

Material And Chemical Trends Supporting E-mobility And The Digital Revolution In Korea

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Young Kwon CEO Key To Way



E-Mobility – Global Landscape

E-mobility Introduction

E-mobility refers to principles and concepts of **utilizing electric powered technologies** (e.g. drivetrains). E-mobility moves away from existing carbon-emitting fossil fuels to using energy from electrical power sources (e.g. the National Grid) through external charging capability.



Major Players in E-Mobility



Global Sales of Electric Vehicles and Plug-in Hybrids





The global electric vehicle market has taken a huge leap forward in the past decade, and industry predicts this trend to continue

E-mobility Introduction

Major Factors Driving this Trend



Expansion in public transportation and micro-mobility options



Advancements in the smart charging of electric vehicles



R&D in battery characteristics



Investment in EV charging infrastructure by Private Sector











Digital Revolution – Global Landscape

Digital Revolution

The Digital Revolution is the shift from mechanical and analogue electronic technology to digital electronics which began in the latter half of the 20th century, with the adoption and proliferation of digital computers and internet connectivity, that continues to the present day.









Digital Payments



Smart Manufacturing

Advancements are driven by innovations and research in semiconductors, electronic devices, connectivity solutions and integrated chips





We are already seeing the impact of the digital revolution with increasing adoption of electronic devices and internet penetration

Digital Revolution Introduction



The blooming Consumer Electronics market

Korean Perspective



Rise in Internet Users Globally with the trend to continue

- Internet Coverage of more than 95% in the country
- Number one in the world for smartphone ownership
- One of the highest rates of LTE coverage in the world.
- Fastest Average Internet Speed





South Korea has been at the forefront of innovation, and has been ranked as number 1 for six consecutive years on the Bloomberg Innovation Index

Innovation in South Korea

Bloomberg names Korea 'most innovative country' for 6th straight year

Jan 23, 2019

World's Most Innovative Economies

South Korea, Germany lead the index in 2019





Topping the Bloomberg Innovation Index from 2014 to 2019



Largest Producer of mobile phones, displays, semiconductors.



9th Largest Trading Nation



2nd Company Spending most on R&D in the world



E-Mobility and Digital Revolution have been major contributors to innovation in Korea

Innovation in South Korea

Cell manufacturers and automotive production, by country, through 2021

China establishes itself as the frontrunner in battery production – Korea overtakes Japan on the back of strong growth

PROJECTED GLOBAL MARKET SHARE, 2021¹¹ ∑USD 18.8 bn





Strong growth in the EV battery space overtaking Japan

5G: South Korea Stays in the Lead

5G connections as a share of all mobile subscriptions in selected countries by 2025 (projection)



* Saudi Arabia, Oman, UAE, Qatar, Kuwait, Bahrain Source: GSMA Intelligence

First country to deploy and adopt 5G networks



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South Korea's strong focus on innovation is driven by high R&D investments by both government and industrial bodies

R&D as a pillar of Innovation



South Korea's spent 4.5% of its GDP on R&D, second only to Israel's 4.9% in 2018.

• The high R&D intensity has emerged from close collaboration between government, industry, and the academic community of Korea.

 Historically, since 1962, focus was shifted to home-grown labor-intensive industries and strong support for R&D was central in first Five-Year Economic Development Plan laid out the following year

 With increased R&D intensity that focused on applied knowledge, major players such as LG, Lotte and Samsung were driven towards new industries, like petrochemicals, car manufacturing and consumer electronics.

• South Korea had the greatest share of researchers who moved from industry to academia in 2017 to 2019 among 71 countries





Some of the most disruptive innovators in Korea are working on cutting-edge technologies in collaboration with Academic and Research Institutes

Major contributors to Innovation



Samsung

- Between 2015 and 2019 they had 159 joint articles with Sungkyunkwan University, 41 joint articles with SNU, 35 with KAIST and lots more with other universities as well.
- collaboration is Their particularly focused on electrochemistry and the development of new energy sources such as lithium-ion batteries

LG

- · Extensive research and participations in Smart City Projects in Korea
- LG Chem has multiple R&D projects currently underway revolving around next-gen battery and clean energy solutions



Hanwha Advanced Materials

- Since 2015 has focused on new methods of construction using thermoplastics and thermosetting composite materials for automobiles
- · Currently expanding into solar power, electronics, nextgeneration mobile communications and the Internet of Things



Hyundai Motor Group

- · Largest car manufacturing company in South Korea and the fourth largest in the world.
- · Part of the "Hydrogen Council", which promotes the development of fuel cell vehicles.
- The company is also supporting innovation externally with Hyundai CRADLE.

