



UK Trade
& Investment
영국 무역투자청



Korea's Growth Engines for the Future

Industries Likely to Emerge Over the Coming Decade

In partnership with:



Executive Summary

This report aims to identify the potential high-growth sectors that are likely to emerge in Korea over the coming decade.

UKTI has commissioned IRC Limited to investigate these emerging industries on its behalf. UK Trade and Investment (UKTI) is a UK Government body that assists British companies exporting and trading overseas, and assists the best foreign companies to invest in the UK. IRC is a Korea-based business development consultancy that has been assisting multinational companies to capitalise on opportunities in Korea for more than three decades. To implement this project, IRC carried out three discrete activities:

- Reviewed several dozen publications (books, articles, speeches)
- Interviewed specialists across a wide range of industries
- Held three focus groups, two with Koreans and one with long-term expats

The project generated a large number of individual opinions and insights into the future. However, there was little consistency or sequential flow across these insights. It is clear that the technologies and industries that will emerge in Korea over the coming 5 to 10 year time period are already visible in social trends, prototype products and R&D projects being carried out today. While it will be easy to trace the origins of trends back to the present in 5 to 10 years, accurate prediction of the future is always a challenge. Furthermore, without doubt, some of the most significant trends will catch society by surprise.

Truly revolutionary changes in industry are more likely to emerge in a longer term time frame. Of course, these predictions are further into the future and therefore, less reliable. Furthermore, long term trends and opportunities are global in nature, not Korea specific.

The most dramatic changes to Korea over the coming decade will be:

- Changes in demographics: ageing population and shrinking households
- Confucianism (hierarchy, homogeneity, conformity) will slowly give way to individualism
- Education will internationalise and specialise
- Manufacturing dominance will be challenged by China but will survive
- 3-D printing will have a major impact on manufacturing (though how is unclear)
- The Internet of Things will reshape the way we live
- Domestic politics are likely to become more polarised and issue driven
- Regulations are more likely to stymie than stimulate emerging industries
- Medical solutions will be customised for the individual: drugs & body parts
- Korea will increasingly become a tourist destination for the Chinese

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The Changing Environment Will Create New Opportunities for UK Companies if They Align Their Products and Services

The Republic of Korea (South Korea) is the 12th largest economy in the world (PPP). It is a member of the G20 and the Organisation for Economic Cooperation and Development (OECD), and it has GDP of around USD 1trillion. The ethnically homogenous population is stable at around 50 million, with around 22 million living in greater Seoul, the capital city.

Geography: South Korea is in the southern part of the Korean peninsula that lies between Japan and China. South Korea is about the size of Scotland and Wales combined. Much of the country is mountainous, especially along the Eastern seaboard. There are also 3,000 small islands, including subtropical Jeju on South Korea's southern tip, a popular tourist and conference destination.

Economy: The country is one of the most technologically advanced in the world with a wide availability of high-tech gadgets and a take up of over 90% for internet broadband. It has few natural resources. The main industries are steelmaking, shipbuilding, automotive, textiles and electronics such as flat-screen televisions and computers. Well-known South Korean brands include Samsung, LG, Hyundai, KIA and Daewoo. The export oriented economy was badly affected by the global economic downturn but has demonstrated resilience and experiencing rapid recovery, with 2.3% growth in 2012 and 3.0% in 2013.

Politics: South Korea operates under a presidential system. The President and the National Assembly (parliament) are directly elected; National Assembly members are elected using a mixed system of first past the post and proportional representation. The President, elected for a single term of five years is relatively powerful. She appoints the State Council (cabinet), comprising the President, the Prime Minister and between 15 and 30 ministers (cabinet ministers are not permitted to simultaneously serve in the National Assembly). The National Assembly, which is made up of no fewer than 200 members (there are currently 300, including the Speaker, who is neutral), is elected for four-year terms. The Saenuri Party controls the National Assembly with 158 seats out of 300. The next National Assembly election is scheduled for April 2016. The current President is the Saenuri's Park Geun-hye, while the Prime Minister is Chung Hongwon. The next president will be elected in December 2017 and take office in January of the following year.

Basic Facts & Statistics on South Korea (2013)

Geography	Location	Southern half of the Korean Peninsula (between China & Japan)
	Area	100,072 km ² (2,413 km of coastline)
Industries & Resources	Industries	Electronics, Telecommunications, Automobile production, Chemicals, Shipbuilding, Steel
	Natural Resources	South Korea's natural resources are limited but do include: Coal, Tungsten, Graphite, Molybdenum, Lead
	Agricultural Products	Rice, Root crops, Barley, Vegetables, Fruit, Cattle, Pigs, Chickens, Milk, Eggs, Fish
Economy	Inflation Rate	1.3%
	GDP	£791 billion (3.0% real growth rate)
	GDP Per Capita	£14,454
	GDP by Sector (2013)	Agriculture: 2% Industry: 38% Services: 60%
	Income per Capita	According to World Bank figures, South Korea's income per capita was at USD \$23,837 for 2013 (latest data available). This puts it ahead of the 'BRICS', and all ASEAN countries, except the micro-nations of Singapore and Brunei. Malaysia's income per capita is USD \$17,748 and Thailand's is USD \$9,875. South Korea is also ahead of 10 EU member states, including Portugal, the Czech Republic, and Poland.
	Monthly Consumption Expenditure Structure (2012)	Food & Beverages: 15% Transportation & Communication: 16% Education, Culture & Recreation: 15% Clothing & Footwear: 5% Medical Care: 7% Restaurants and hotels: 8% Furniture & Utensils: 5% Fuel, Light, and Water Charges: 4% Housing: 11% Others: 14%
	Exports	£339.4 Billion
	Export Commodities	Semiconductors, Wireless telecommunications equipment, Motor vehicles, Computers, Steel, Ships, Petrochemicals
	Export Markets	China 26%, US 11%, Japan 6%, HK 5%, UK 1%
	Imports	£312.6 Billion
	Import Commodities	Machinery, Electronics and electronic equipment, Oil, Steel, Transport equipment, Organic chemicals, Plastics
	Import Partners	China 15%, Japan 11%, US 7%, Saudi Arabia 7%, Australia 4%, Germany 3%, UK 1%
People	Population	50,219,669
	Labour Force (Age of 15 ~ 64)	36,712,000
	Labour Force by Occupation	Agriculture: 6.1% Industry: 16.8% Services: 77.1%
	Unemployment Rate	3.5%



Brief Overview of Changes in Society & Economy

Demographics

Korea's birth rate is low, below replacement levels. At the current rate, Korea's population will peak before 2030 and begin to fall.

Korea's population is aging rapidly with the over 65 segment expected to exceed 20% by 2025. The low birth rate that is exhibited in all industrialised countries is exacerbated by social pressures on child rearing. Working mothers face challenges as support for child care is less available than in many advanced nations and society places financially burdening expectations on parents. Many advanced nations offset low birth rates through immigration but historical trends and strong nationalism currently inhibit this solution for Korea.

The traditional 'social safety net' provided by the family is eroding due to shrinking family size and the trend towards double income households. At the same time, alternative 'modern' welfare systems are under developed. This is leading to people working to later in life, elderly living alone and elderly poor. Meeting the burgeoning social needs is a major headache for Korean society.

Cultural Changes

Confucianism and its emphasis on order and stability has defined the social fabric of Korean society for at least five centuries. In the modern era, this led to a lifestyle of parents sacrificing to enter their children (particularly sons) in the best universities to work in the leading conglomerates. This 'dream' was never available to more than about 10% of graduates leading to a lot of disappointment. The decline of Confucianism, rise of individualism and failure of social expectations to broadly deliver a sense of pride and accomplishment is leading to a diversification of career ambitions. As a result, social cohesion is under stress.

Per-capita income has crossed the tipping point where aspirations are focused more on quality of life and lifestyle than accumulation of material possessions. Koreans now travel internationally for tourism, extended overseas assignments, education and emigration. The foreign population in Korea has reached 1.5 million which, while still quite small, accounts for some 3% of the total residents of the peninsula. Integration with the world is also driving rapid and significant cultural changes.

Industrial Changes

Manufacturing (and exports), the engine that launched Korea's industrialisation is under threat, primarily from China. Korea has established itself as a supplier of 'middle technology', sophisticated but economical. Korean industry maintains two key strengths, connectivity and manufacturing which are key ingredients for the emerging Internet of things. Both the government and industry are investing heavily in R&D but remain challenged at converting new developments into commercial products. Energy accounts for more than 1/3 of Korea's imports so the cost of energy is a key determinant of Korea's industrial future. Korea has heavily invested in nuclear energy. The impact of shale oil and gas will drive down energy prices but its overall impact is difficult to predict. Renewable energy will not make a significant impact on supply or cost of energy in the coming decade. Korea remains susceptible to fluctuations in energy prices which are largely outside of its control.

The service industry is significant (2/3 of GDP) but is highly dependent on low value added activities. There is recognition by Korean firms of the need to drive up the value chain of services but this outcome is linked to education. The Chaebol (family controlled conglomerates) which dominate the economy with the top



10 accounting for 84% of GDP are under social and legal pressure. Oligopoly and oligopsony are stifling the ability of small and medium firms to exercise their flexibility to offer creative and innovative solutions. A challenge in the coming decade is to curtail the dominance of the Chaebol without destroying the economy. Perhaps this will help to relieve the increasing levels of wealth disparity.



Political Changes

Korean society has practiced democracy for just the last 25 of its 5000 years of history. Democracy is young and developing. The central government continues to lead the economy and lags in the creation of an environment where firms have equal opportunity – a level playing field. To drive the next generation of economic prosperity, the government must shift its role from a restrictor of corporate behaviour to an enabler of emerging entrepreneurs. At the same time, the pressure to provide social services to the aging population is beginning to create financial pressure.

Educational Changes

Education over the past two generations has been very effective at remoulding an agrarian population for industrialisation and urban living. However, the rote learning practices that have been so successful in the past has inhibited investment in the teaching of the critical thinking skills required in the coming decade. Parents increasingly utilise online and alternative education resources to overcome the weaknesses in the current education system.

Geo-Political Changes

China is Korea's largest market both for industrial products and for services (primarily tourism). Any radical political change in China and/or the collapse of North Korea would render all other changes insignificant.

In light of this setting we look at industries that are likely to emerge over the coming decade. A comprehensive discussion of these trends is presented in the Appendix.

1

Life Style



Demographic and economic changes are driving changes in lifestyles which in turn cause changes in consumer patterns.

1.1 Smaller Is Better

Smaller one and two person households will drive consumption from quantity to economy and quality, from ownership of tangible assets to experience. This will drive changes in ownership of common assets, cars, televisions and even dwellings.

Dwellings

Apartments will be smaller, suited for one or two people and conveniently located. Construction companies will shift their focus to living units for single people. Larger units will be subdivided or re-configured to accommodate single people. Smaller apartments are less expensive and therefore can be located closer to central urban areas.

Home Appliances: Compact and Smart

Smaller households will result in smaller dwellings and therefore home appliances will be sized for single person households. At the same time, consumers will demand smarter appliances that can be controlled remotely, safely keep food warm or fresh, notify when maintenance is required and issue warnings if a function fails.

Retail

The retail format will fall into three types:

- Mega complexes will offer a full range of services from grocery & department stores to entertainment & restaurants. Consumers will visit large retail formats primarily for entertainment and socialising.
- Convenience stores in residential areas will supply daily necessities (provided in small packaging and/or ready to eat).
- On-line shopping will become the dominant retail format.

Delivery Services

Anything delivered anywhere at any time safely. Universal delivery is already fully established in Korea. Delivery of all but the least expensive items is included in the product price. The Internet of Things (IoT) will make delivery efficient and safe. Deliverers will know for certain that the recipient is at the anticipated location, recipients will know when something will arrive. The recipient will know the name of the deliverer, have a photo identification and be assured of his background. Feedback ratings will ensure quality. The entire transaction will be recorded and payment settled from an electronic account.

Household Repair

Basic household maintenance services (such as fixing sticking windows, tightening loose hinges, and repairing appliances) will be available on an 'app'. As with delivery services, all information about the service provider, timing, billing will be incorporated into a single account. Feedback will ensure quality.



Customised Personal Services

Food preparation, laundry, cleaning, grooming, will all be contracted and delivered at desired times. Contracting, billing, verification of personnel's credentials, performance feedback will all be implemented automatically. Currently, such personal care services are labour intensive and managed manually. In the future, it will be connected electronically and organised to efficiently deliver cost effective care.

Security

Consumers will only utilise service providers that they know are reliable. Service Delivery companies need to know with confidence that their employees are reliable, have the required skills and licenses and can be trusted. Korea has a strong social network service culture so feedback mechanisms are likely to be highly effective.

1.2 Sharing

Sharing is a growing trend. Seoul City enacted the 'Seoul Metropolitan City Sharing Promotion Ordinance' on December 31 2012. The goal is to support the vitalisation of sharing in both the public and private sector. The city acknowledges and supports companies and organisations that attempt to resolve social problems through sharing and designates them as 'sharing companies'. City activities include:

- An online sharing portal SHARE HUB (<http://sharehub.kr/>) designed for the sharing of information about domestic and foreign sharing organisations and companies and supports networking among sharing related companies and organisations.

