Suisse	-	2021.04.16	245,982	-	245,982
1-2 nd EUR Overseas Convertible bonds ²	Credit Suisse	-	2021.04.16	403,191	-	403,191
Debentures in Korean won (non-guaranteed)	NH Investment & Securities Co., Ltd. and others	1.93	2020.02.16	100,000	-	100,000
	NH Investment & Securities Co., Ltd. and others	2.26	2022.02.16	100,000	-	100,000
	NH Investment & Securities Co., Ltd. and others	2.71	2021.03.02	50,000	-	50,000
	NH Investment & Securities Co., Ltd. and others	3.00	2023.03.02	40,000	-	40,000
Less: discount on debentures				(36,274)	(8)	(36,266)
Total				2,752,899	49,992	2,702,907

¹ Details of 1-1st USD overseas convertible bonds are as follows:

	Details
Aggregate principal amount	USD 220,000,000
Issue price	USD 220,000,000
Coupon rate (%)	0.00
Issue date	April 16, 2018
Maturity date	April 16, 2021
Redemption	- Redemption at maturity: Outstanding bond principal, which is not repaid early or which call option is not exercised on, is repaid at maturity as a lump sum. - Prepayment: The issuer has a call option.
Underlying shares	509,606 registered ordinary shares (treasury shares)
Conversion price (Korean won/shares)	460,000
Conversion period	From May 27, 2018 to April 06, 2021
Call option by the issuer	- Share price (based on closing price) is higher than 130% of conversion price for more than 20 trading days during 30

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	consecutive trading days in a row, after 1 year from the closing date.
	- The amount of outstanding bonds is less than 10% in aggregate principal amount of the bonds originally issued (clean up call).
	- As a result of changes relating to tax laws in Korea, the issuer becomes obliged to pay any additional amounts.
Call option by bondholders	- The shares cease to be listed or admitted to trading or are suspended for a period equal to or exceeding 30 consecutive trading days.
	- The occurrence of a change of control

² Details of 1-2nd EUR overseas convertible bonds are as follows:

	<u>Details</u>
Aggregate principal amount	EUR 315,200,000
Issue price	EUR 315,200,000
Coupon rate (%)	0.00
Issue date	April 16, 2018
Maturity date	April 16, 2021
Redemption	- Redemption at maturity: Outstanding bond principal, which is not repaid early or which call option is not exercised on, is repaid at maturity as a lump sum. - Prepayment: The issuer has a call option.
Underlying shares	775,128 registered ordinary shares (treasury shares)
Conversion price (Korean won/shares)	533,600
Conversion period	From May 27, 2018 to April 06, 2021
Call option by the issuer	- Share price (based on closing price) is higher than 130% of conversion price for more than 20 trading days during 30 consecutive trading days in a row, after 1 year from the closing date. - The amount of outstanding bonds is less than 10% in aggregate principal amount of the bonds originally issued (clean up call). - As a result of changes relating to tax laws in Korea, the issuer becomes obliged to pay any additional amounts.
Call option by bondholders	- The shares cease to be listed or admitted to trading or are suspended for a period equal to or exceeding 30 consecutive trading days. - The occurrence of a change of control

Details of finance lease liabilities as at December 31, 2019 and December 31, 2018, are as follows:

(in millions of Korean won)

Leaser	<u>2019</u>				
	Annual interest rate (%)	Latest maturity date	Total amount	Current	Non-current
Hyundai Oil Bank and others	1.98 ~ 4.13	2068.12.31	277,245	55,108	222,137
Total			<u>277,245</u>	<u>55,108</u>	<u>222,137</u>

(in millions of Korean won)

Leaser	<u>2018</u>				
	Annual interest rate (%)	Latest maturity date	Total amount	Current	Non-current
Hyundai Oil Bank	3.12	2024.12.31	27,168	4,886	22,282
CHUNGBUK					
TECHNOPARK	4.13	2023.12.31	1,076	122	954
Total			<u>28,244</u>	<u>5,008</u>	<u>23,236</u>

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15. Provisions

Changes in provisions for other liabilities and charges for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019				
	Warranty¹	Greenhouse gas emission²	Legal claims³	Restoration⁴	Total
Beginning balance	198,575	11,700	402	126,976	337,653
Additions	652,528	23,606	13	8,884	685,031
Used	<u>(254,852)</u>	<u>(10,149)</u>	<u>(45)</u>	<u>(20,910)</u>	<u>(285,956)</u>
Ending balance	596,251	25,157	370	114,950	736,728
Less : current portion	<u>(417,561)</u>	<u>(25,157)</u>	<u>-</u>	<u>(29,411)</u>	<u>(472,129)</u>
Total	<u>178,690</u>	<u>-</u>	<u>370</u>	<u>85,539</u>	<u>264,599</u>

(in millions of Korean won)

	2018				
	Warranty¹	Greenhouse gas emission²	Legal claims³	Restoration⁴	Total
Beginning balance	92,662	23,069	20,629	90,056	226,416
Additions	208,511	11,733	7,070	50,439	277,753
Used	<u>(102,598)</u>	<u>(23,102)</u>	<u>(27,297)</u>	<u>(13,519)</u>	<u>(166,516)</u>
Ending balance	198,575	11,700	402	126,976	337,653
Less : current portion	<u>(81,146)</u>	<u>(11,700)</u>	<u>-</u>	<u>(26,520)</u>	<u>(119,366)</u>
Total	<u>117,429</u>	<u>-</u>	<u>402</u>	<u>100,456</u>	<u>218,287</u>

¹ Warranty provisions have been accrued for the estimated warranty costs to be incurred due to quality control, exchange, refunds with regard to products based on historical experience. In addition, provisions related to downtime loss compensation for ESS fire accidents are included.

² Greenhouse gas emission provisions have been accrued for estimated expenditures to be obligated for any excess emission. The estimated emission for the year ended December 31, 2019, amounts to 8,255 thousand tons (2018: 7,834 thousand tons).

³ Lawsuit provisions have been accrued for certain pending cases.

⁴ As at December 31, 2019, restoration provisions have been accrued for the estimated expenses to restore land pollutions and others.

16. Net Defined Benefit Liabilities

Details of net defined benefit liabilities recognized in the consolidated statements of financial position as at December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019	2018
Present value of defined benefit obligations ¹	1,343,553	1,167,524
Fair value of plan assets	<u>(1,164,393)</u>	<u>(939,980)</u>
Liabilities in the consolidated statement of financial position	<u>179,160</u>	<u>227,544</u>

¹ The present value of retirement benefit obligations is net of existing contributions to the National

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Pension Plan of ₩ 768 million as at December 31, 2019 (2018: ₩ 837 million).

The amounts recognized in the consolidated statements of profit or loss for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Current service cost ¹	161,211	145,176
Past service cost	-	812
Interest cost	6,063	5,846
Total, included in employee benefit expenses	<u>167,274</u>	<u>151,834</u>

¹ The above amounts excluded ₩ 1,720 million (2018: ₩ 1,096 million) of expenses capitalized to construction in progress and development costs.

Post-employment benefits recognized for defined contribution plan for the year ended December 31, 2019, amounted to ₩ 6,969 million (2018: ₩ 5,511 million).