Korea Institute of Science & Technology

- · Development of nanocarbon composites and carbonfiber reinforced polymer composites for industry.
- · Research in cutting edge technologies like Doublesided transparent displays, Graphene Cu composite wire, Low-temperature activated environmental catalyst for different applications across sectors, 2D quantum dot technology etc.

Seoul National University

- · Research interests include nanomaterials synthesis, nanofabrication and characterisation, nano-analysis and quantum mechanics, and molecular dynamics simulation
- Efforts are underway to commercialize and popularize graphene applications among industrial partners





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The Material and Component Industry Policy has been at the heart of all material innovations supporting the 4th Industrial Revolution in Korea

The Material Innovation Policy

Materials and Component Industry Policy	Focused on High Value Manufacturing. It started in the 1970s with a no import localization policy supported by guarantees and affordable financing to encourage local purchasing and manufacturing
First Basic Plan 2001 - 2008	Vision for South Korea to become a supply hub for materials and components. The objective was to increase domestic production and reduce trade deficits.
Second Basic Plan 2008 - 2012	Vision for South Korea to become recognized as one of the top five nations for materials and components by 2012, and to achieve technology levels of the advanced nations.
Third Basic Plan 2013 - 2017	To build on South Korea's increased technological capabilities and improve their international standing to be in the top four for materials and components by 2020.
Fourth Basic Plan 2017 - 2021	Placing South Korea amongst the world's top exporters in advanced materials and components.





The Fourth Basic Plan, currently ongoing, has 4 strategic aims to achieve its objectives

Current Material and Component Industry Policy



Develop 100 new materials and component technologies by 2025 and be recognized as one of the top four materials and component exporters in the world by mobilizing government's capacity to develop the new materials and components.



Enhance support for restructuring so that industry is ready for the 4th Industrial Revolution. Expand the ecosystem to support the development of converged/integrated materials and components by enhancing the technological capabilities of SMEs and strengthening local R&D innovation capabilities.



Build a high efficiency, eco-friendly production system for the materials and component industry to support the efficiency of SMEs and the development of eco-friendly methods of sourcing core materials



Strengthen the global competitiveness of materials and component companies, through an **expansion in international cooperation**, an **increase in advancement support**, further investment in mergers and **acquisition support**, and a track record of successful demand-oriented and corporate collaboration.



The 4 th Industrial Revolution	Advancement of major industries	Total	
8	10	18	

materials and components technologies						
The 4 th Industrial Revolution	Advancement of major industries	Total				
8	4	12				

Structure for the Fourth Basic Plan



Some examples of recent material innovations pushing e-mobility and the digital revolution in Korea

Material Innovations



Carbon-Silicon Composites



Lighter but Stronger Steel



Hidden IoT Displays



Photovoltaic Paint



Foldable Displays



5G Testing Grounds



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Alliances and collaborations further push the transformation in technology and emobility

Active Alliances and Collaborations



- 1. Hyundai Motor Group completed an alliance network with all three battery majors from Korea – LG Chem, Samsung SDI and SK Innovation
- 2. SK Telecom Teams Up with Byton for Mobility Alliance. The cooperation between the two companies will involve a variety of business areas including the development and application of integrated in-vehicle infotainment (IVI) and support for marketing.
- 3. Lumi United Technology partnered with LG Uplus, to deliver a new home security solution. LUMI's expertise in smart home combined with LG U+'s cutting edge technology and telecommunications platform is an ideal partnership that will help bring the best smart home solution and services for users.
- 4. RIZE and Sindoh Co., Ltd. Announce Strategic Partnership to Expand New Opportunities for Safe, Sustainable 3D Printing. This includes applications like electronics components, PCBs, tooling jigs and fixtures etc.





While innovations drive the adoption of electronics and automobiles, it is critical to focus on safety across the lifecycle

Importance of safety





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