- Sharing public facilities that often sit unused such as evenings and weekends free of charge or at low cost. The reservation website is yeyak.seoul.go.kr/
- Sharing parking lots through various means as proposed by each local borough or district.
- Room sharing across generations – connecting young people in need of low-cost housing with senior citizens who have idle rooms.
- Supporting sharing economy start-ups.

Shared Assets

Single consumers and the elderly will be more focused on utility than ownership. Unless there are specific needs to own expensive assets, they will be borrowed or shared.

Mass Transit Information System

Already in Korea, apps can be programmed to advise when selected public transportation will arrive at the closest stop. This will evolve into a sophisticated IoT product where buses will know where to stop to pick up passengers. Passengers will be able to select the best routes and modes to use to travel between two points.

Dwellings

The drive to utility is forecast to increase the sharing of apartments as well. As single people spend little time at home (they are at work or play), the utilisation rate of apartments is nearly as low as that of the car. Some futurologists have forecast that people who have complimentary schedules and lifestyles will turn to sharing apartments.



1.3 Silver Market

The aging population will give rise to a cluster of industries:

Housing

Housing for the elderly has already emerged as a new industry in Korea but the quality of care is poor and the industry reputation has suffered. The demand for housing for the elderly will increase while public funds available for welfare services will be under extreme pressure. Opportunities will abound for competitive suppliers and providers of innovative solutions

Care for the Elderly

The elderly will need health care as well as personal services. The developments in health care (see section 2.2.6. below) will significantly improve the availability and affordability of health care. It will require local facilities where the elderly can go for testing, access to tele-medicine, and treatment but the care givers can be less qualified (and therefore less expensive) than required of health professionals.

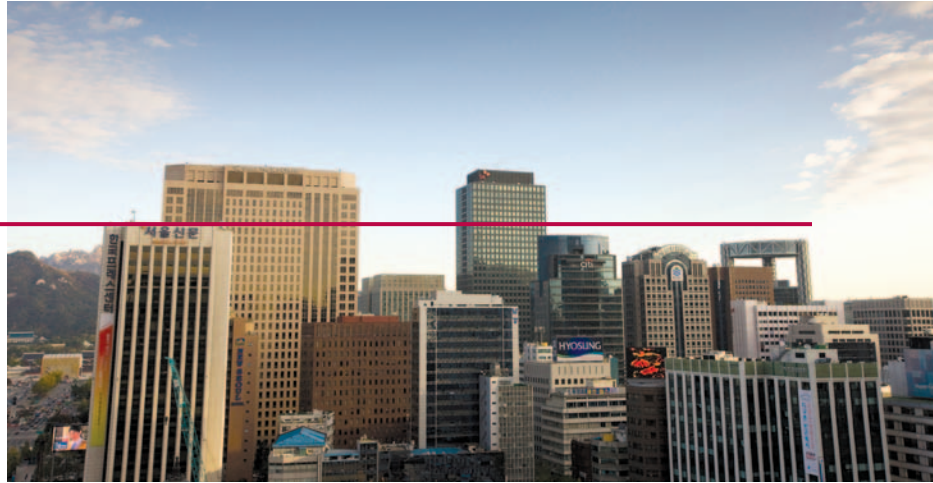
Employment Services

Job placement services that can match the skills of mid-career or retiring professionals with needs of the market will also be in demand.

Cosmetics and Beauty Care for the Elderly

As people live longer, the demand for cosmetics that preserve the look of youth will grow as well. Korean cosmetics makers are expanding into this segment. There is a subtle but discernible shift in advertising to a more aged segment. Functional foods and plastic surgery aimed at the elderly are also expected to grow.





The speed at which technological changes are being introduced is accelerating and the impact on daily life is growing. The lapsed time between introduction of the internet and it becoming an integral part of daily life was about 10 years. Mobile technology took less than 5 years to make the same transition.

The technologies that will transform life in the coming 5 to 10 years are already under development or in the early stages of commercialisation. The major obstacle is public acceptance. As a rule, Korean consumers adopt new products very rapidly. Emerging products such as wearable devices and 3D TV will quickly be commercialised. While some in the population are eager to embrace new technologies, many people fear new technologies and the changes that they will bring. Elderly people are more conservative and resistant to change so as Korea's population becomes more aged, public acceptance will be more challenging.

2.1 New Technologies & Materials

The most dramatic and predictable change that will generate the greatest impact on industry in the future is the end of population growth. With a birth rate (2010) of 1.22 (217th out of 222 countries according to CIA Factbook), Korea's population will peak at just over 52 million in 2030 and begin to fall rapidly (source: Statistics Korea). The most pessimistic scenario forecasts that the population will peak as early as 2016. This will have an impact on every aspect of society and the economy.

Manufacture of 3-D Printers

Korean firms excel at producing and commercialising new mechanical devices. If they decide to enter the market, they could emerge as the leader in the manufacture and distribution of 3D printers.

- Equipment Rentals
Making 3-D machines available for hire on a

permanent, short term or case by case basis will become a new component of leasing companies. Retail chains will emerge to serve individual consumers. They will stock machines as well as maintaining an inventory of materials.

- Materials
3-D printing will require a broad menu of raw materials to use to make products from machinery to body parts to food to medicine. Chemical, metal, food and pharmaceutical companies will generate 'ink' to use with 3-D printers. This will require flexible materials with multiple applications and therefore, a dramatic shift in the way that they make, store, distribute and sell their products. Given the high levels of competition in petrochemicals with increasing production in the Middle East and in China, Korean industry will shift towards fine chemicals and specialised chemicals.
- Software
'Recipes' (software programs or apps) will be needed for making products in 3-D machines. Markets will be global because software can be distributed on-line, instantly for free. Making the recipes 'user friendly' so they can easily be customised will be the key value added.

Flexible Manufacturing

Korean manufacturing companies have normally purchased equipment that is dedicated to a specific function. While this strategy creates an efficient production line, it lacks flexibility. 3-D printers will facilitate manufacturing companies to be more flexible and offer customised, unique products.

Sensors and Actuators

The Internet of Things is the next generation of Systems Integration or Environmental Integration. IoT is an eco-system that integrates measurement and control of functions. While the eco-system is under development, the devices that will be incorporated into the IoT (the Things) have already been commercialised. However, to connect the devices to the eco-system,



they will need to sense their environment. The demand for and diversity of sensors will increase exponentially. IoT will need to move physical things so demand for actuators will also increase. (Just as the shift from IPv4 to IPv6 exponentially increased the number of IP addresses, IoT will increase the demand for sensors.)

Big Data

Korean companies have technologies to collect and analyse data and large databases already exist. However, even with some of the world's leading ICT companies in Korea, industry has been struggling with utilising big data to drive productivity. One industry expert interviewed for this project admitted that he was impressed when he saw how well even small German companies was utilising big data to enhance productivity of their factories.

Big data presents opportunities for benchmarking large numbers of examples to discern trends, explore cause and effect and learn new approaches. Big data will be applied to almost every sector such as retail, fashion, finance, public safety, manufacturing, logistics, and so on. The challenge is not availability of data but how to use it to generate the best result in each sector.

Privacy will be another major issue. Koreans are very sensitive about protecting their private information. Society has not reached a consensus on balancing privacy with the opportunities presented by utilising big data.

Eco-Friendly Materials

The pressures of waste management are becoming acute. Legislation around the world is creating pressure for manufacturers to take responsibility for disposal of products at the end of their life cycle. This will drive manufacturers to consider disposability of materials when they design and produce hard goods. This has already had an impact on construction materials. Other industries will also seek materials and components that can be recycled and develop manufacturing processes that facilitate disassembly.

Reverse Distribution

With manufacturers taking responsibility for disposing of hard goods at the end of their life cycle, they will be required to organise 'reverse distribution' to take back products at their 'end-of-life' cycle. As this practice becomes more common, a new industry for collecting, disassembling and recycling used products will grow and prosper.

Carbon Fibre

One example of a key, next generation advanced material is carbon fibre. Some Korean Companies have relatively competitive technologies in the sector and the Korean government also considers it as key new material for the future of industry. The Ministry of Science, ICT and Future Planning (MSIP) forecast that the global market for carbon fibre would grow from 12 trillion KRW in 2012 (£6.9 billion) to 100 trillion KRW (£57 billion) by 2030. To stimulate national competitiveness in this sector, MSIFP announced a carbon fibre development project in May 2014 (through 2017). It will promote adoption of new carbon fibre applications in key industries as follows:

- Automotive frames: 9.6 Billion KRW (£5.5 million)
- CNG pressure vessels for taxis and buses): 21.3 Billion KRW (£12.25 million)
- Aircraft structures: 12.4 Billion KRW (£7.12 million)

The main players in this field in Korea are

- Hyosung
- Taekwang Industrial
- Samsung General Chemicals
- SK Chemical
- GS Caltex

Virtual Reality Devices

Samsung Electronics is expected to release its virtual reality headset in 2014. The device is for its "Galaxy" brand mobile devices and uses OLED display. Sony, Facebook and Google have already released their prototype virtual reality headsets.



Smart Fashion

Clothing will incorporate functions that automatically warm or cool the wearer based on the balance between body and ambient temperatures. Clothing will also have self-drying capabilities.

Customised Fashion

3-D printing, unlimited information, and global payment services have created an industry of customised fashion. Consumers can create their own design to be custom made and shipped to them anywhere in the world at competitive prices.

Super Smart Phones – Communications Incorporated into Diverse Products

Communication functions will be incorporated into many devices and not a discrete device such as a telephone. Just as Apple converted an entertainment device into the iPhone, eye glasses, watches, furniture, vehicles will all be equipped with communication functions.

Voice Recognition Applications

Presently, voice recognition technology is quite primitive. As communication is integrated into multiple devices, voice commands will be developed to control them.

Heads Up Displays

Similar to voice recognition, heads up display applications will convert not only vehicle windshields but also mirrors, desk tops, operating tables, and other devices will be programmed to display information needed to carry out relevant tasks.

2.2 Automotive & Transport

The automobile has undergone considerable change over the past 100 years. The coming decade will see accelerated changes to the industry.

EV & Fuel Cell Vehicles

The predicted growth in electric vehicles has not met expectations, primarily due to performance and price differentials. In the coming decade, 'generational' technological improvements will close the gap between the cost of electric vehicles and petroleum vehicles. A new generation of batteries will be available in a less than five years. The increase in availability and drop in price of natural gas will drive the popularity of fuel cell technology for vehicles (and many other applications).

Interconnectivity

Vehicles are already connected. The Internet of Things will elevate the connections to a new level. In the future, a variety of functions will become available and many standard in all vehicles:

- Advanced GPS – weather, traffic volumes/accidents will be monitored and drivers advised of optimum routes
- Maintenance - real time monitoring of devices and systems to optimise maintenance. For fleets, this information would be connected to maintenance centre to reduce time vehicles are off the road
- Accident prevention – sleepiness detection, collision warning systems
- Driverless cars – within a decade, cars will be able to 'drive themselves' using interconnected technology. "Pick me up" apps will direct cars from the parking lot to the front door.
- Efficiency for fleets – driving behaviour, speed, tire inflation, type of fuel, oil level, overloading will be monitored and communicated to fleet headquarters
- Location management – location, speed, load conditions can be used to optimise routes and delivery schedules and detect theft
- Tolls will be paid automatically from the integrated system

- Advertising – retailers will communicate with passing cars advertising specials and offering incentives to stop
- Policing
 - Driving speed, overloading, driver's alcohol consumption can be monitored on each vehicle.
 - Accidents can be communicated directly to emergency services automatically
 - Traffic volumes can trigger traffic signals, open or close lanes on highways, bridges

Public Transport

- Buses and passengers will communicate so buses know where to stop, how many passengers to anticipate. Traditional bus stops could disappear, particularly in less populated areas.
- Commuters will know where busses are, which bus is coming next, optimise routes to destination
- Transport payments will be integrated on smart phones (or similar devices) so no cash or cards are needed
- Subways can select which doors to open to distribute loads for optimised efficiency. Passengers will be advised when waiting at the station which doors will open.

2.3 Energy

Energy Savings

Korea consumes more energy per person and per dollar of GDP than most OECD nations. The country is constantly investing in increased capacity. In the coming decade, the emphasis will be on improving the efficiency of energy use. This will involve the development of new building materials (insulation, building materials that are photovoltaic, building materials that automatically

block or permit the permeation of light, heat and air), monitoring and control systems that measure (sensors) and respond to (actuators) changes in environmental conditions and demand (IoT).

Smart Grid

Installing and managing smart grids will be demanding and highly competitive. Electricity will be entering the grid from many very different sources with highly different characteristics. Connections will be both users and providers of electricity at different times of the day and week. Consumers will have greater flexibility about when they use power (for charging vehicles, etc.). The cost (and prices) of power will fluctuate constantly requiring users to install control systems and develop algorithms to manage consumption rates. The grid will become a sophisticated, multidirectional distribution system.