Post-employment benefits recognized in the consolidated statements of profit or loss for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Cost of sales	114,739	104,952
Selling and administrative expenses	59,504	52,393
Total	<u>174,243</u>	<u>157,345</u>

Movements in the present value of defined benefit obligations for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Beginning balance	1,167,524	1,049,511
Business combination	-	2,461
Transfer in	20,820	12,012
Transfer out	(5,909)	(8,412)
Current service cost	162,931	146,272
Past service cost	-	812
Interest expense	30,649	32,609
Remeasurements:		
Actuarial loss from change in demographic assumptions	5,316	2,553
Actuarial loss from change in financial assumptions	74,372	62,476
Actuarial loss from experience adjustments	(21,594)	2,139
Others	916	(91)
Exchange differences	(949)	(666)
Payments from plans	(90,523)	(134,152)
Ending balance	<u>1,343,553</u>	<u>1,167,524</u>

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Movements in the fair value of plan assets for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Beginning balance	939,980	868,830
Transfer in	-	1,546
Transfer out	(184)	(628)
Interest income	24,586	26,763
Remeasurements:		
Return on plan assets (excluding amounts included in interest income)	(6,796)	(8,942)
Contributions:		
Employers	283,196	155,567
Payments from plans	(75,299)	(102,229)
Administrative costs	(1,090)	(927)
Ending balance	<u>1,164,393</u>	<u>939,980</u>

The actual return on plan assets for the year ended December 31, 2019, was ₩ 17,790 million (2018: ₩ 17,821 million).

The significant actuarial assumptions as at December 31, 2019 and 2018, are as follows:

	2019	2018
Discount rate	2.4%~2.5%	2.7%~3.5%
Salary growth rate	4.0%~5.0%	2.2%~5.0%

The sensitivity analysis for changes in key actuarial assumptions as at December 31, 2019, is as follows:

<i>(in millions of Korean won)</i>	Increase by 0.5%	Decrease by 0.5%
Discount rate:		
Increase (decrease) in defined benefit obligations	(77,275)	84,952
Salary growth rate:		
Increase (decrease) in defined benefit obligations	82,373	(75,826)

A decrease in corporate bond yields may lead most significantly to an increase in defined benefit liabilities.

The above sensitivity analyses are based on a change in an assumption while holding all other assumptions constant. In practice, this is unlikely to occur, and changes in some of the assumptions may be correlated. The sensitivity of the defined benefit obligation to changes in principal actuarial assumptions is calculated using the projected unit credit method, the same method applied when calculating the defined benefit obligations recognized on the statement of financial position.

The methods and types of assumptions used in preparing the sensitivity analysis did not change compared to the prior period.

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Plan assets as at December 31, 2019 and 2018, consist of:

<i>(in millions of Korean won)</i>	2019		2018	
	Amount	Composition	Amount	Composition
Insurance contracts with guaranteed yield	1,138,725	97.8%	922,829	98.18%
Equity linked bonds	24,891	2.14%	15,576	1.66%
Time deposits	777	0.06%	1,575	0.16%
	<u>1,164,393</u>	<u>100.00%</u>	<u>939,980</u>	<u>100.00%</u>

Plan assets consist of various debt instruments with principal and interest protection and others which have no quoted market prices in an active market.

As at December 31, 2019, the weighted average duration of defined benefit obligations is 12.74 years.

The Group reviews the funding level on an annual basis and has a policy of eliminating deficit from the fund. Expected contributions to post-employment benefit plans for the year ending December 31, 2020, are ₩ 364,576 million.

17. Other Current and Non-Current Liabilities

Details of other current and non-current liabilities as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Current		
Advances from customers	150,673	128,308
Withholdings	108,140	117,442
Unearned revenues	48,907	13,105
Accrued expenses	198,206	298,458
Total	<u>505,926</u>	<u>557,313</u>
Non-current		
Long-term accrued expenses	59,514	52,359
Long-term unearned revenues	15,272	15,272
Long-term advanced received	58,699	28,788
	<u>133,485</u>	<u>96,419</u>

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18. Commitments and Contingencies

(1) As at December 31, 2019, the Parent Company and certain subsidiaries have been guaranteed from the Seoul Guarantee Insurance Company for the execution of contracts and others.

(2) As at December 31, 2019, the Parent Company and certain subsidiaries have various specific line of credit agreements with several financial institutions, as follows:

(unit: Korean won in millions, foreign currencies in millions)

Classification	The Parent Group		Certain Overseas Subsidiaries					
	KRW	USD	KRW	USD	CNY	EUR	INR	THB
Limit of bank overdraft	59,100	-	-	220	1,100	29	-	10
Limit of the letter of credit	32,000	397	-	420	5,146	-	2,894	-
Limit of discount of notes from export	-	784	-	-	-	-	-	-
Limit of guaranteed payments in other foreign currency	-	132	-	-	-	-	-	-
Limit of loan arrangements	-	-	101,250	2,564	3,898	1,065	-	-

The Group also entered into comprehensive credit line agreements with other financial institutions relating to trade finance and import/export amounting to ₩ 20,000 million (including bank overdraft of 5,000 million) and US\$ 55 million.

(3) As at December 31, 2019, the Parent Company and certain subsidiaries have B2B purchase arrangements with several financial institutions with limit of ₩ 450,000 million and ₩ 152,400 million, respectively as well as enterprise general fund arrangement with limit of ₩ 350,000 million.

(4) As at December 31, 2019, in relation to price fixing of mobile batteries, the consumers in Canada and Israel have filed two class actions against the Parent Company and certain overseas subsidiaries. However, the ultimate outcome of these cases cannot be determined at the reporting date.

(5) In addition, as at December 31, 2019, the Parent Company and certain subsidiaries have been named as a plaintiff in 23 and 17 legal actions, respectively, involving ₩ 21,917 million and ₩ 3,328 million in claims, respectively. They have been named as a defendant in 136 and 36 legal actions, respectively, with ₩ 8,169 million and ₩ 19,856 million in claims, respectively. The ultimate outcome of these cases cannot be determined at the reporting date.

(6) As at December 31, 2019, the Parent Company is under investigation by the related authorities in relation to the manipulation of the emission of fine dust-causing substance in the Yeosu Industrial Complex, and the final outcome of these investigations cannot be determined at the reporting date. As at December 31, 2019, the Parent Company shut down the relevant production facilities.

(7) The Parent Company has entered into manufacture and production technical contracts with ExxonMobil and others.

(8) The Parent Company has entered into a license agreement with LG Corp. to use trademarks on the products that the Group manufactures and sells, and on the services the Group provides in relation to its business.

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(9) As at December 31, 2019, the Parent Company has entered into payment guarantee contract of USD 6 million, EUR 6 million and KRW 5,373 million with financial institutions to guarantee the warrant of certain installed products. Also, certain subsidiaries have entered into payment guarantee contract of CNY 117 million with financial institutions in relation to custom of imported raw materials.

(10) As at December 31, 2019 and 2018, assets pledged as collateral for the borrowings are as follows:

(in millions of Korean won)

	2019			Secured party
	Secured amount	Borrowings / Loan	Limit	
Factory	20,880	Current and non-current borrowings	16,208	KDB
	<u>20,880</u>		<u>16,208</u>	

(in millions of Korean won)

	2018			Secured party
	Secured amount	Borrowings / Loan	Limit	
Other receivables	300	Non-current borrowings	353	Hana Bank
Factory	20,880	Non-current borrowings	16,800	KDB
Dormitory	600	Non-current borrowings	1,038	Woori Bank
	<u>21,780</u>		<u>18,191</u>	

(11) Capital expenditure arrangement that has not incur at the end of the reporting period is as follows:

(in millions of Korean won)

	2019	2018
Property, plant and equipment	2,069,630	2,041,834

(12) In June 2019, the Group had entered into an agreement with SMGA(Shanghai maple guorun), a subsidiary company of Geely Auto Group, to establish a joint venture of electric-car battery with 50:50 shares. The committed amount of investment is ₩ 103,400 million.