New and Renewable Energy

Renewable energy sources are already well defined and will continue to develop but current technologies are uncompetitive. Industry believes that the 'next generation' is needed to bring down the cost of new and renewable energy sources to compete with conventional energy sources. The sectors that are expected to receive the greatest attention in Korea include fuel cells, photovoltaic and bio-mass. Bio-mass will be primarily waste disposal but technologies to increase efficiencies will emerge. Energy storage systems (including batteries) will increase.

Nuclear Decommissioning, Waste Fuel Reprocessing and Disposition

Korean nuclear power plants are ageing and the oldest (operational since 1978) have already undergone life extending modifications. Within the coming decade, the old plants will require decommissioning, skills that are new in Korea. Korean firms are eager to learn about decommissioning and re-processing of spent fuel.



LED / OLED Applications

The take up of LED and OLED lights has not met expectations and manufacturing facilities are over invested. However, this has depressed the cost of LED lights which in turn will stimulate applications. Companies that find creative ways to utilise LED / OLED lights will flourish. Interior lighting will be steadily replaced with LED/ OLED but the versatility of these products will stimulate a plethora of applications: information signs (such as road signs that reflect real time road conditions), easily programmable (with unlimited variability) advertising signs, art, hydroponic farming (with the light adjusted to the needs of the specific plants), etc. LED / OLED lights have low power requirements so they can be installed in remote locations and powered by photovoltaic cells, controlled remotely (IoT) and possibly be connected to ESS.

Natural Gas Pipeline from Russia

Plans are under way to develop a pipeline to deliver gas from Russia to Korea within a decade (pending resolution of some political issues). There are several proposed routes for the pipeline:

- Route 1. Sakhalin through North Korea to Korea: This option is unacceptable under the current political relationship between the North and South. It would be expensive as it would require installing a dedicated 700 km (above ground) pipeline.
- Route 2. Sakhalin under the East Sea (submarine pipeline) to Korea: The ROI on this option is unattractive considering the amount of gas to be delivered.
- Route 3. Russia – China – Korea under the Yellow Sea: In May 2014, China and Russia signed an agreement to build a pipeline to China with construction to begin in August 2014. Connecting to the China pipeline would involve a 400 km pipeline under the (relatively shallow) yellow sea, the most cost effective alternative.

Natural Gas Pipeline Plan



Source: Compiled by IRC

Natural Gas Trading

The right to distribute natural gas in Korea is held exclusively by the Korea Gas Corporation (KOGAS). Currently the only OECD country with monopolistic supply, the market will be privatised and open to competition with multiple sources of gas from the Russian pipeline, domestic supply and imports. An active trading regime in the region will be established within 5 years.

2.4 Construction

The heyday of construction in Korea has past. For decades, construction was a guaranteed way to wealth for both the construction companies and the owners of the property. Civil construction (roads, tunnels, railways, land reclamation, public facilities) boomed during Korea's industrialisation period. Developers acquired land and changed zoning to permit construction of apartments or industrial facilities which were built as quickly and economically as possible and sold. During the period of rapid growth, construction was so lucrative that several thousand construction companies were established. Now, Korea's infrastructure is well developed. There are more apartments than households.



Civil Construction

While the country will continue to invest in upgrading roads, railways, and public facilities, the number of projects will be considerably lower than in the past. The government will invest in some civil projects to support the industry but the widening budget deficit limits the extent to which this can be sustained.

Residential Real Estate

There is now an oversupply of apartments, in particular, large ones and outside of the Seoul metropolitan area. Many development projects result in unsold units. The elderly are exiting the workforce and selling their apartments to fund their retirement further pushing up supply and down demand. Single people are either buying small apartments or unable to afford to purchase apartments on a single income have turned to renting. Some experts suggested that building small units will continue to be viable for the coming decade.

Customised Homes

A common practice for construction development companies is to 'pre-sell' apartments. When a development project is launched, the company builds a set of 'model apartments' that represent the types of layout that will be offered. Interested buyers select a layout and begin making regular payments while the building is under construction (helping the construction company to finance the project). Individual consumer needs or desires will be customised and built into the apartment.

Building Maintenance

The focus of the construction sector during the rapid growth phase of industrialisation was on building residential, commercial and industrial facility as quickly and economically as possible. Values were climbing quickly so it was economical to tear down old buildings and building new ones. There was very little need for and development of maintenance capabilities. As the stock of Korean real estate assets ages

and real estate values are stable, there will be a need to manage and maintain old buildings to extend their life.

Refurbishing and Upgrading

The residential stock built over the past 3 decades no longer meets the needs of demanding residents. Frequently, the construction was poorly maintained and unappealing. As the stock ages, there will be growing opportunities in upgrading the facilities to meet increasing expectations of residents.

Smart Homes

The emergence of the Internet of Things will radically change the interior of homes. Within a decade, everything in the home will be connected and controlled: lighting, heating & cooling efficiency, integrated entertainment on demand delivered on multiple devices, security (intruders, fire, harmful gases). Smart homes will be controlled through integrated software platforms. Korean suppliers have been primarily focused on the production of hardware. Any software applications have been dedicated programs to manage or control a single function. The skills required for developing a platform on which to integrate multiple hardware components (probably from many suppliers) will emerge over the coming decade, either domestically or from overseas.

Leisure

As the population becomes more affluent and as the number of retired people (who have more leisure time) increases, there will be more demand for leisure projects. Chinese tourists (who already account for nearly 50% of visitors and visitor spending) are a huge potential for leisure complexes in Korea. Already there are huge investment projects on Jeju (golf and other sports facilities, parks, gambling and night clubs, theatres and cinemas). Customers and tourists will demand more sophisticated facilities driving the need for new capabilities in design, new materials, and operations management.



Construction of Leisure Complexes

Korean and even foreign development companies are targeting Korea to develop new leisure complexes aimed not only at Koreans but also Chinese and other Asian tourists. Already this year, a major US \$700 million, multi-purpose entertainment complex was announced in Paju Northwest of Seoul. An Asia/Middle East consortium has just broken ground on a \$2.7 Billion multi-purpose (gambling, amusement park, water park, hotel) mega-resort on the southern island of Jeju. New development projects are planned or under construction providing additional leisure opportunities.

Tourism Infrastructure

The infrastructure is inadequate to accommodate the expected increase in (primarily Chinese) tourists. There will be opportunities for new hotels, transportation systems, clinics, restaurants, medical facilities, insurance, and translation services.

Overseas Engineering, Procurement, Construction (EPC)

Korean construction companies continue to be major contenders in all major plant construction projects around the world. This is likely to continue but the competition is stiff and margins are often thin. BOT or BOO contracts are becoming more common requiring EPC companies to secure financing in addition to building the plant. Customers will want to purchase not a power plant or a desalination plant but rather electricity or water. It will require a shift in approach from building the lowest first cost build to pursuing the lowest lifetime cost.

Nuclear Power Plants

With a 30 year history of building and/or operating nuclear power plants (in four locations), Korean industry has sufficient technology to safely design, build and operate nuclear power plants. In late 2009, a consortium won its first overseas nuclear power plant contract in the UAE. As one of the few players active in the industry, Korea is in a good position

to participate in new nuclear power plant construction projects around the globe.

North Korea

The sudden opening of North Korea to development is unlikely but possible. Were it to happen, it would offer a tremendous surge of construction opportunities: civil, residential and plant. Over-land routes that provide access to China and onward to Europe would potentially bring tremendous benefit to Korea. Due to the tremendous investment required, funding to finance the rebuilding of an infrastructure that is of poor quality and deteriorating will be an opportunity and a challenge.

2.5 Medical

Tele-medicine

Tele-medicine holds a bright future in Korea. Korea has an advanced medical system able to deliver first rate health care at competitive prices. Hospitals capture images and test results instantly providing them to physicians for rapid diagnostics and treatment. Surgical robots are becoming common place. Korean firms are leading developers and manufacturers of advanced electronic products. Major companies, notably Samsung Electronics, have committed vast R&D budgets to developing medical equipment. The internet architecture in Korea is based on nationwide fibre optics cables. Public health organisations are establishing clinical kiosks at local government offices. Doctors will soon be able to check patients' conditions in remote places through clinical kiosks. All the components needed for rapid growth of tele-medicine are in place. Only politics (resistance by doctors) threaten Korea's opportunity to be a leading player in telemedicine.

Long Distance Care

Connectivity will permit doctors to monitor patients regardless of the location of the doctor or the patient. Robotic surgery assists surgeons to carry out complex operations.



Currently, patients travel to the surgeon but when robotic surgery is used, the surgeon does not physically touch the patient (even though they are traditionally in the same room). Connectivity will permit the world's top surgeons to perform procedures physically remote from the patient – conceivably across the world.

Wearable Devices

The Internet of Things extends to the human body.

- Miniaturisation of sensors and flexible printing technologies will permit patients to have monitoring sensors implanted in the body or attached to the skin (like a tattoo). This will facilitate real time monitoring of patients conditions contributing to the knowledge of the patients symptoms and warning of pending medical problems.
- New, miniaturised batteries that last five to 10 times longer than current technologies will expand the types of devices that can be implanted (which can be monitored and replaced BEFORE they fail.) These devices will include tracking devices for children or patients with dementia.
- Medicine can be delivered from wearable devices in the doses and at the specific times that they are needed throughout the day replacing pills and injections.

Equipment & Devices

Korea's conglomerates, Samsung in particular, have targeted medical equipment as a focus for future business. Korean industry is effective at manufacturing diagnostic equipment such as ultra-sonic devices but remains weak at complicated bio technology devices such as artificial hearts or neuro technology devices. This will be a key focus for the coming decade.

Bio-Tech / Bio-Science

Korean firms are combining ICT and bio technology to create a new sector called u-health. One area of development is bio sensors, devices that

can transfer bio signals to electronic signals. A Korean government report referenced the robot hands created by Touch Bionics (a UK company) as an example of Bio-tech and ICT convergence. The robot hands can be precisely controlled using a smart phone application.

Big Data

Real time monitoring of individuals will exponentially increase the 'big data' of medical knowledge. Benchmarking will expand beyond the experience of the individual doctor, hospital or even country and similarities can be explored in cases across the globe. This will improve diagnostics and suggest new treatments.

Another important contribution of big data would be the prediction, tracking and management of pandemic outbreaks.

Customised Drugs

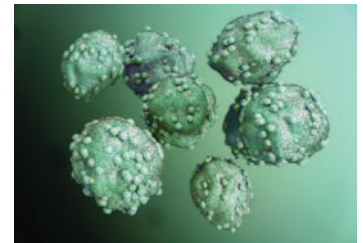
Advanced tools for analysing the 'big data' will help the medical profession to more precisely define what drugs are needed to treat specific conditions and to customise the recipe if drugs for each individual. 3-D printing will facilitate pharmacies to produce customised drugs on an individual basis.

Molecular Diagnostic Checks

Korean molecular diagnostic technology companies are globally competitive and companies in the sector are already profitable. Cancer tests using gene analysis are growing rapidly in Korea and molecular diagnostics will replace the existing cancer diagnosis methodologies in the future. Molecular diagnostics are more comfortable and less expensive. The method will be applied to other diseases in the future.

Gene Therapy

Gene therapy products are still in the R&D stage. The Korean government has allocated long-term financial support for the sector. According to the National Research Foundation of Korea, 27 gene therapy clinical demonstrations were approved



by the government from 2003 to 2013, 13 of which are still on going. Gene therapy products to treat cancers, HIV or hereditary diseases will be commercialised in the US and Europe in a few years but high price will prevent wide spread acceptance. Even small companies can compete in the local diagnosis market.

Bio-Similar

According to Frost & Sullivan, the global bio similar market size will grow from US \$870 million in 2012 to US \$24 billion in 2019 (CAGR 60.6%). Sandoz, Teva and Hospira have 80% global market share today. Samsung, Celtrion and Dong-A Socio Holdings are the main players in the bio similar industry in Korea but as quality control / reliability are key factors of market acceptance, credibility and brand power are critical. As late entrants (late beginners) in the sector, the success of Korean firms is uncertain.

Cell Therapy Products (Stem Cell, Cord Blood)

Korean companies hold a competitive level of CTP technology when compared globally. Korean stem cell technology level is at a cutting edge level. The key to success is skilled manpower and adequate R&D budget. Korean companies have very good quality R&D people in the sector but their willingness to secure and allocate adequate levels of funds is uncertain.

Bio Printing

A Korean research team successfully implanted 3D printed bones into mice in 2014. They expect 3D printed bones will be applied to humans within 5 years. Another research team announced that they had developed bio inks that contain only cells without biocompatibility materials.

Medical Tourism

A major high-value added service industry is medicine. Korea has an advanced, well equipped, efficient and affordable medical care system. Internationally trained doctors use state-of-the-art equipment in modern facilities. Local

hospitals (which are required to be not-for-profit) are squeezed by the government's efforts to curtail the costs of the national health insurance system. The government is encouraging medical tourism as a low social impact, high value added service market that will help to fund the financially stretched insurance scheme. Medical tourism to Korea is growing rapidly. In 2012, 131,000 visitors came to Korea for medical treatment earning the country 726 billion KRW (£ 417 million), more than triple the number just 4 years earlier. Inbound medical tourism grew 60% between 2012 and 2013. Patients come primarily from China but also from the USA, Japan, Russia, central Asia, and the Middle East.

Future Technologies

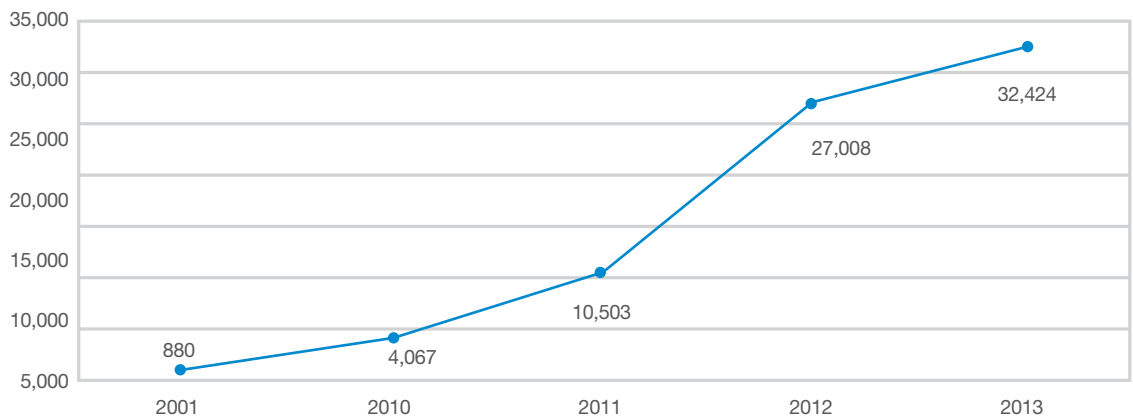
The medical and genetics sector has profound implications for the consumerisation of DNA ('printing' DNA) to allow people to 'design' their children or enhance capabilities of adults, growing replacement body parts from one's own DNA reducing the risks of rejection that accompany transplants (Korean institutions are on the verge of commercialising bone replacement therapy), the bio medical field will unleash countless possibilities – and possibly major ethical challenges.

2.6 Agriculture

Industrialisation drove urbanisation and Korea's rural population dropped from over 70% to around 7% in two generations. The farming population is elderly with median age over 60. There is new, noticeable trend with urban families moving back to the farm for a 'sea change'. As economic growth slows and unemployment rises, the government recognises that agriculture forms an alternative engine for job creation. Training and financial support programs are being developed to assist this movement. The new comers from the city bring with them skills in technology and distribution that could change the way that farms are managed.



Households return to rural area



Source: Ministry of Agriculture, Food and Rural Affairs

Agricultural Technology

Korea has an open economy and protection for farmers has diminished. The only way for farmers to survive is to apply new technologies and selection of crops. Korean companies are seeking ways to apply ICT to agricultural applications. Farmers are developing premium products and rapid delivery.

Urban Farm Factories

Smart LED will facilitate artificial light for farming. Research will identify what types of light are needed to grow each type of fruit or vegetable, accelerate growth, enhance flavour, and increase eye appeal. Greenhouse technology (including hydroponics) will be applied to high rise 'factory' farms in land scarce Korea. They can economically be located close to population centres, shortening the time to market and reducing logistics costs.

Research into LED farming is well underway. The Jeonbuk LED Fusion Technology Center reports that using current technology, productivity in the laboratory is 100 times higher than outdoor agriculture. However, test pilot factories are not yet generating vegetable of

sufficient quality (flavour and texture) compared to outdoor farming. The key technologies in this sector are LED types, automation and robotics.

Organic Farming

Factory farms will be 'closed' ecosystems. Pest and disease control can be biological such as use of natural pests and soil pathogens to reduce infections without the use of fertilizers or pesticides. Natural pollination via bees and other insects is being studied and promoted. More urban farming (as well as greenhouses) will become organic. Demand for chemical pesticides will fall while demand for organic solutions (predator insects, anti-pathogen fungus) will emerge. The entire industry will focus on organic, eco-friendly high quality produce.

Pharmacologicals

The demand for pharmaceutical use organic chemicals from vegetables such as polyphenol and isoflavon which are known as good for anti-aging and anti-cancer will increase. Greenhouse and factory farming will facilitate efficient production of these chemicals in controlled environments.



3.1 Education

Education is already available on-line and the offering will grow exponentially over the coming decade. Education will be increasingly de-linked from physical location. Schools (the physical institutions) will need to re-invent themselves.

Global Education

Korean schools have already targeted international students as a key market. Korean institutions will also compete for the on-line market. The offerings will have to be at an internationally appealing level and will have to be available in multiple languages.

Teachers will be Psychologists not Mathematicians

Content will be increasingly delivered on-line so it can be more diversified / specialised. Teachers' skills will shift from delivering knowledge of subjects such as math, history and science to psychology of how to manage and motivate students.

Certification

A major challenge to on-line education is for employers to know if the student has adequately learned the coursework. Service providers that can accurately and reliably certify that students have in fact mastered the coursework will emerge and be highly valued.

University Specialisation

Korea has too many universities offering similar curricula. As the student age population declines, demand will fall. As global options become available to everyone, competition will be severe. Universities will have to specialise to survive, some will close.

University as a Forum for Interaction

A major challenge to Korean education has been the homogeneity of content which has in turn stifled innovation. One role that a university can offer to differentiate itself is creating an environment where individuals from diverse

backgrounds can meet to challenge each other's assumptions and to learn from the interaction of ideas.

One interviewee for this project advocated a Korean version of Singularity University. Funded by the ICT giants, this forum would invite thought leaders to exchange ideas and generate a new wave of innovation and creativity. While industry would benefit from such an entity, it will require a major mind-shift by established Korean companies and educational institutions.

On-line Interaction

The forum for interaction could also take place on-line. On-line educators can deliver 'out of the box' thinking that will challenge beliefs and teach students to question their assumptions. Creating a platform for dialogue, discussion and debate with people from different cultures and backgrounds exposing students to different assumptions and approaches would greatly enhance on-line education.

Cooperation with Global Universities

Combining on-line education with an opportunity to establish global inter personal links will emerge in the coming decade. Already, Korean universities have established joint programs with many reputable foreign universities. On-line lectures will be a key element of all universities to assist students to communicate naturally in English. More important will be developing a personal community with students from around the world. Human relationships created by face to face interaction are very powerful. Cooperation with reputable universities will broaden these relationships globally.

The Government will no-longer Dictate the Curriculum

With education available globally, parents will have infinite choice and will not need to send their children to conventional schools. The national government will be unable to dictate the curriculum and the more they try, the greater will be the shift to alternative sources.



Career Development Programs

Our world is changing rapidly and the skills required in the workplace are changing just as quickly. Four years of university education experienced in your early 20s will not be valid over a 40-year career. Frequent updates will help keep abreast of changes in the area of specialisation. Some of this on-going education will be learned by doing in the workplace but more technical, specialised skills will require professional instruction.

Career development programs must be specialised and practical. No longer restricted to learning from local colleagues, they will access the best specialists in the world that will deliver their knowledge across the globe through on-line platforms.

Re-training

Career development helps professionals keep abreast with changes in their specific discipline. However, shifts in industry will make some careers obsolete while creating new ones. There will be high demand for retraining professionals during their working life. Industries and related skill requirements will change more rapidly in the future.

Vocational Training

In Korea, the four year university degree is losing its lustre. More students are graduating even from the top universities to find that jobs are not available. At the same time, Korean industry is challenged to fill technical positions. There is a gradual shift towards training in technical skills that are needed in industry.

Safety Education

Korea has recently experienced several tragedies that were partially the result of human error. These tragedies could possibly have been prevented by application of standard safety procedures. Companies with a long history of safe performance and established

safety procedures could commercialise their training procedures and deliver them on line globally. On-line training and testing can ensure that, for example, each and every member of a ferry crew knows how to respond to specific accidents and threats.

3.2 Leisure

The leisure industry is another area that will see tremendous growth over the coming decade. Korean citizens are wealthier, they have more time (especially as they retire) and are healthier.

Integrated Entertainment Facilities

Hyper markets and department stores were originally exclusively for shopping. They are under pressure from the inexpensive and convenient on-line shopping alternatives. They have responded by evolving into integrated entertainment destinations. All major supermarkets and department stores have added restaurants and play areas for children. Many are now incorporating sports facilities, movie theatres and amusement facilities. Primarily focused on families, they must further evolve to include services and options for the elderly, singles and tourists. Alliances and cooperation between integrated shopping facilities and entertainment organisations (e.g. E-Mart & Everland) should be anticipated.

Entertainment Content

The Korean government has imposed a 'screen quota' system requiring local movie theatres to allocate at least 50% of their showings to domestically produced films. Now, Korea's film and concert industry is booming. Korean drama and movies have surged in popularity at home and across Asia. Korean music groups with their clean image, choreographed moves and harmonised singing have attracted fans around the globe.



Tourism (China)

Another major leisure service industry is tourism. 573,852 Chinese tourists visited Korea in 2013, 45% of the total and accounted for nearly 50% of tourist spending. Tourist spending on skiing, golf and other leisure activities grew 103% in 2013. Tourist expenditure on other cultural experiences grew by 18%. The Pyeongchang Winter Olympics 2018 organising committee has targeted Chinese tourists as the main users of the facilities after the Olympic Games have concluded.

3.3 Service Exports

Korea franchised many foreign brands and launched them domestically. Now, Korean firms have begun exporting domestically based franchises and services overseas. While primarily focused on Asia, some franchises have expanded to the US and Europe. Paris Croissant has made significant inroads into China but also opened in Los Angeles. Although the presence of ethnic Koreans may have been a factor in site selection, the clientele today is primarily the local population. Other bakery and chicken brands have begun operations overseas. Interestingly, Korean 'hakwon' (after school study classes) have started to appear in North America as parents wish to supplement the publicly provided education there.

3.4 Business Services

The demand for business services will increase. High levels of trade, inbound and outbound FDI, tightening rules on corporate governance, transparency and adherence to international accounting practices, competitive pressures encouraging outsourcing of non-core activities all suggest that the need for high value service support will continue to grow in the future. Recent Free Trade Agreements with Europe and the US have opened the door for service providers. The

demand for high value services are most likely to be served by foreign companies or Korean with extensive foreign experience.

Entrepreneurship & Incubators

There are a number of entrepreneurs who have attempted to create clusters of companies to encourage start-up companies. Interestingly, returned Koreans and Korean businesspeople with extensive international experience are playing a significant role in this trend. Lee, Jung-wook, the former CEO of Daum and Lycos was identified as a pivotal player. Richard Min plays a similar role in fashion related start-ups. The government recognises the importance of entrepreneurship and is developing policies to support innovation. One industry insider identified a positive programme where government funding matches investments of venture capitalists leveraging their efforts.

Residential Real Estate as an Investment

The primary financial investment product of middle-class Koreans was real estate. During Korea's long, 40 year period of economic development, the mantra was that real estate prices would always rise, a belief that held true with the sole exception of the Asian Financial Crisis of 1997/98. However, there have been on-going efforts by the government to reduce real estate speculation which has dampened prices. Now, consumer debt levels are high and there are insufficient funds to continue to invest in property. Furthermore, the demand for (housing) apartments is largely saturated and upside potential is less promising. Consumers are eager for alternative financial investments.

A major expansion in demand for non-property investment products is anticipated over the coming decade. The first 'fund supermarket' was introduced in April 2014. International investing is relatively simple and provides alternative models. Market and product information is relatively easy to obtain. Investment in foreign financial products reached US\$ 5.6 billion in 2013. International



investment is sure to increase as regulations are relaxed and investors become comfortable with the practice. Several Asian nations (including Hong Kong) are discussing free cross border sale of investment products simply by registering the fund locally.

Sales channels are evolving. Consumers who historically preferred to visit their local branch to transact business are turning more to on-line alternatives. In 2013, 34% of all financial transactions were implemented over the internet. Greater diversity is anticipated in the future through mobile devices and integrated shopping centres.

Online Commerce

Online commerce is moving from internet to mobile making it even more convenient and accessible 24 hours per day. Within 10 years, it is anticipated that virtually all payments will be through mobile devices (or perhaps the next generation of mobile devices). This has commercial, social and political consequences. Banking profitability (which is low in Korea) will benefit but branches will close and employment in the banking sector decline.

Integrated Order, Delivery & Payment

Consumers are shifting from 'bricks and mortar' stores to online. (With increasing frequency, consumers visit stores only to learn about and compare products and then purchase online.) Korean consumers can search the world to identify the most cost effective source of virtually any product. Dramatically falling deliver costs are driving this trend. In 2014, the Korean government tried to curtail this practice by imposing a US\$ 500 monthly limit on overseas purchases but had to rescind the edict in the face of consumer resistance uproar. There will be a substantial market for developing and managing eco-systems that integrate 'browsing', order, shipment, delivery, payment, returns, and customer feedback (on the product and the process).