(13) In December 2019, the Group had entered into an agreement with GM to establish a joint venture of electric-car battery with 50:50 shares. The committed amount of investment is ₩ 1,000,000 million.

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19. Share Capital

Changes in share capital and share premium for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won and in shares)

	Ordinary shares		Preferred shares		Share premium
	Number of shares	Share capital	Number of shares	Share capital	
January 1, 2018	70,592,343	352,962	7,688,800	38,444	2,014,038
December 31, 2018	70,592,343	352,962	7,688,800	38,444	2,014,038
December 31, 2019	70,592,343	352,962	7,688,800	38,444	2,014,036

Changes in treasury shares for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	Number of shares		Carrying amount	Gain on disposal of treasury shares
	Ordinary shares	Preferred shares		
January 1, 2018	1,652,416	16,367	354,945	13,855
Odd-lot stock acquisition	1	-	-	-
December 31, 2018	1,652,417	16,367	354,945	13,855
December 31, 2019	1,652,417	16,367	354,945	13,855

20. Retained Earnings

Retained earnings as at December 31, 2019 and 2018, consist of:

(in millions of Korean won)

	2019	2018
Legal reserve ¹	352,286	329,554
Discretionary reserve ²	13,608,917	12,541,819
Retained earnings before appropriation	837,487	2,122,879
Total	14,798,690	14,994,252

¹ The Commercial Code of the Republic of Korea requires the Parent Company to appropriate for each financial period, as a legal reserve, an amount equal to a minimum of 10% of cash dividends paid until such reserve equals 50% of its issued share capital. The reserve is not available for cash dividends payment, but may be transferred to share capital or used to reduce accumulated deficit. When the accumulated legal reserves (the sum of capital reserves and earned profit reserves) are greater than 1.5 times the paid-in capital amount, the excess legal reserves may be distributed in accordance with a resolution of the shareholders' meeting.

² The Group separately accumulates a discretionary reserve for research and human resource development through appropriation of retained earnings, which has been included as deductible expense for the corporate income tax return according to the Special Tax Treatment Law. The reserve could be reversed in accordance with the terms of related tax laws.

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21. Other Components of Equity

Details of other components of equity as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Treasury shares (Note 19)	(354,945)	(354,945)
Capital transactions within the Group ¹	(19,298)	(19,298)
Total	<u>(374,243)</u>	<u>(374,243)</u>

¹ Includes gain or loss on disposal of investments and investment differences due to changes in equity, net of deferred tax.

22. Selling and Administrative Expenses

Selling and administrative expenses for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Wages and salaries	881,869	822,676
Post-employment benefits (Note 16)	59,504	52,393
Employee benefits	195,847	157,843
Travel expense	80,336	62,718
Water & utilities	55,944	45,226
Packaging expense	10,582	9,708
Rental expenses	97,616	94,724
Commission expenses	566,432	443,153
Depreciation	159,668	117,200
Advertising expense	39,021	32,486
Freight expenses	579,642	556,816
Training expense	25,843	24,015
Amortization (Note 12)	108,203	84,573
Sample expense	25,942	18,925
Development costs	242,618	186,286
Others	821,092	391,385
Total	<u>3,950,159</u>	<u>3,100,127</u>

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23. Breakdown of Expenses by Nature

Cost of sales, and selling and administrative expenses by nature for the years ended December 31, 2019 and 2018, consist of:

<i>(in millions of Korean won)</i>	2019	2018
Changes in inventories of merchandise, finished goods, semi-finished goods and work in process	(337,096)	(527,872)
Raw materials and consumables used	16,476,613	16,831,855
Purchase of merchandise	1,311,136	1,380,984
Employee benefit expenses (Note 24)	2,640,983	2,425,323
Advertising expenses	40,330	34,005
Freight expenses	623,691	598,564
Commission expenses	927,238	731,651
Depreciation and amortization	1,856,467	1,482,405
Rentals and fees	83,558	97,098
Other expenses	4,106,474	2,882,930
Total	<u>27,729,394</u>	<u>25,936,943</u>

24. Employee Benefit Expenses

Details of employee benefit expenses for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Salaries	2,198,064	2,042,056
Post-employment benefits – Defined benefit plan (Note 16)	167,274	151,834
Post-employment benefits – Defined contribution plan (Note 16)	6,969	5,511
Others	268,676	225,922
Total	<u>2,640,983</u>	<u>2,425,323</u>

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25. Finance Income and Costs

Details of finance income and costs for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Finance income		
Interest income ¹	45,316	47,836
Dividend income	1,724	123
Exchange differences	214,090	159,561
Gain on valuation of derivative instruments	29,600	2,855
Others	67	-
Total	<u>290,797</u>	<u>210,375</u>
Finance costs		
Interest expense ²	209,335	135,513
Exchange differences	227,194	231,872
Loss on valuation of derivative instruments	273	99
Others	7	13
Total	<u>436,809</u>	<u>367,497</u>

¹ Details of interest income for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Deposits held by financial institutions	38,762	42,137
Other loans and receivables	6,554	5,699
Total	<u>45,316</u>	<u>47,836</u>

² Details of interest expense for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Interest related to financial institutions	93,202	81,161
Interest on finance lease liabilities	3,593	994
Interest on debentures	121,760	66,646
Other interest expenses	17,939	7,617
Capitalized interest for qualifying assets	(27,159)	(20,905)
Total	<u>209,335</u>	<u>135,513</u>

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26. Other Non-Operating Income

Details of other non-operating income for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Exchange differences	498,126	326,088
Gain on disposal of property, plant and equipment	11,602	8,409
Gain on disposal of intangible assets	405	2
Reversal of impairment loss on property, plant and equipment (Note 11)	215	452
Others	42,503	42,242
Total	<u>552,851</u>	<u>377,193</u>

27. Other Non-Operating Expenses

Details of other non-operating expenses for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Exchange differences	488,799	323,312
Loss on disposal of property, plant and equipment	45,913	27,915
Loss on disposal of intangible assets	1,726	1,940
Impairment loss on property, plant and equipment (Note 11)	125,560	52,914
Impairment loss on intangible assets (Note 12)	61,750	12,845
Donations	14,614	14,295
Others	25,776	97,958
Total	<u>764,138</u>	<u>531,179</u>

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28. Tax Expense and Deferred Tax

Details of income tax expense for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Current tax on profit for the years	243,906	517,100
Adjustments in respect of prior years	52,976	18,430
Deferred tax - movement in temporary differences	(108,429)	(134,160)
Deferred tax – tax credit carryforwards	(2,031)	(10,446)
	<u>186,422</u>	<u>390,924</u>
Deferred tax charged directly to equity	(20,226)	8,997
Current tax charged directly to equity	18,260	20,814
Income tax expense	<u>184,456</u>	<u>420,735</u>

The aggregate current and deferred tax charged directly to equity (other comprehensive income) for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Current tax		
Remeasurements of net defined benefit liabilities	18,260	20,814
Deferred tax		
Loss on valuation of derivative instruments	(10,958)	5,081
Exchange differences on translation of foreign operations	448	1,731
Gain on disposal of financial assets at fair value through other comprehensive income	-	424
Gain on valuation of financial assets at fair value through other comprehensive income	(9,716)	1,761
Total	<u>(20,226)</u>	<u>8,997</u>