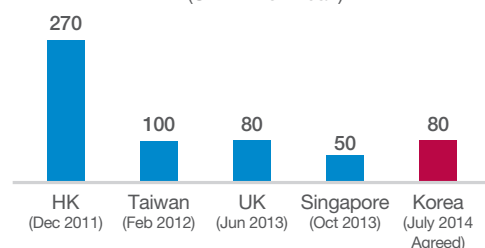
Direct Settlement between Yuan (Renminbi) and KRW

China is Korea's primary trading partner accounting for nearly one quarter of all imports and exports (and almost equal to the next three countries combined). As with the majority of international trade, all trade was conducted in 3rd country currency (predominantly US\$). When Chinese President Xi, Jinping visited Korea in July 2014, he agreed with Korean President Park, Geun-hye to open trade on direct exchange between the Korean Won and Chinese Yuan. Korea joins Hong Kong, Singapore, Taiwan and the UK in Yuan trade. The UK has 26% of the global market for offshore Yuan trading.

International Investment in China

Korean investors will soon be able to invest directly in Chinese equities. In July 2014, Chinese President Xi Jinping promised to provide Korea investors with an Renminbi Qualified Foreign Institutional Investor (RQFII) allocation of approximately 13 Trillion KRW (£7.5 billion). This suggests that as China opens its financial markets, financial investment companies in Korea will be able to capitalise on opportunities there. Koreans have thrived for many years in an ambiguous regulatory environment and know how to work in a semi-regulated economy.

RQFII by Country
(Unit: Billion Yuan)



Source: Korea Securities Depository

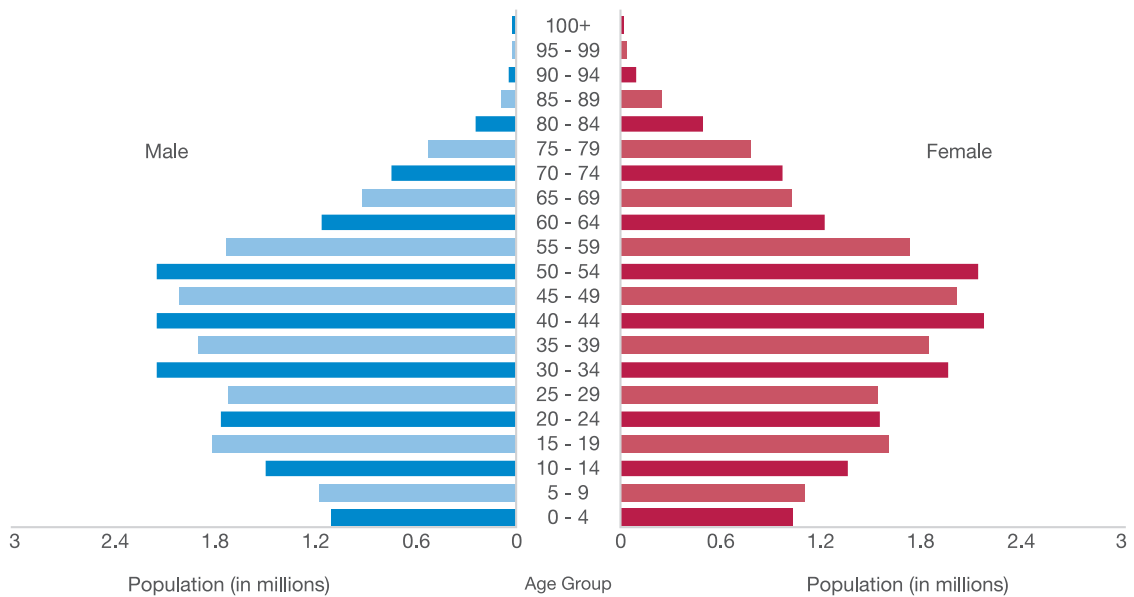
1 Demographic Environment



1.1 Declining Population

The most dramatic and predictable change that will generate the greatest impact on industry in the future is the end of population growth. With a birth rate (2010) of 1.22 (217th out of 222 countries according to CIA Factbook), Korea's population will peak at just over 52 million in 2030 and begin to fall rapidly (source: Statistics Korea). The most pessimistic one scenario forecasts that the population will peak as early as 2016. This will have an impact on every aspect of society and the economy.

Korea, South - 2013





1.2 Ageing Population

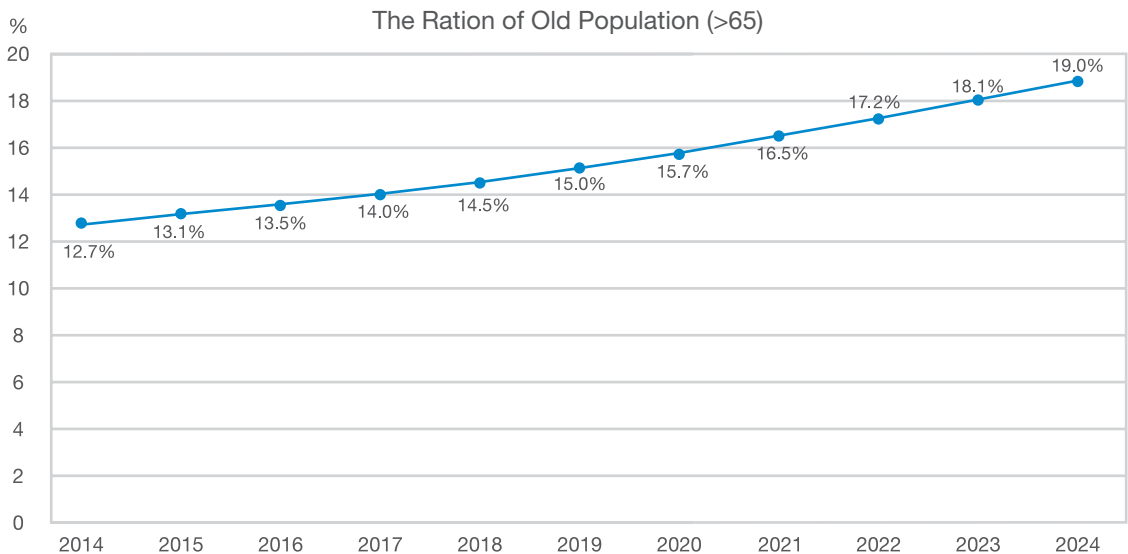
Many developed countries are facing the prospect of ageing populations but with a low birth rate and high life expectancy (77.4 for men and 83.9 for women), Korea is one of the most rapidly ageing societies in the world. The normal drop in birth rate observed in all developed nations is compounded by imbalance between the number of men and women of marrying age exacerbated by the decision by many young people to forego marriage altogether.

Reflecting a global trend, Korea's birth rate has declined as it has developed but this phenomenon is exacerbated by an unusually high drop in marriages. There are 96 women for 100 men and one in 4 men and one in 5 women are expected to remain single through their child bearing years. It is interesting to note that the 'boy preference' has recently reversed to a 'girl preference'.

Company policies are not as family friendly as in the West. Employment practices favour men as loyalty to the organisation and working overtime are considered virtues while mothers allocate time and energy to rearing their children.

Another hurdle to childrearing is the cost of education which as a ratio to GDP was highest among OECD countries in 2013. These economic pressures combined with the increase in individualism have led to low marriage rates and fewer children.

The population over 65 will jump from 12% to 19% by 2024. Within 3 years, Korea will classify as an "aged society" and by 2024 will be approaching "post-aged" status (the ratio of people over 65 exceeding 20%). The time it will take for Korea to evolve from "aged" and "post-aged" is 8 years compared to 12 years for China and 39 years for France. The median age will be 43 in 2020 and 47 in 2030.



Source: Statistics Korea

1.3 Immigration

Nationalism

Historically, immigration has not been encouraged in Korea. Korea has traditionally been an isolated and highly homogenous society. They are brought up to be proud that they are a single race nation and their blood lines are pure. Being Korean is synonymous with being a member of that unique race. Nationality and race are inseparable; it is not something that can be acquired but you are born with. Children from international families (called multi-racial) were looked down on. They were not even allowed to join the military until 2006. (Note: Every Korean male has the obligation to serve in the military.) Even today, military service is optional for mixed race men.



Korean society is internationalising. Korea is integrated into the global economy. Koreans are now travelling overseas freely (since 1990). Many Koreans who emigrated as children or the children of emigrants are returning to Korea to live. The shortage of women of marriageable age, particularly in rural areas, has led to the import of brides from China (mostly ethnic Koreans), Vietnam, the Philippines and elsewhere in Asia. These 'mail order brides' peaked in 2005 when more than 43,000 foreign women married Korean men accounting for 13% of all marriages that year. According to Statistics Korea, more than 236,000 foreign women have married Korean men since 2000. Statistics Korea issued a report on 30 July 2014 where it stated that one in 20 children born in Korea was multi-racial (progeny of a Korean and non-Korean). There are thousands of US troops in Korea and a similar number of business expatriates. High wages (relatively speaking) are attracting people from less developed countries in Central and Southeast Asia and filling jobs that Koreans no longer want to do (called 3D for dirty, dull and dangerous).

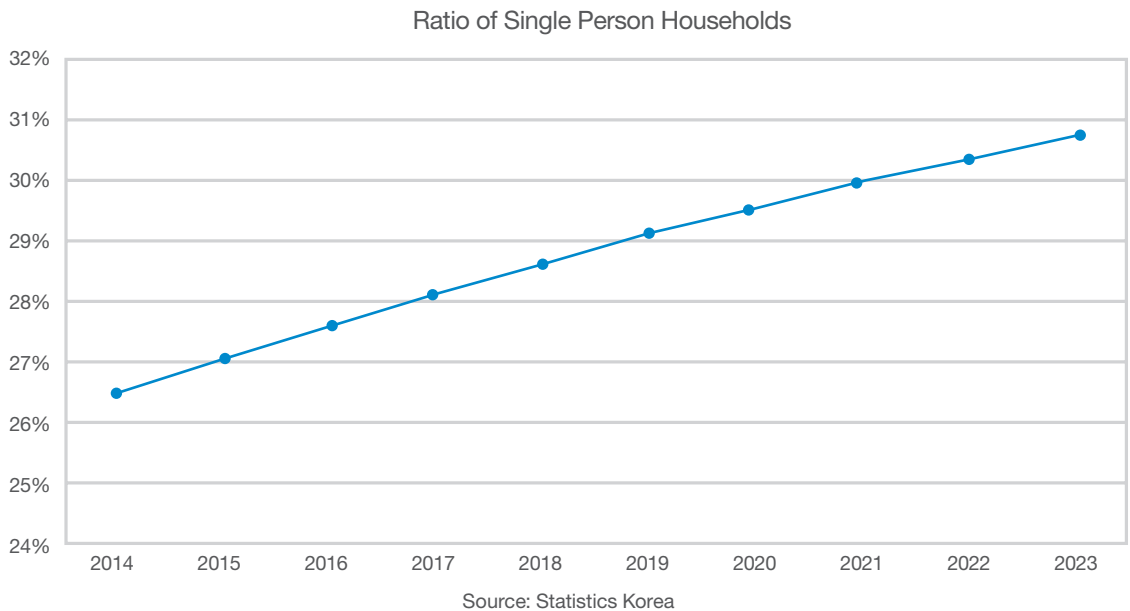
Foreign Population in Korea

Today an estimated 1.5 million foreigners live in Korea accounting for about 3% of the population. This trend is expected to continue in light of the shortage of labour and low birth rate. The trend will challenge the homogeneity of Korean society.

	2009	2010	2011	2012	2013
Total	1,168,477	1,261,415	1,395,077	1,445,103	1,576,034
Long term*	920,887	1,002,742	1,117,481	1,120,599	1,219,192
Short term**	247,590	258,673	277,596	324,504	356,842
Illegal	177,955	168,515	167,780	177,854	183,106

*Long term foreigners: Registered foreign residents

**Short term foreigners: Foreigners without registered residence (usually in Korea for less than 3 months)



1.4 Single Person Households

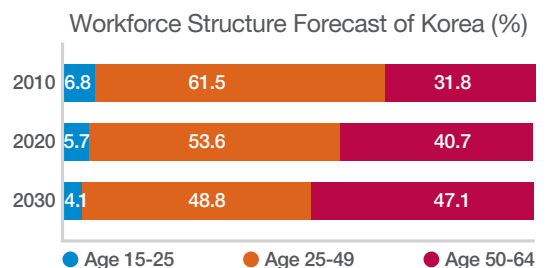
Another dramatic demographic change is the rapid rise of single person households. The combination of longer life expectancy, people remaining single and the increasing social acceptance of divorce have resulted in a jump in the population of single person households (more than one quarter today and forecast to approach one third by 2024).

to a decline in the sense of responsibility that children have for their parents.

Korea is in need of a comprehensive welfare system but as a recently industrialised country, the system are still under development. As a result, the existing safety net for the elderly is weak. Rather than a golden retirement, many elderly face poverty. The suicide rate among the elderly has doubled since 2000.

1.5 Elderly Poor

Korean corporations and government institutions have relatively low retirement ages beginning as young as 55. Life expectancy is 81 years; people will live more than 25 years after retirement. This financial burden on the elderly is significant. Historically, children cared for their parents after retirement but this ‘social safety net’ has broken down. The elderly have fewer children than did their predecessors. At the same time, socio cultural shifts have led





1.6 Working Elderly

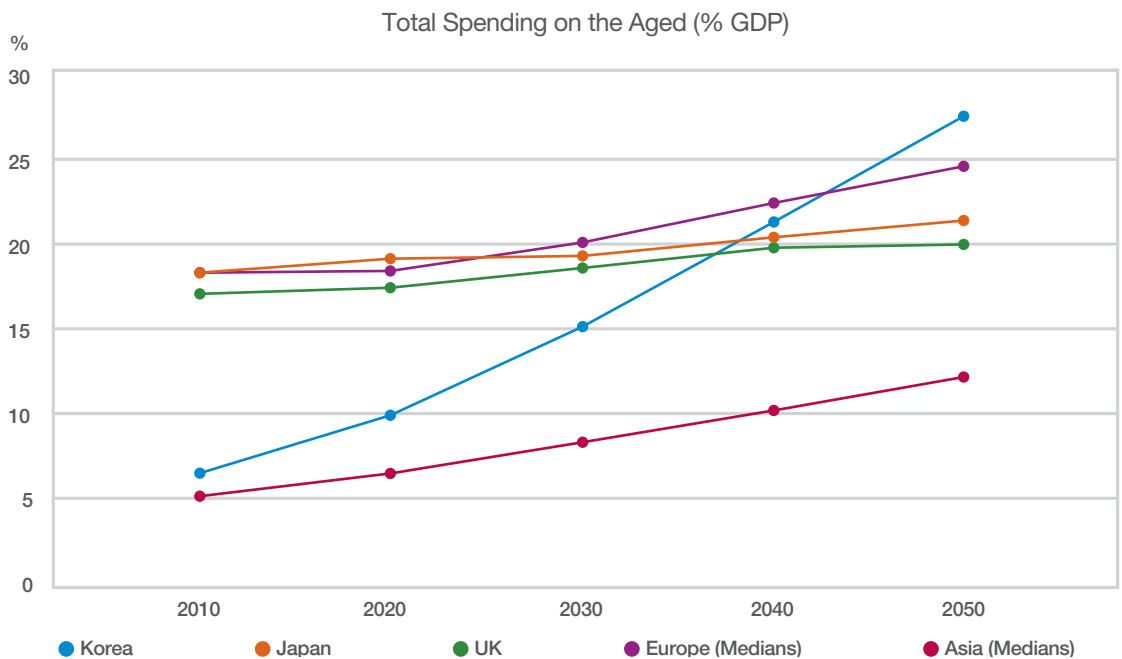
Historically, upon retirement, the departing employee received ‘severance pay’, a lump sum payment equivalent to one month’s salary for each year with the company. As severance pay is inadequate to meet the needs of retirees for the coming 25 years, a common practice is to invest severance pay in a small retail business (often a franchise restaurant or service business) hoping to generate enough income to live on. This often leads to unfortunate results. Retirees seldom have the experience required to manage a small business and a large portion of such businesses fail. The Joongang Daily reported on 10 January 2013 that 16% of franchises failed in the first year while 63% failed in less than 5 years.

The pension system is being adjusted to one that pays out a fixed monthly stipend but it is likely

to be a generation before it adequately funds retirement years (if at all). A major challenge over the coming decade is a meaningful solution that allows people to work to an older age, either in their mainstream job or with a second career.

1.7 Welfare Burden

The growing aged population with inadequate provisions for retirement and a shrinking young generation to finance the burden is a major challenge for society in the decade ahead. Every society faces a ‘generation gap’ between the elderly who feel entitled to support and youth who are increasingly independent and self-centred but in Korea’s situation, this gap is severe.



Source: Standard & Poor’s

2

Cultural Environment

2.1 Traditional Culture and Social Environment

Korean society and culture were shaped by its agrarian origins overlaid with Confucian philosophy. Farming was considered the only noble endeavour because it generated national wealth. Land, the resource for wealth creation, was the ultimate source of value. For over 1500 years, Korea was a unified country, ruled by a king who made, enforced and interpreted the rules. Social structure reflected that of a kingdom or large estates with an 'owner' or head supported by a hierarchy of people indebted to him: family, administrators, tenant farmers, servants, etc. As the head controlled all resources, maintaining a good relationship was the best means to access resources.

Confucianism is an ethical and social philosophy originating in China in the 5th century BC. The primary tenets are order and stability. It is a hierarchical social order based primarily on age and lineage. Each individual has a defined relationship to others in the family and by extension, society. Koreans address each other like family members calling all adult men "uncle" and adult women "aunt". Individuals prospered by being a member of a successful family (or group or country) so subjugated personal ambition for the good of the family. Decisions were made by the patriarch who allocated resources, arranged marriages and guided careers. Preserving the group and relationships within the group was the highest value. Society was highly cohesive.

Scholarship is revered under Confucianism and government officials were recruited from the body of revered scholars. Families sacrificed to send bright children to schools to pass exams to become scholar officials. Once in position, government officials could influence the allocation of resources for the benefit of the family. Education was the road to social mobility and success.



This social structure positioned Korea for industrialisation. The President (in lieu of the king) allocated resources for the good of the nation. The people followed instructions and worked hard postponing personal gratification and sacrificing for the development of the nation. Businesses were also structured like families with the founder (and subsequently his offspring) taking the role of the patriarch. He allocated company resources, assigned employees to functions, decided promotions and dismissals. Employees worked hard for the firm and took pride in company success. They respected the founder as they would their fathers (and expected to be well cared for like children). Confucian ethic facilitated the disciplined, obedient behaviour that underlay Korea's rapid industrialisation.

2.2 Korean Dream

Over the past half century of economic development, a "Korean dream" emerged. Parents sacrificed for the future of their children. They micromanaged their children's lives, pressuring them to study for long hours, enrolling them in the right schools, going into debt to fund supplemental study of academic subjects and fine arts skills, sending them overseas to learn English, all to give them every opportunity to succeed. Graduates of the top schools were hired by the top companies (successful groups) that took care of their employees for life. Employees of successful firms were able to attract the best wives and embark on a life of material comfort.

This was the middle class dream. Young people got married in their late 20s. The groom's family purchased an apartment while the wife's family furnished it with a full range of the latest appliances. They purchased an automobile (first a small one but trading up as a symbol of rising economic status). The couple had two kids before their mid-30s buying the most trendy strollers, toys and latest fashion to demonstrate that they were 'good' parents. And the cycle starts again.



The apartment served not only as a residence but also as a vehicle for saving and accumulating wealth. As real estate prices always increase, young couples tried to upgrade their apartment when possible and demonstrated their wealth by its size and location.

2.3 Fading Confucianism

The traditional ‘Korean dream’ is fading; the universally defined ‘life plan’ is unravelling. Demographic and social changes are undermining the Confucian ethic. The pivotal role of the extended family has succumbed to urbanisation, smaller families. The ratio of college bound students (once the highest in the world) has started to drop. Working women are no longer dependent on their family and have rejected their subservient position. Marriage is an option rather than a given. Cohabitation and divorce, once matters of shame and ostracism are commonplace. Children no longer feel the obligation to care for their parents. Confucianism with its collective, hierarchical, relationship based structure is giving way to individualism. The pre-programmed life’s path is giving way to wellbeing and personal ambition.

Voluntary Unemployment: Many students that have followed the ‘Korean dream’ and graduated from prestigious universities find that they are unable to secure commensurately prestigious jobs. Rather than endure the ‘shame’ of accepting an ‘inferior’ job at a SME, they elect to remain at home and live with their parents. As their parents retire with little financial security, they will be unable to continue to support their adult children. They must find a new dream.

Alternative Dreams: While Korea remains far from multi-cultural, foreign influence is continuing to rise. Virtually all young Koreans have had extended experience overseas to study, work or play. Internationalisation is exposing the population to alternative values and life style choices. The coming decade will likely see significant changes in Korean culture.

Gender inequality: Korea ranks poorly in terms of inequality of pay between men and women with statistics suggesting that women earning as low as 60% of men performing the same task. Given the growing ratio of single person households, especially women, there will be pressure to redress this imbalance.

2.4 Consumption: From Hard Goods to Lifestyle

The culture of demonstrating wealth by accumulating things is diminishing (particularly for singles). Consumer behaviour is shifting from the purchase of durable goods to lifestyle. Single people account for a rapidly growing share of discretionary spending which will shape the industries that will succeed in the future.

Forecast Spending by Single Person Households

Year	Trillion KRW	% of Private Spending
2006	16	3%
2010	60	11%
2030	194	20%

Source: Statistics Korea, Woori Investment & Securities

2.5 New Order and Social Environment

When Korea was a homogenous culture with clearly understood ‘unwritten’ expectations of behaviour and relationships, people share expectations and values. As the old order fades, a new order and a new set of agreed norms must emerge. The coming decade will be a struggle to develop a new set of more transparent, explicitly defined norms of behaviour. With the demise of the monolithic culture, personal interactions can no longer depend on universal understanding of behavioural norms. Rules and procedures will become more explicit and documented resulting in a more transparent society.

3

Industrial Environment

3.1 Manufacturing

Following the Japanese model, Korea adopted a manufacturing oriented strategy for economic development. With the rise of industrialisation, the concept of 'production' shifted from (the agrarian ideal of) growing rice to manufacturing. The bias that only production is 'real' business remains. This prejudice is reflected in bank lending policies, tax codes as well as status and reputation of individual business people.

Manufacturing remains a key strength of Korea. As with most development models, Korea began with light industry – primarily textiles, shoes, apparel – before migrating to more sophisticated and capital intensive sectors. The capital accumulation made possible by the centrally planned economy and policy loans facilitated investments in heavy industry, steel, cement, shipbuilding, automobiles and electronics. Manufacturing remains the mainstay of the economy today.

Korea's manufacturing base is being threatened by the rapid rise of China. Until now, Korea has maintained a competitive advantage by offering timely delivery of consistent, reliable quality. This gap will be difficult to maintain over time as China continues to improve its quality and move up the value chain. One industry insider interviewed for this project recommended that Korea do "whatever China is NOT doing". The barriers to entry in manufacturing are falling. China is a giant machine. When it enters a market Korea had better "get off the tracks". For example, Xiaomi, a Chinese mobile phone manufacturer released its first Smartphone in August 2011. In 2013, it manufactured 20 million Smartphones and in the first six months of 2014, made 26 million. Within 2 years, China will dominate the mobile phone market. Another industry insider predicted that all flat panel displays will be Chinese by 2015. (Already, 50%

of TVs sold are 55" or above.) Korea's formula for survival is 'plus one', provide added value to products. The Chinese will dominate standard products; Korea can compete by supplying extra functions. Another industry insider pointed out that China produces 600 times as many PhDs annually as does the UK.

Complex components (as opposed to completed products) remain a profitable sector of the economy. Samsung remains competitive at electronic components. Automotive parts and components remain globally competitive due to their reliability. GM Korea exports more than 50% of its total production as CKD kits for assembly in other countries. Samsung ships components to its own factories offshore and to customers worldwide.

Shipbuilding retains some promise for Korea's manufacturing sector. Korea's competitiveness for 'simple' vessels (container carriers, bulk cargo vessels) has eroded. However, the industry is focused on sophisticated, highly complex vessels and platforms for the oil and gas sector. The consensus among industry insiders interviewed for this project was that Korea had a competitive advantage over China in this sector that would be sustainable for at least 10 years. Shipbuilding equipment is not as advanced. For the past 20 years, the industry has had an overt objective to increase local content of ships assembled in Korea but without success. Local content has not increased above 20% in the past 2 to 3 decades.

Pessimists have warned that Korea would be unable to climb the value chain into industries dominated by the Japanese. However, today, Korea competes head to head with Japan in advanced industries such as automotive, ICT and shipbuilding.





**MADE IN
KOREA**

3.2 Middle Technology

Sandwiched between the advanced industrial nations on one hand and the emerging new players such as China, Korea needs to find its niche. Optimists point to the 3 billion new consumers emerging from India and China who want adequate quality at modest prices. Some economists point to this segment as Korea's niche. China is most competitive in the mass production of standardised products. When variation or customisation is required, Chinese suppliers are unable to deliver. Korea's niche is sophisticated, mid-tech, non-standard products.