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Movements in deferred tax assets (liabilities) for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019					
	Increase (decrease)					Ending balance
	Beginning balance	Business combination	Profit (loss) for the year	Other comprehensive income	Exchange differences	
Net defined benefit liabilities	311,710	-	47,211	-	19	358,940
Plan assets	(256,798)	-	(61,048)	-	-	(317,846)
Provision for impairment on receivables	812	-	273	-	20	1,105
Property, plant and equipment	95,892	-	17,305	-	222	113,419
Intangible assets	(30,033)	-	1,378	-	(507)	(29,162)
Investments in subsidiaries, associates and joint ventures	(20,293)	-	(11,205)	-	-	(31,498)
Accrued income	(534)	-	320	-	(4)	(218)
Others	152,723	2,851	133,741	(20,674)	195	268,836
	<u>253,479</u>	<u>2,851</u>	<u>127,975</u>	<u>(20,674)</u>	<u>(55)</u>	<u>363,576</u>
Exchange differences on translation of foreign operations	(3,836)	-	(515)	448	26	(3,877)
Tax credit carryforwards	20,693	-	2,031	-	225	22,949
Tax loss carryforwards	79,944	-	1,195	-	1,007	82,146
Deferred tax assets (liabilities)	<u>350,280</u>	<u>2,851</u>	<u>130,686</u>	<u>(20,226)</u>	<u>1,203</u>	<u>464,794</u>

(in millions of Korean won)

	2018					
	Increase (decrease)					Ending balance
	Beginning balance	Business combination	Profit (loss) for the year	Other comprehensive income	Exchange differences	
Net defined benefit liabilities	274,554	-	37,372	(66)	(150)	311,710
Plan assets	(237,514)	-	(19,284)	-	-	(256,798)
Reserve for research and human resources development	(18,334)	-	18,334	-	-	-
Provision for impairment on receivables	677	-	150	-	(15)	812
Property, plant and equipment	83,996	459	11,316	-	121	95,892
Intangible assets	(27,618)	-	(2,343)	-	(72)	(30,033)
Investments in subsidiaries, associates and joint ventures	(12,011)	-	(8,706)	(111)	535	(20,293)
Accrued income	(1,096)	-	667	-	(105)	(534)
Others	138,789	(17,112)	30,844	7,443	(7,241)	152,723
	<u>201,443</u>	<u>(16,653)</u>	<u>68,350</u>	<u>7,266</u>	<u>(6,927)</u>	<u>253,479</u>
Exchange differences on translation of foreign operations	(4,501)	-	(1,068)	1,731	2	(3,836)
Tax credit carryforwards	15,518	(5,271)	10,446	-	-	20,693
Tax loss carryforwards	26,419	(3,546)	57,881	-	(810)	79,944
Deferred tax assets (liabilities)	<u>238,879</u>	<u>(25,470)</u>	<u>135,609</u>	<u>8,997</u>	<u>(7,735)</u>	<u>350,280</u>

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The reconciliations between income tax expense and accounting profit for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Profit before income tax expense	560,560	1,940,047
Tax at domestic tax rates applicable to profits in the respective countries¹	213,020	556,118
Tax effects of:	(28,564)	(135,383)
Income not subject to tax	(18,854)	(31,410)
Expenses not deductible for tax purposes	35,405	18,545
Unrecognized deferred income tax for temporary differences in the current year	19,594	(62,391)
Tax credit	(92,052)	(97,616)
Effects of change in tax rate	-	308
Others	27,343	37,181
Income tax expense	184,456	420,735
Effective tax rate(income tax expense/profit before income tax)	32.91%	21.69%

¹ The weighted average applicable tax rate on profit before income tax for the year ended December 31, 2019, is 38.00% (2018: 28.67%).

Realization of deferred tax assets is dependent on the Group's ability to generate future taxable profits in excess of the profits arising from the reversal of taxable temporary differences, and economic and industry outlooks. Management periodically reviews on these factors.

Details of deductible (taxable) temporary differences unrecognized as deferred tax assets (liabilities) as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018	
Investments in subsidiaries, associates and joint ventures	(125,485)	(113,689)	Permanently re-invested income not distributed as dividend
Goodwill	893,853	650,872	No possibility of disposal
Land	(694,422)	(694,422)	
Unused tax loss carryforwards	488	488	
	305,471	259,059	Uncertainty of future tax income

The maturity of unused loss is as follows:

<i>(in millions of Korean won)</i>	Less than 1 year	Between 1-2 years	Between 2-5 years	Over 5 years
2019 Tax loss carryforwards	93,677	46,962	30,760	341,155
2018 Tax loss carryforwards	70,730	83,388	59,458	268,961

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29. Earnings per Share

Basic earnings per share is calculated by dividing the profit attributable to ordinary shares by the weighted average number of shares in issue excluding shares purchased by the Parent Company and held as treasury shares. As at the reporting date, the Parent Company has no potential ordinary shares. Preferred shares have a right to participate in the profits of the Parent Company. These participation rights have been considered in presenting the EPS for ordinary shares and preferred shares.

Basic earnings per share attributable to the owners of the Parent Company for the years ended December 31, 2019 and 2018, are computed as follows:

Basic earnings per ordinary share

*(in millions of Korean won and
in number of shares)*

	2019	2018
Profit attributable to ordinary shares ¹	281,637	1,324,787
Weighted average number of ordinary shares outstanding ²	68,939,926	68,939,926
Basic earnings per ordinary shares (in won)	<u>4,085</u>	<u>19,217</u>

Basic earnings per preferred share

*(in millions of Korean won and
in number of shares)*

	2019	2018
Profit attributable to preferred shares ¹	31,728	147,821
Weighted average number of preferred shares outstanding ²	7,672,433	7,672,433
Basic earnings per preferred shares (in won)	<u>4,135</u>	<u>19,267</u>

¹ Profit attributable to ordinary and preferred shares are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Profit attributable to the equity holders of the Parent Company	313,365	1,472,608
Ordinary shares dividends (A)	137,880	413,640
Preferred shares dividends (B)	15,728	46,418
Undistributed earnings for the year	159,757	1,012,550
Undistributed earnings available for ordinary shares (C)	143,757	911,147
Undistributed earnings available for preferred shares (D)	16,000	101,403
Profit for the year attributable to ordinary shares (A+C)	281,637	1,324,787
Profit for the year attributable to preferred shares (B+D)	31,728	147,821

² Weighted average numbers of shares are calculated as follows:

Ordinary shares outstanding	2019			
	Period	Number of shares	Number of days	Number of shares x days
Beginning balance	2019. 1. 1 - 2019. 12. 31	68,939,926	365	<u>25,163,072,990</u>
Total				<u>25,163,072,990</u>

Weighted average number of ordinary shares outstanding: 25,163,072,990 / 365 = 68,939,926

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shares

Preferred shares outstanding	2019			
	Period	Number of shares	Number of days	Number of shares x days
Beginning balance	2019. 1. 1 - 2019. 12. 31	7,672,433	365	2,800,438,045
Total				2,800,438,045

Weighted average number of preferred shares outstanding: $2,800,438,045 / 365 = 7,672,433$
 shares

Ordinary shares outstanding	2018			
	Period	Number of shares	Number of days	Number of shares x days
Beginning balance	2018. 1. 1 - 2018. 12. 31	68,939,926	365	25,163,072,990
Total				25,163,072,990

Weighted average number of ordinary shares outstanding: $25,163,072,990 / 365 = 68,939,926$
 shares

Preferred shares outstanding	2018			
	Period	Number of shares	Number of days	Number of shares x days
Beginning balance	2018. 1. 1 - 2018. 12. 31	7,672,433	365	2,800,438,045
Total				2,800,438,045

Weighted average number of preferred shares outstanding: $2,800,438,045 / 365 = 7,672,433$
 shares

Diluted earnings per share is calculated based on the weighted average number of ordinary shares outstanding, adjusted for the assumption that all of dilutive potential ordinary shares to be converted. The Parent Company has one category of dilutive potential ordinary shares: convertible bonds, which were issued during the year ended December 31, 2018. Convertible bonds are considered to be converted into potential ordinary shares and the amount, subtracting income tax effect from related gain and loss such as interest expense on convertible bonds, is added to profit for the period attributable to ordinary shares and preferred shares.