3.3 The Internet of Things (IoT)

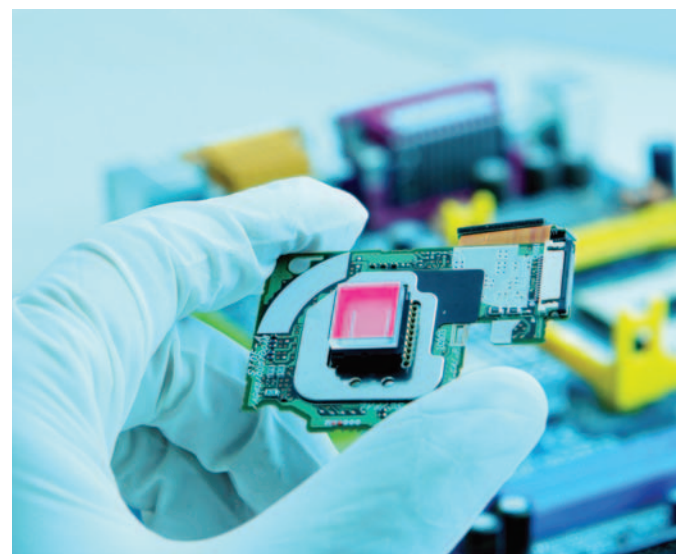
The world is increasingly interconnected. The trend is already evident around us. Within a decade, IPv6 will be the standard and a new era of IoT will be launched. Interconnectivity will transform every aspect of human life and commercial activity: business, way of life, medicine, agriculture, energy, education, services. The interconnected environment could have greater impact on our way of life than all of industrial development over the past two centuries by linking all of the 'things' that we use into a single 'system'.

The key to IoT and success in the future will be deployment of platforms or ecosystems. Samsung Electronics, the leading ICT company in Korea is trying to establish an eco-system in its 'home networking' sector based on its strength in home appliances. Samsung's challenge is that it is fundamentally a hardware specialist and the eco-system is a software solution. While Korean entrepreneurs and industrial giants have successfully developed individual software applications, to date, the skills for development of an ecosystem do not yet exist. (Samsung develops a separate

operating system for every model of mobile phone it manufactures compared to Apple which uses a standard architecture across all devices from computers to iPads to iPhones.)

It is more likely that the platform will come from an independent source. Samsung (and other hardware companies looking for an eco-system) would be better served to work together. Samsung has joined two protocol development groups, Google's Thread Group and Intel's Open Internet Consortium to address this issue.

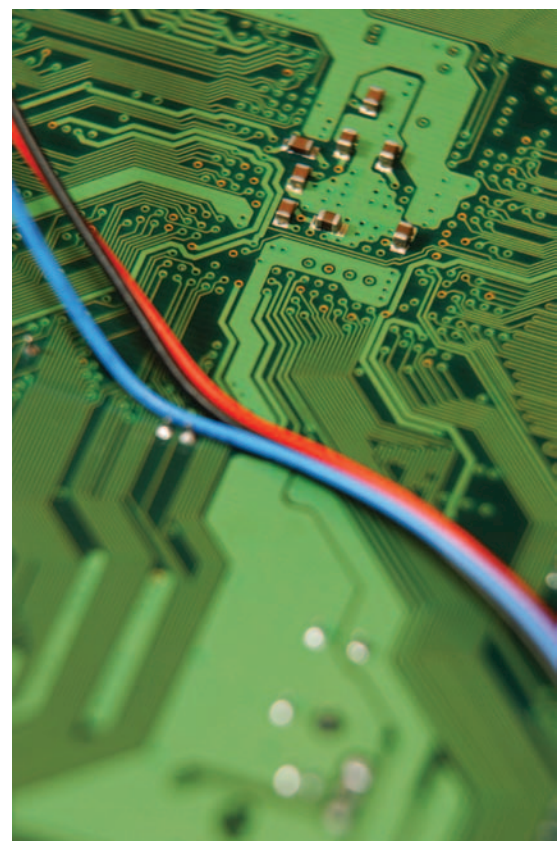
Fear for personal privacy and 'big brother' control is likely to generate resistance to the IoT. Therefore, the IoT will most likely be applied first to applications that generate little scepticism about such as public transportation, shopping and medical care where the benefits are immediate and tangible.



3.4 R&D Investment

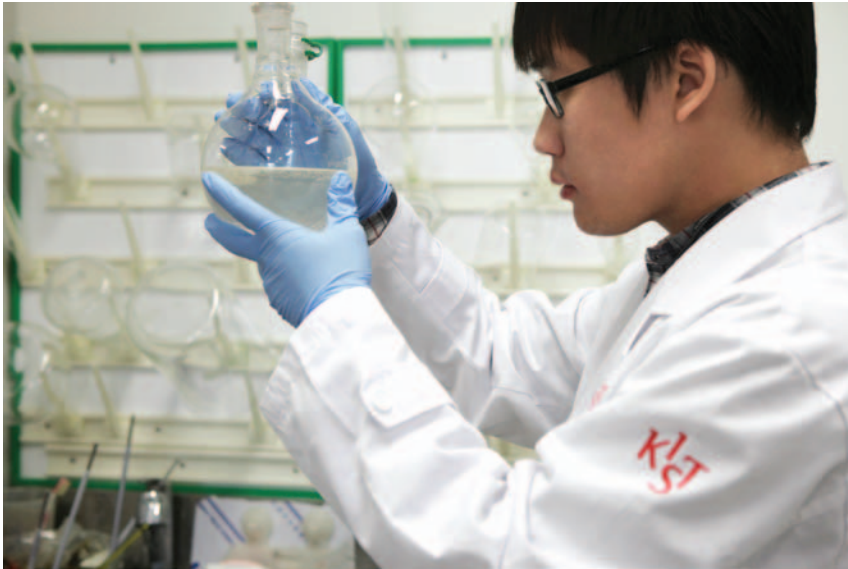
Korea ranks high in terms of R&D investment as a percentage of GDP (4% or US\$ 55 billion in 2012) and also ranks high in terms of researchers as a proportion of employed people (12 per 1000).

While investment is reasonably high, the government's share of R&D investment is higher than the OECD average and industry-university cooperation is relatively low by global standards. This suggests that the effectiveness of commercialising R&D output is limited.



Country	Gross Domestic Expenditures on R&D as a percentage of GDP	R&D Volumes in Million 2005 USD-Constant Prices and PPP	Researchers per Thousand Employment
Israel	4	9,051	15
Korea	4	55,402	12
Finland	4	6,073	16
Sweden	3	11,325	11
Japan	3	133,226	10
Denmark	3	5,388	14
Germany	3	83,233	8
Switzerland	3	8,686	6
Austria	3	8,778	9
Slovenia	3	1,408	10

Source: OECD

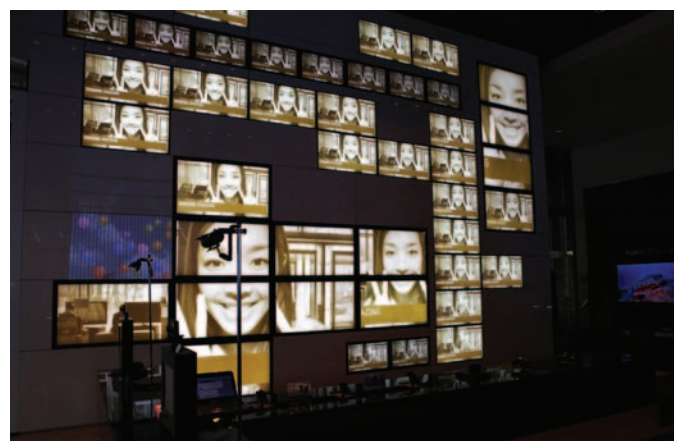


Government Investments in Next Generation Technologies

In 2012, the Ministry of Knowledge Economy (now the Ministry of Trade, Industry & Energy) announced that it would allocate a budget of 1.5 Trillion KRW (£ 860 billion) over 7 years to develop the following technologies. The ministry compared these investments with Japan and Taiwan:

Sector	Korea	Japan	Taiwan
Bio / Healthcare	Personalised medicine Gene analysis U-healthcare Food safety	Healthcare Welfare	Silver industry Medical equipment Functional food
Green Technology	Bio energy Energy storage system Carbon reduction Environment monitoring system Pollutants reduction Waste recycling	Fuel cells Environment Energy	Photovoltaic Wind power
ICT	Next generation semiconductor	ICT home appliance	Digital home
Robots	Service robots	Robots	Intelligent robots
Nano / New Materials	Next generation materials		
Knowledge / Contents	Big data Virtual reality contents Broadcasting / Communication convergence platform	Contents Business service	
Others	Smart car Disaster management		Smart car parts

Source: Ministry of Science, ICT & Future Planning, LG Economic Research Institute



Private Investment in Next Generation Technology

Samsung Group

Samsung will invest 23 Trillion KRW (£13 billion) in 5 new sectors through 2020.

Sector	Company	Status
Secondary Battery for Electric Car	Samsung SDI	Secondary battery supply contracts in place with BMW, Chrysler and Mahindra.
Bio-Pharmaceutical	Samsung Biologics	Developing 6 bio-similar medicines, 2 are being tested in 2nd phase clinical trials.
Medical Equipment / Healthcare	Samsung Electronics Samsung Medison	Established a Medical Equipment Division, acquired local and foreign players such as Medison, NeuroLogica, Ray and Nexus.
LED	Samsung Electronics	Samsung LED was established in 2009 but absorbed into Samsung Electronics in 2012. Samsung Electronics is providing the best quality LED, display modules, light engine and lamps based on technical experience in semiconductor production.
Photovoltaic	Samsung Electronics	R&D in thin film solar cells.

Source: News articles, Compiled by IRC

Hyundai Motor Group

Hybrid car, Green Car, Telematics (IoT)

The Hyundai Motor Group must invest heavily or ally itself with an ICT company because in the future, cars will be electronic devices rather than machines.

SK Group

The SK Group will invest 17.5 Trillion KRW (£10 billion) through 2020 into 3 core industries: new energy, smart environment and innovation technology.

- New energy development (Budget: 4.5 Trillion KRW)
 - Solar, Bio fuel, Secondary batteries
 - Acquiring overseas resources such as oil, gas, iron and natural rubber
- Smart Environment (Budget: 4.2 Trillion KRW)
 - Smart city
 - Smart grid
 - Eco-friendly material development
 - Water treatment
- Innovative Technologies (Budget: 8.8 Trillion KRW by 2020)
 - Industrial productivity enhancement
 - Connected car
 - Mobile remote healthcare
 - New medicine development

LG Group

The LG Group's future strategy is Green. The LG Group announced that it will generate 15% of total revenue from green industries by 2020.

Sector	Company	Status
Secondary Battery for Electric Car	LG Chemical	Now supplying secondary batteries to 10 auto makers including GM, Ford and Hyundai.
Photovoltaic	LG Electronics LG Siltron	R&D stage LG Electronics plans to expand production capacity to 1 GW in 2 to 3 years. LG Siltron plans to establish 600 Mw photovoltaic wafer production lines by 2015.
Water	LG Electronics	Cooperating with Hitachi Plant Technology to develop desalination plant technology. Acquired local water treatment facility operating company, Daewoo Entec.
LED	LG Innotek	LED chip, package and module producer. Its Paju factory is the largest LED production facility in the world.

POSCO Group

- Materials: Lithium, Nickel
- Clean energy: Fuel cells, Clean coal

POSCO had to curtail its ambitions in 2014 due to a slowdown in its core business.

KT

KT plans to invest 4.5 Trillion KRW over 3 years.

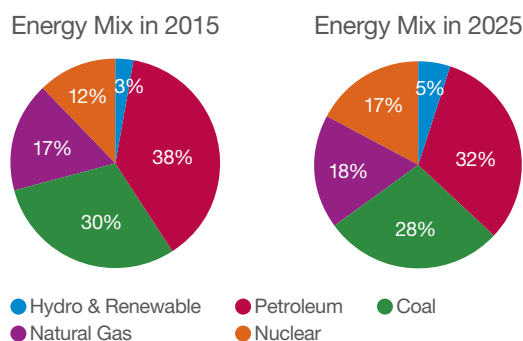
- Security: Integrated Security (IoT)
 - Integrated security systems for individual and industrial facility safety
 - Developing an integrated, nationwide security and disaster response system
- Smart Energy: R&D for “next generation” technology focusing on integrated energy management (IoT). KT targets to achieve 15% energy saving through measuring and managing energy use. The system will optimise energy distribution and will allow users to remotely control electric appliances.



3.5 Energy

Securing adequate energy to power industry has been a major challenge for Korea since it began industrialising. Without any significant domestic sources, Korea imports 97% of its energy needs which accounted for 36% of all imports in 2013 (GBP £115 billion). Global trends, particularly the development of shale oil and gas suggest that energy costs will remain stable or decline over the coming decade which will be highly welcome by Korea's economy.

Large investments and long lead times make dramatic shifts in energy sources difficult. The coming decade will see a slight shift away from coal in response to global pressures to reduce carbon emissions. Increasing gas supplies will likely replace some consumption of oil. In response to global developments, there will be some minor changes in Korea's energy mix in the coming decade.



Source: Korea Energy Economics Institute
"Long Term Prospect of Energy Demand in Korea"
December 2013

Nuclear

The Korean government has made a major commitment to nuclear energy. There are 23 nuclear plants operating in Korea (in 4 locations). There are 5 new nuclear power plants under construction with 6 more in the planning stage. However, the 2011 Fukushima disaster has dramatically raised public concerns about nuclear safety. Highly sensitive to public opinion, it is possible that these plans will be scaled back over the coming decade.