<i>(in millions of Korean won and in number of shares)</i>	2019	2018
Diluted earnings per ordinary shares		
Profit for the year attributable to the ordinary shares	281,637	1,324,787
Gain and loss on convertible bonds (after tax effects)	(9,016)	6,444
Profit used in calculating diluted earnings per share	272,621	1,331,231
Weighted average number of ordinary shares outstanding	68,939,926	68,939,926
Adjustments for calculation of diluted earnings per share:		
Assumed conversion of convertible bonds	1,284,734	915,153
Weighted average number of ordinary shares and potential ordinary shares used as the denominator in calculating diluted earnings per share	70,224,660	69,855,079
Diluted earnings per share attributable to the ordinary shares (in won)	3,882	19,057

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<i>(in millions of Korean won and in number of shares)</i>	2019	2018
Diluted earnings per preferred shares		
Profit for the year attributable to preferred shares	31,728	147,821
Gain and loss on convertible bonds	(1,559)	(1,224)
Profit used in calculating diluted earnings per share	30,169	146,597
Weighted average number of preferred shares outstanding	7,672,433	7,672,433
Adjustments for calculation of diluted earnings per share:		
Assumed conversion of convertible bonds	-	-
Weighted average number of preferred shares and potential preferred shares used as the denominator in calculating diluted earnings per share	<u>7,672,433</u>	<u>7,672,433</u>
Diluted earnings per share attributable to the preferred shares (in won)	<u>3,932</u>	<u>19,107</u>

30. Dividends

Details of dividends of the Parent Company as at December 31, 2019 and 2018, are as follows:

	2019	2018
Number of shares entitled to dividends: shares issued and outstanding (par value per share: ₩ 5,000)		
Ordinary shares	68,939,926	68,939,926
Preferred shares	7,672,433	7,672,433
Dividend per share (<i>in Korean won, %</i>)		
Ordinary shares: cash	2,000 (40%)	6,000 (120%)
Preferred shares: cash	2,050 (41%)	6,050 (121%)
Cash dividends to distribute (<i>in millions of Korean won</i>)		
Ordinary shares	137,880	413,640
Preferred shares	15,728	46,418
	<u>153,608</u>	<u>460,058</u>

Dividend payout ratios of the Parent Company for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Dividends (A)	153,608	460,058
Profit attributable to equity holders of the Parent Company (B)	<u>313,365</u>	<u>1,472,608</u>
Dividend payout ratio (A/B)	<u>49.02%</u>	<u>31.24%</u>

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Dividend yield ratios of the Parent Company for the years ended December 31, 2019 and 2018, are as follows:

(in Korean won)	2019		2018	
	Ordinary shares	Preferred Shares	Ordinary shares	Preferred Shares
Dividend per share (A)	2,000	2,050	6,000	6,050
Market value at the end of year (B) ¹	312,000	171,500	353,250	198,125
Dividend yield ratio (A/B)	0.64%	1.20%	1.70%	3.05%

¹ Average price in the stock market during one week preceding two business days before shareholder list closing date for the general shareholders' meeting.

31. Related Party Transactions

As at December 31, 2019 and 2018, LG Corp. is an entity exercising a significant influence over the Group, which owns 33.34% of the Parent Company's ordinary shares.

Details of associates and other related parties that have sales and other transactions with the Group or have receivables and payables balances as at December 31, 2019 and 2018, are as follows, and the details of investments in subsidiaries, associates and joint ventures are described in Note 1.3:

Related party	Related party's subsidiary (Domestic)	Related party's subsidiary (Overseas)	Details
S&I corp.	S&I CM	-	Subsidiary of LG Corp.
LG CNS Co., Ltd.	Biz Tech Partners Co., Ltd. and others	LG CNS America Inc. and others	Subsidiary of LG Corp.
LG Management Development Institute	-	-	Subsidiary of LG Corp.
LG Sports Ltd.	-	-	Subsidiary of LG Corp.
LG Holdings Japan	-	-	Subsidiary of LG Corp.
LG MMA Corporation	-	-	Joint venture of LG Corp.
LG Display Co., Ltd.	-	LG Display (China) Co., Ltd. and others	LG Enterprise group ¹
LG Electronics, Inc.	LG Innotek Co., Ltd. and others	Inspur LG Digital Mobile Communications Co., Ltd. and others	LG Enterprise group ¹
LG International Corp.	Pantos Logistics Co., Ltd. and others	LG International (Japan) Ltd. and others	LG Enterprise group ¹
LG Hausys, Ltd.	-	LG Hausys Tianjin Co., Ltd. and others	LG Enterprise group ¹
LG Household & Health Care Ltd.	Coca-Cola Beverage Co. and others	LG Household & Health Care trading (Shanghai) Co.,Ltd.	LG Enterprise group ¹
LG Uplus Corp.	-	-	LG Enterprise group ¹
G II R Inc.	HS AD Inc.	GIIR Rus LLC	LG Enterprise group ¹
Silicon Works Co., Ltd.	-	-	LG Enterprise group ¹
SERVEONE ²	-	Serveone(Nanjing).Co.,Ltd. and others	LG Enterprise group ¹

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¹ Although these entities are not the related parties of the Group in accordance with Korean IFRS 1024, these entities belong to a large enterprise group in accordance with the Monopoly Regulation and Fair Trade Act.

² During 2019, SERVEONE has been excluded from other related parties as S&I corp. has sold its shares of SERVEONE.

Sales and purchases with related parties for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019			
	Sales and others	Purchase and others		
		Purchase of raw materials /merchandises	Acquisition of property, plant and equipment and intangible assets	Others
Entity with a significant influence over the Group				
LG Corp.	2,666	-	-	73,171
Associates and joint ventures				
SEETEC Co., Ltd.	49,774	197,502	342	90,611
TECWIN Co., Ltd.	3	55	4,728	220
HL Greenpower Co., Ltd.	834,289	-	-	1,148
Others	196	27	1	2,937
Other related parties				
LG MMA Corporation ¹	108,957	190,917	-	6,087
S&I Corporation and its subsidiaries ²	11,234	755,355	620,251	139,372
LG CNS Co., Ltd. and its subsidiaries	18,258	3,862	344,607	87,073
Others	5	-	-	18,154
Others				
LG Display Co., Ltd. and its subsidiaries	1,123,640	148	80,116	2,151
LG Electronics Inc. and its subsidiaries	960,332	575,282	728,049	106,866
LG International Corp. and its subsidiaries	185,471	454,183	43,235	537,084
LG Hausys, Ltd. and its subsidiaries	191,851	7,633	4,483	7,079
Others	14,499	23,901	1,041	12,652
Total	3,501,175	2,208,865	1,826,853	1,084,605

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(in millions of Korean won)

	2018			
	Sales and others	Purchase and others		
		Purchase of raw materials /merchandises	Acquisition of property, plant and equipment and intangible assets	Others
Entity with a significant influence over the Group				
LG Corp.	10	-	-	69,969
Associates and joint ventures				
SEETEC Co., Ltd.	29,019	133,005	4,665	84,759
TECWIN Co., Ltd.	-	224	3,383	286
HL Greenpower Co., Ltd.	523,822	-	-	790
Others	26	-	-	2,586
Other related parties				
LG MMA Corporation ¹	114,240	264,957	-	6,743
S&I Corporation and its subsidiaries	15,374	547,144	680,905	257,749
LG CNS Co., Ltd. and its subsidiaries	65,622	2,665	273,639	99,874
Others	6	-	-	14,324
Others				
LG Display Co., Ltd. and its subsidiaries	1,234,012	80	1,564	5
LG Electronics Inc. and its subsidiaries	1,036,834	456,254	1,038,106	96,852
LG International Corp. and its subsidiaries	290,208	541,641	1,699	454,390
LG Hausys, Ltd. and its subsidiaries	209,702	3,312	1,545	7,073
Others	16,242	27,341	2,340	9,409
Total	3,535,117	1,976,623	2,007,846	1,104,809

¹ Net sales and purchase amounts after offsetting for Raffinate transactions with LG MMA.

² SERVEONE has been excluded from the related parties at December 31, 2019 since S&I corporation sold its shares of SERVEONE in 2019. Transactions with SERVEONE until the sale of shares have been included in the above information.

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Balances of receivables and payables arising from sales and purchases of goods and services as at December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019			Total
	Receivables			
	Trade receivables and others	Loan receivables	Other receivables	
Entity with a significant influence over the Group				
LG Corp.	-	-	12,391	12,391
Associates and joint ventures				
SEETEC Co., Ltd.	4,140	-	636	4,776
TECWIN Co., Ltd.	-	-	-	-
HL Greenpower Co., Ltd.	54,907	-	-	54,907
Others	-	-	10	10
Other related parties				
LG MMA Corporation	8,425	-	844	9,269
S&I Corporation and its subsidiaries	8	-	24,574	24,582
LG CNS Co., Ltd. and its subsidiaries	7,650	-	-	7,650
Others	607	-	4,356	4,963
Others				
LG Display Co., Ltd. and its subsidiaries	128,562	-	74	128,636
LG Electronics Inc. and its subsidiaries	231,821	-	21,095	252,916
LG International Corp. and its subsidiaries	13,861	-	-	13,861
LG Hausys, Ltd. and its subsidiaries	19,995	-	262	20,257
Others	39	-	1,096	1,135
Total	470,015	-	65,338	535,353

(in millions of Korean won)

	2019			Total
	Payables			
	Trade payables	Borrowings	Other payables	
Entity with a significant influence over the Group				
LG Corp.	-	-	1,360	1,360
Associates and joint ventures				
SEETEC Co., Ltd.	15,781	-	11,375	27,156
TECWIN Co., Ltd.	-	-	1,633	1,633
HL Greenpower Co., Ltd.	-	-	65	65
Others	-	-	258	258
Other related parties				
LG MMA Corporation	13,413	-	-	13,413
S&I Corporation and its subsidiaries	19	-	300,928	300,947
LG CNS Co., Ltd. and its subsidiaries	860	-	163,654	164,514
Others	-	-	462	462
Others				
LG Display Co., Ltd. and its subsidiaries	7	-	87	94
LG Electronics Inc. and its subsidiaries	115,622	-	436,962	552,584
LG International Corp. and its subsidiaries	10,398	-	97,017	107,415
LG Hausys, Ltd. and its subsidiaries	512	-	5,925	6,437
Others	1,706	-	4,328	6,034
Total	158,318	-	1,024,054	1,182,372

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(in millions of Korean won)

	2018			
	Receivables			Total
	Trade receivables and others	Loan receivables	Other receivables	
Entity with a significant influence over the Group				
LG Corp.	-	-	11,286	11,286
Associates and joint ventures				
SEETEC Co., Ltd.	4,520	-	300	4,820
TECWIN Co., Ltd.	-	-	-	-
HL Greenpower Co., Ltd.	89,122	-	-	89,122
Others	-	-	837	837
Other related parties				
LG MMA Corporation	12,402	-	610	13,012
S&I Corporation and its subsidiaries	2,859	-	27,949	30,808
LG CNS Co., Ltd. and its subsidiaries	13,155	-	108	13,263
Others	549	-	4,357	4,906
Others				
LG Display Co., Ltd. and its subsidiaries	182,223	-	1,978	184,201
LG Electronics Inc. and its subsidiaries	245,029	-	61,263	306,292
LG International Corp. and its subsidiaries	43,346	-	712	44,058
LG Hausys, Ltd. and its subsidiaries	16,005	-	47	16,052
Others	59	-	721	780
Total	609,269	-	110,168	719,437

(in millions of Korean won)

	2018			
	Payables			Total
	Trade payables	Borrowings	Other payables	
Entity with a significant influence over the Group				
LG Corp.	-	-	5,102	5,102
Associates and joint ventures				
SEETEC Co., Ltd.	17,384	-	10,728	28,112
TECWIN Co., Ltd.	-	-	871	871
HL Greenpower Co., Ltd.	-	-	225	225
Others	-	-	250	250
Other related parties				
LG MMA Corporation	19,803	-	-	19,803
S&I Corporation and its subsidiaries	5,044	-	469,309	474,353
LG CNS Co., Ltd. and its subsidiaries	162	-	167,494	167,656
Others	-	-	689	689
Others				
LG Display Co., Ltd. and its subsidiaries	14	-	4	18
LG Electronics Inc. and its subsidiaries	131,680	-	360,155	491,835
LG International Corp. and its subsidiaries	14,918	-	85,452	100,370
LG Hausys, Ltd. and its subsidiaries	439	-	2,233	2,672
Others	1,659	-	3,852	5,511
Total	191,103	-	1,106,364	1,297,467

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Fund transactions with related parties for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019		2018	
	Equity contributions in cash (capital reduction)	Loan (Repayment)	Equity contributions in cash (capital reduction)	Loan (Repayment)
Associates and joint ventures				
HUAJIN NEW ENERGY MATERIALS(QUAZHOU)CO.,LTD	41,202	-	26,129	-
WUXI CL New Energy Technology Ltd.	-	-	559	-
Combustion Synthesis Co., Ltd.	645	-	1,503	-
LG Vina Chemical Co., Ltd.	-	-	1,767	-
LG Fuel Cell Systems Inc.	-	-	5,036	-
Vinfast Lithium Battery Pack Limited Liability Company	5,323	-	-	-
LG Holdings (HK) Ltd.	(15,788)	-	-	-
Total	31,382	-	34,994	-

Dividends received from related parties for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019	2018
Associates and joint ventures		
SEETEC Co., Ltd.	10,000	10,000
LG VINA Chemical Co., Ltd.	-	810
Total	10,000	10,810

Dividends paid to related parties for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019	2018
Entity with significant influence over the Group		
LG Corp.	141,205	141,205
Total	141,205	141,205

Key management includes directors and audit committee members having duties and responsibilities over planning, operations and controlling of the Group's business activities.

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Compensation for key management of the Group for the years ended December 31, 2019 and 2018, consist of:

<i>(in millions of Korean won)</i>	2019	2018
Short-term employee benefits	83,330	63,084
Post-employment benefits	4,999	8,233
Total	88,329	71,317

Key management includes directors and audit committee members having duties and responsibilities over planning, operations and controlling of the Group's business activities.

There are no provisions recognized against receivables from related parties as at December 31, 2019.

As at December 31, 2019, there is no payment guarantees provided by the Group for related parties.

32. Cash Generated from Operations

Reconciliation between profit before income tax and cash generated from operations for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Profit before income tax	560,560	1,940,047
Adjustments for:		
Depreciation	1,719,597	1,379,321
Amortization	136,870	107,948
Post-employment benefits	167,274	151,834
Finance income	(184,059)	(114,499)
Finance costs	387,285	254,416
Foreign exchange differences	5,751	19,327
Loss on valuation of inventories	12,640	31,862
Gain on disposal of property, plant and equipment	(11,602)	(8,427)
Gain on disposal of intangible assets	(405)	(2)
Loss on disposal of property, plant and equipment	45,913	27,915
Loss on disposal of intangible assets	1,726	1,940
Impairment loss on property, plant and equipment	125,560	52,914
Impairment loss on intangible assets	61,750	12,845
Reversal of impairment loss on property, plant and equipment	(215)	(452)
Gain on disposal of investments in joint ventures	(599)	-
Impairment loss on investments in joint ventures	-	26,344
Additions to provisions	685,031	277,753
Other income	8,778	(8,877)
Increase in inventories	(718,805)	(958,689)
Decrease in trade receivables	595,234	52,072
Decrease (increase) in other receivables	81,139	(107,321)
Decrease (increase) in other current assets	(147,130)	3,159
Increase in trade payables	217,041	165,413
Increase (decrease) in other payables	934,698	(22,436)

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Decrease in other current liabilities	(214,744)	(82,806)
Decrease in net defined benefit liabilities	(282,235)	(184,390)
Decrease in provisions	(285,956)	(166,516)
Other cash flows from operations	(64,636)	37,151
Cash generated from operations	3,836,461	2,887,846

Changes in liabilities arising from financial activities for the year ended December 31, 2019, are as follows:

(in millions of Korean won)

	2019						At December 31, 2019
	At January 1, 2019	Cash flows from financing activities	Reclassification of current portion	Amortization (transfer)	Lease liabilities	Exchange differences	
Short-term borrowings	1,563,153	(1,171,227)	790,355	-	-	(46,127)	1,136,154
Long-term borrowings	1,005,094	1,143,561	(790,355)	-	301,661	98,997	1,758,958
Debentures	2,752,900	2,713,579	-	17,419	-	35,258	5,519,156
Conversion rights	30,384	-	-	-	-	(29,454)	930
Total	5,351,531	2,685,913	-	17,419	301,661	58,674	8,415,198

The significant non-cash transactions for the years ended December 31, 2019 and 2018, are as follows:

(in millions of Korean won)

	2019	2018
Transfer of construction-in-progress	5,117,685	3,461,294
Transfer of machinery-in-transit	208,708	150,003
Reclassification of long-term borrowings into current portion	1,010,178	359,723
Reclassification of other payables under the reverse factoring arrangement	862,452	-
Other payables related to acquisitions of property, plant and equipment and intangible assets	2,344,088	1,691,256

33. Segment Information

General information about the Group's reportable segments is as follows:

Segment	Products or services	Major customers
Petrochemicals ¹	ABS, PC, PE, PP, Acrylic, Alcohol, SAP, PVC, Synthetic rubber, Special resin, BPA, Ethylene, Propylene and others	LG Electronics Inc., OCI Group Co. Ltd., Mitsubishi Corp. and others
Energy solutions	Mobile batteries, Automotive batteries, Electricity storage batteries and others	Hewlett-Packard Co., General Motors Corp., and others
Advanced materials ¹	Polarizers, Automotive components, LCD Photoresist, OLED materials, Battery materials and others	LG Display Co., Ltd., Samsung Display Co., Ltd., BOE, AUO and others

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Life sciences	Growth hormone, Vaccine, Antidiabetic, agricultural chemicals and others	HUADONG NINGBO, UNICEF, Intervet and others
Common and others	Crop protection products, Seeds, Fertilizers, General management, sales and R&D and others	National Agriculture Cooperative Federation and others

¹ The Group changed the name of segment from Basic materials & Chemicals business to Petrochemical business, and integrated IT & Electronic materials and Advanced materials into Advanced materials business. In addition, part of the petrochemical business was reclassified into the Advanced materials business sector. The information for comparative period is restated to reflect these changes.

The segment information on revenue, profit and loss for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019					
	Petro-chemicals	Energy solutions	Advanced materials	Life sciences	Common and others ³	Total
Total segment revenue	15,552,789	8,350,251	4,901,042	627,802	596,373	30,028,257
Inter-segment revenue	554,857	-	785,759	5,618	56,981	1,403,215
Revenue from external customers ¹	14,997,932	8,350,251	4,115,283	622,184	539,392	28,625,042
Operating profit (loss) ²	1,416,340	(454,312)	65,162	37,199	(168,741)	895,648

<i>(in millions of Korean won)</i>	2018					
	Petro-chemicals	Energy solutions	Advanced materials	Life sciences	Common and others ³	Total
Total segment revenue	16,990,960	6,499,381	4,706,282	575,126	606,702	29,378,451
Inter-segment revenue	662,447	465	527,510	3,997	1,019	1,195,438
Revenue from external customers ¹	16,328,513	6,498,916	4,178,772	571,129	605,683	28,183,013
Operating profit (loss) ²	2,030,437	209,170	72,338	49,547	(115,422)	2,246,070

¹ Revenue from external customers consists of sales of goods. Interest income and dividend income are included in finance income.

² Management assesses the performance of the operating segments based on a measurement of operating profit of segment.

³ Common and other segments include operating segments not qualifying as a reportable segment, supporting divisions as well as R&D divisions.

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The segment information on assets and liabilities as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won</i>	2019					
	Petro-chemicals	Energy solutions	Advanced materials	Life sciences	Common and others	Total
Reportable segment asset ¹	10,564,216	12,091,983	5,142,540	1,906,005	4,319,682	34,024,426
Investments in associates and joint ventures	5,132	28,254	67,059	17	207,115	307,577
Reportable segment liability ¹	3,358,939	6,587,857	1,135,526	232,049	5,326,266	16,640,637

<i>(in millions of Korean won</i>	2018					
	Petro-chemicals	Energy solutions	Advanced materials	Life sciences	Common and others	Total
Reportable segment asset ¹	9,376,933	8,110,146	4,743,639	1,873,916	4,839,503	28,944,137
Investments in associates and joint ventures	5,208	20,853	26,120	17	213,924	266,122
Reportable segment liability ¹	3,018,476	4,243,999	1,121,732	194,420	3,043,382	11,622,009

¹ Assets and liabilities are measured in a manner consistent with those in the financial statements, and allocated on the basis of segment operation.

The external sales and non-current assets by geographical segments from continuing operations for the years ended December 31, 2019 and 2018, and as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	Sales		Non-current assets ¹	
	2019	2018	2019	2018
Korea ²	8,251,763	8,996,392	13,208,426	11,678,654
China	9,675,578	9,256,242	3,975,505	2,542,444
Asia	3,830,511	4,620,136	58,990	45,648
America	1,871,443	1,721,120	559,051	533,924
Europe	4,587,130	3,166,553	3,051,227	1,045,716
Others	408,617	422,570	-	-
Total	28,625,042	28,183,013	20,853,199	15,846,386

¹ Represents aggregate amount of property, plant and equipment, intangible assets and investment properties.

² Domestic sales include the exports made through local letters of credit.

There is no single external customer contributes over 10% of the Group's revenue for the years ended December 31, 2019 and 2018.

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34. Business Combination

On October 1, 2018, the Group acquired 100% shares of Uniseal, Inc., which manufactures automotive adhesive. As a result of the business combination, the Group expects increase in sales through diversification in market such as entering into new industry and others.

Goodwill arising from the business combination is attributable to the acquired customer base and sales increase expected from combining the operations of the Parent Group and Uniseal, Inc. The Group recognized a goodwill amounting to ₩ 64,851 million for the related business combination in the prior year. In 2019, certain intangible assets and goodwill have been subsequently adjusted to reflect the final result of purchase price allocation. In this regard, the Group's prior year financial statement has been partially amended with no effect on total equity.

The following table summarizes the consideration paid for Uniseal, Inc., the fair value of assets acquired and liabilities assumed at the acquisition date:

<i>(in millions of Korean won)</i>	Amount
Consideration	
Cash and cash equivalents	143,327
Total consideration	<u>143,327</u>
Recognized amounts of identifiable assets acquired and liabilities assumed	
Cash and cash equivalents	456
Trade and other receivables ¹	9,082
Inventories	5,594
Property, plant and equipment	22,475
Intangible assets	51,829
Trade and other payables	(4,932)
Other payables	(183)
Deferred tax liabilities	(14,399)
Fair value of identifiable net assets	<u>69,922</u>
Goodwill	<u>73,405</u>
Total	<u>143,327</u>

¹ The fair value of trade and other receivables equals to the gross contractual amounts.

The contingent consideration arrangement requires the Group to pay in cash the former owners of Uniseal, Inc. if the revenue during the year ended August 31, 2019, exceeds \$60 million.

On October 1, 2018, the Group acquired 100% shares of Ugimag Korea Co., Ltd, which manufactures parts of electronic products and automobiles. As a result of the business combination, the Group expects sales growth or sales to increase through enlarging materials business.

Goodwill of ₩ 11,615 million arising from the business combination is attributable to the acquired customer base and expected sales growth combining the operations of the Parent Group and Ugimag Korea Co., Ltd.

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The following table summarizes the consideration paid for Ugimag Korea Co., Ltd, the fair value of assets acquired and liabilities assumed at the acquisition date:

<i>(in millions of Korean won)</i>	Amount
Consideration	
Cash and cash equivalents	23,020
Total consideration	<u>23,020</u>
Recognized amounts of identifiable assets acquired and liabilities assumed	
Cash and cash equivalents	359
Trade and other receivables ¹	7,576
Prepaid income tax	1
Inventories	4,403
Property, plant and equipment	29,640
Intangible assets	4
Trade and other payables	(4,100)
Borrowings	(23,908)
Other liabilities	<u>(2,570)</u>
Fair value of identifiable net assets	11,405
Goodwill ²	<u>11,615</u>
Total	<u>23,020</u>

¹ Fair value of trade and other receivables equals to the gross contractual amounts.

² Goodwill resulting from the acquisition of Ugimag Korea Co., Ltd, has been fully impaired and recognized as impairment losses.

35. Assets Held for Sale

The Group decided to dispose of 2CCL business with the approval of management in January 2017. The related assets were reclassified as assets held for sale, and the disposal was completed in September 2019. Research Institute, which was acquired during the course of the business combination of FarmHannong Co., Ltd., are also included in disposal group.

Details of assets and liabilities of disposal group classified as held for sale as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Assets of disposal group		
Property, plant and equipment	19,573	2,406
Intangible assets	<u>-</u>	<u>358</u>
Total	<u>19,573</u>	<u>2,764</u>

Assets held for sale were measured at net fair value immediately before the initial classification as assets as held for sale and there are no other non-operating expenses (income) recognized from the measurement for the years ended December 31, 2019 and 2018.

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36. Assets and Liabilities related to Contracts with Customers

Assets and liabilities related to contracts with customers as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Contract assets		
A right to recover the product	5,191	4,323
Total contract assets	<u>5,191</u>	<u>4,323</u>
Contract liabilities		
Advances in relation to revenue from the Group's main business activities	183,606	47,265
Expected services to be transferred	3,500	34,823
Expected customer incentives	6,400	10,530
Unearned revenue	34,247	16,781
Expected refunds	10,893	9,139
Total contract liabilities	<u>238,646</u>	<u>118,538</u>

Revenue recognized in relation to contract liabilities

Revenue recognized in the current year that was included in the contract liability balance at the beginning of the year, and revenue recognized in the current year from performance obligations satisfied (or partially satisfied) in previous years are as follows.

<i>(in millions of Korean won)</i>	2019
Revenue recognized in the current year from the contract liability balance at the beginning of the year	67,384
Advances in relation to revenue from the Group's main business activities	58,875
Unearned revenue	2,474
Expected services to be transferred	6,035
Revenue recognized from performance obligations satisfied in previous periods	-

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37. Investment Properties

Details of investment properties as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019			2018				
	Cost	Accumulated depreciation	Accumulated impairment	Book amount	Cost	Accumulated depreciation	Accumulated impairment	Book amount
Land	4,368	-	-	4,368	486	-	-	486
Buildings	61,242	(12,202)	(80)	48,960	491	(27)	-	464
	<u>65,610</u>	<u>(12,202)</u>	<u>(80)</u>	<u>53,328</u>	<u>977</u>	<u>(27)</u>	<u>-</u>	<u>950</u>

Changes in investment properties for the years ended December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019			2018		
	Land	Building	Total	Land	Building	Total
Beginning balance	486	464	950	486	541	1,027
Acquisitions/Transfers	3,882	49,722	53,604	-	-	-
Disposals/Transfers	-	-	-	-	(65)	(65)
Depreciation	-	(1,226)	(1,226)	-	(12)	(12)
Ending balance	<u>4,368</u>	<u>48,960</u>	<u>53,328</u>	<u>486</u>	<u>464</u>	<u>950</u>

The fair value of investment properties is measured either by independent professional appraisers with certified qualification or measured based on official appraised value of land and available information from recent transactions of similar properties, and it is classified as 'level 3' of the fair value hierarchy. The fair value of investment properties as of December 31, 2019, is ₩ 53,083 million.

Rental income from investment properties under operating lease is ₩ 7,723 million, and operating expenses incurred for investment properties that generated rental income (including maintenance and repair expenses) are ₩ 1,214 million. Operating expenses incurred for investment properties that do not generate rental income (including maintenance and repair expenses) are ₩ 12 million.

Operating lease

Investment properties are leased to tenants under operating leases with monthly rent payments. Where considered necessary to reduce credit risk, the Group may obtain bank guarantees for the term of the lease.

Although the Group is exposed to changes in the residual value at the end of the current leases, the Group typically enters into new operating leases and therefore will not immediately realize any reduction in residual value at the end of these leases. Expectations about the future residual values are reflected in the fair value of investment properties.

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The future minimum lease payments expected to be received in relation to the above operating lease agreement for investment properties as at December 31, 2019 and 2018, are as follows:

<i>(in millions of Korean won)</i>	2019	2018
Within one year	6,848	-
	<u>6,848</u>	<u>-</u>

38. Events after the Reporting Period

On January 31, 2020 the Board of Directors resolved to sell shares of LG Holdings(HK) LTD. to secure Group's liquidity for future investment.

On January 31, 2020, the Board of directors resolved to discontinue Glass substrate business due to the rapid increase in production facilities in China and resulting adverse impact on domestic market.

On January 31, 2020, the Board of Directors resolved to issue public debentures. On February 19, 2020, the Group issued the public debentures amounting to ₩ 900 million as following.

<i>(in millions of Korean won)</i>	Latest maturity date	Amount
53-1st Debenture (non-guaranteed/public)	2023.02.19	350,000
53-2nd Debenture (non-guaranteed/public)	2025.02.19	250,000
53-3rd Debenture (non-guaranteed/public)	2027.02.19	50,000
53-4th Debenture (non-guaranteed/public)	2030.02.19	250,000

39. Approval of Issuance of the Financial Statements

The consolidated financial statements for the year 2019 were authorized for issue by the Board of Directors on January 31, 2020 and are subject to change with approval of shareholders at their Annual General Meeting.