New and Renewable Energy (NRE)

Korea has focused on developing new and renewable energy over the past 10 years. Emphasis has been spread across all types of renewable energy developing basic technologies for eventual commercialisation. Following the global financial crisis in 2008, selling renewable energy generating equipment was designated as a 'new economic growth engine' to stimulate industry.

Subsidies for renewable energy have fallen globally. With the discovery of shale gas and oil and resulting drop in energy prices, the interest in renewable energy has declined. As Korea's goal was to export renewable energy generation systems, the drop in demand has led to a drop in interest on the part of Korean industry.

Fuel Cells: Korea has invested heavily in fuel cell technology for both automotive and construction applications. As fuel cell prices decline and performance improves, applications are likely to increase. The future of fuel cells is highly promising.

Smart Grid & Smart Meters: Energy saving and improvement of energy efficiency are likely to grow in importance regardless of the future of NRE. Promising sub-sectors that are likely to emerge over the coming decade include smart grids, micro-grids, and super-grids. With its strong background in the ICT sector, Korea is very active in developing smart grid technology and related parts.



Korea has also committed to developing high voltage direct current to increase flexibility, stabilise the grid and reduce transmission losses.

Geothermal: Seoul city is keen to promote shallow geothermal energy and announced that it will be applied to air conditioning and heating of public buildings and facilities such as subway stations.

Private companies including POSCO and Nexgeo, government research institutes including the Korea Institute of Geoscience and Mineral Resources and Seoul National University are now cooperating to develop core technologies for deep geothermal power plants. A test trial deep geothermal power plant with a capacity of 1.5 MW will be completed in the Pohang area in 2015.

Ultra-efficient photovoltaic: Ultra-efficient photovoltaic technology was designated as one of “10 clean energy innovative technologies” by the Clean Energy Ministerial Conference in Seoul in May 2014. Yoon, Sang-jik, the Minister of Trade, Industry & Energy said the chosen technologies would be incorporated into national energy policies. Korean conglomerates such as Samsung, Hanwha and LG announced that they would invest heavily into photovoltaic.

Energy Storage System (ESS): ESS is an essential component of almost every kind of new energy system. Late to begin developing ESS, the government announced a plan to support local companies such as KEPCO, Hyosung and SK D&D to develop ESS investing 712.5 Billion KRW (£410 million) between 2014 and 2017. KEPCO plans to develop and install a 500 MW ESS by 2017. Hyosung will develop and install a 250 kW ESS at a factory in Sejong city. SK D&D will install ESS at the New & Renewable Energy Test Project on Jeju Island.

Natural Gas (Impact of Shale Gas in the US)

The discovery and exploitation of shale gas and oil in the US is likely to have both a positive and negative impact on the Korean economy. As a major consumer (and importer) of energy, lower

gas prices will boost the economy, especially the manufacturing sector. However, as energy costs fall, the premium for NRE over conventionally energy will grow depressing interest in renewable energy. Furthermore, the primary activity of Korea’s shipyards is the construction of oil & gas processing vessels and platforms. Dropping energy prices will reduce investment in exploitation of difficult to access deep water reserves of oil and gas which will reduce the demand for these products. A positive result for the yards will be the substantial increase in the number of gas transport vessels, complex, expensive and primarily produced in Korea.

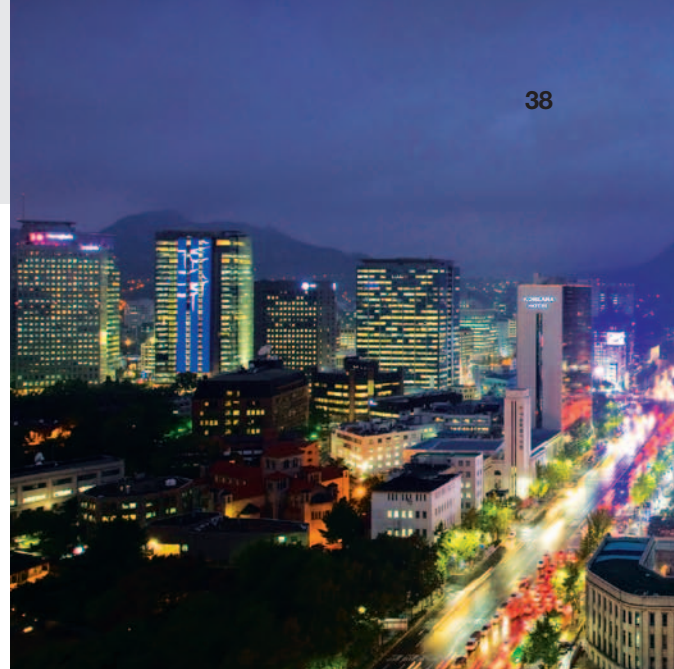
Domestic Hydrates

Geological studies suggest that there are 620 million tons of hydrates off the east coast of Korea, equivalent to 17 years usage. The government plans to commercialise hydrate production by 2019 (Japan by 2018, China by 2030). As Korea is virtually 100% dependent on imported energy, developing a local source of gas would change the trade dynamic. However, as extraction of gas from hydrates is costly, if the price of energy drops as a result of US shale gas and oil, it will not be cost effective to tap this resource.

Oil Exploration Off the Korean Coast

The Ministry of Trade, Industry & Energy is preparing a plan (to be completed in 2014) for developing oil & natural gas wells in Korean seas. The plan includes strategies, investment plan, technical support and training human resources to find and extract oil and gas off the Korean coast. The plan includes options to cooperate with China to explore the Yellow Sea.

Daewoo International, a private natural resource developer (owned by POSCO) will dig a test well off the east coast near Ulsan in the 4th quarter of 2014 to measure the quantity of natural gas in the known reserve. The company is already producing natural gas from Donghae-1 gas well in the same area (with a proven reserve of 5 million tons and linked to the mainland by pipe. Daewoo also operates a gas well in the sea near Myanmar).



3.6 Services

From the time Korea was an agrarian country, society has valued production of real goods and devalued services. To this day, there is still some residual stigma against services. The businesses that developed high value added skills in other countries (legal, accounting, banking) were considered 'utilities' to support manufacturing rather than 'businesses' in and of themselves. Services were provided for free in order to promote the sale of 'real' products.

In spite of the cultural preference that favours manufacturing over service, services account for more than 60% of Korea's economy but they are heavily weighted towards low skilled activities. As a result, Korea ranks poorly on service sector productivity compared with manufacturing productivity. The Ministry of Strategy and Finance calculates that the ratio of Service Sector Productivity to Manufacturing Sector Productivity is 45% compared to the US (68%), France (112%), Germany (82%) and OECD 11 country average (82%). Korea's service sector remains weak and uncompetitive.

The central government has set a target of employment of 70% of the working age population. Services have been proposed as the source of many of these jobs. Korea's challenge is to migrate from low to high value added services.

Low Value Added

Korean industry has already proven that it can be highly effective at low value services. With the aging population, and elderly people requiring jobs, low value added jobs are likely to be filled by unskilled elderly people, usually working part time. Unskilled jobs will also be filled by 'visiting' workers from China and Southeast Asia. Many of these highly efficient, low value added jobs provide important support to manufacturing.

Repairs: Korea's after sales service performance is outstanding. Any product can be returned within the warranty period and will be replaced or repaired at no charge. Even after warranty, repairs are rapid (often a matter of hours even if a call-out is required) and inexpensive. (Call-out fees range from 10,000 KRW to 50,000 KRW, £5.5 ~ £28.) Good after sales service is required for any manufacturer to succeed. (Service is not charged separately, its cost is bundled with the product.)

Delivery: Another low value added service that has exploded in the past decade is rapid delivery. Anything that fits on a motor cycle can be delivered across the city in a matter of hours for less than £10. The author shipped a 50 kg gas range 230 km in just over 24 hours for £8.9. Inexpensive, rapid, reliable delivery has been a key component in the rapid growth in online shopping services. Even groceries can be ordered on line and delivered within the hour.

High Value Added Services: Engineering / Design

Korea has entered many industries first as a manufacturer, and then successfully made the transition into the knowledge based components of the business.

Korea launched industrialisation through manufacturing, transforming imported inputs into outputs for export. All high value added service activities were left to overseas players: design, engineering, development, sourcing, sales & marketing, distribution, and planning. However, as Korea developed, it began to learn these skills. (These services activities were socially acceptable as they could be disguised as manufacturing.)



Manufacturing

Textiles:

In the 1970s, young Korean women moved from the farm to the city to work 14 hours per day, 28 days per week weaving, cutting, sewing, and stitching textiles for export.

Construction:

Korean labour constructed infrastructure, building and plant facilities projects in the Middle East.

Automotive:

The modern auto industry was launched in the 1960s by assembling CKD vehicles from primarily Japanese brands and then later assembling vehicles under license.

Shipbuilding:

Launched in the 1970s utilising Korean labour to carry out very dangerous bending, welding and assembly of large vessels, Korea is now the world's largest shipbuilder.

High Value Added Service

All production has shifted overseas, but Koreans now design, develop, distribute and market fashion brands in Korea and around Asia.

Korean contractors learned skills for project management, inspection, sourcing, and procurement and have become key competitors in every major EPC project around the world.

Today, 11,000 Hyundai engineers and technicians design, develop and test state-of-the-art vehicles at the Namyang R&D centre, Hyundai vehicles now receive the highest quality rankings from global evaluators such as JD Powers.

The industry has moved up the value chain applying skills learned making simple vessels to become the most competitive producer of highly sophisticated and demanding oil and gas production platforms in the world. They are now focusing on developing engineering skills to independently conceive, design, develop and deliver systems for the most demanding environments.



In each of these industries, Korean manufacturers sought to move 'upstream' and 'downstream' to develop its value added service sector beyond the production process.

While Korea's industrialisation began with converting 3rd party provided inputs into outputs, today they have developed high value added planning, designing, engineering and project management skills – high value added services.

High Value Added Services: Software Design

Another high value added service is software design. The industry has become very good at developing single application software – a program to control a device such as a television, smart phone, game, etc., but platform development, software 'families' or 'environments' that are used across a wide range of devices is quite weak.

3.7 Chaebol

Chaebol, family controlled conglomerates are a result of Korea's centrally planned and directed economy. The Chaebol were a key element in the development of the nation facilitating large scale investment. Today, they have grown to dominate the economy. According to the online publication 'ohmynews' (16 October 2013), the top 10 Chaebol account for 84% of the economy. Family control frees them from shareholder demands for return on investment. While this provides the freedom to make rapid decision and to aggressively pursue visionary, long term projects, these sprawling organisations participate in every type of business activity, absorbing resources (capital, talent) and stifling small companies and new entrants. (Korea has only recently introduced the 'holding company' structure; the Chaebol are loosely connected by history and loyalty to the owner and have no legal existence.) Only one company has grown from a start up to a 'large' company (over 150 billion won of revenue or more than 1,000 employees) in the past three decades. Chaebol dominance has become a political issue. Curtailing the Chaebol without derailing the economy is challenging. The government has imposed a ban on Chaebol participating in some 100 business activities but this has done little to rectify the imbalance.

Corporate Governance: The structure of a Korean corporation resembles a family estate. Employees obey the chairman and middle managers just as one would father and uncles.

The conglomerates support their affiliated companies by providing favourable terms and conditions of trade. Yonhap News reported that 'Chaebol dot com' recently carried out research into internal transactions and uncovered that 92% of the transactions between affiliates of the top 10 Chaebol in 2013 were negotiated contracts rather than competitive bidding. Small and medium companies are particularly at a disadvantage and find it difficult to establish a business relationship with the Chaebol.

There are a few large corporations like POSCO, KEPCO and KT that are not Chaebol and do not have controlling families. Most of these are privatised government corporations. The government continues to select the heads of these corporations even though they have nominally been privatised.

The management system at the Chaebol is under pressure. Social and legal tolerance for the patriarchal governance style is diminishing. International accounting practices have been imposed. Shareholder rights groups are active. Over the coming 10 years, due to increasing scrutiny by regulators and the public combined with generational change in group ownership, the governance of the Chaebol is likely to see considerable change. It is highly likely that the Chaebol will divide into more focused business units and that the voices of other stakeholders will be more influential. The Asian financial crisis of 1997 / 1998 brought about significant tightening of governance standards. Another external economic shock will accelerate the imposition of more stringent governance standards.



Generational Change

Company	Owner	Birth Year	Age	
			2014	2025
CJ	Lee, Jay-hyun	1960	54	65
Dongbu	Kim, Joon-ki	1944	70	81
GS	Huh, Chang-soo	1948	66	77
Hanwha	Kim, Seung-youn	1952	62	73
Hyundai Heavy Industries	Chung, Mong-joon	1951	63	74
Hyundai Motor Company	Chung, Mong-ku	1938	76	87
LG	Ku, Bon-mu	1945	69	80
Lotte	Shin, Kyuk-ho	1922	92	103
Samsung	Lee, Kun-hee	1942	72	83
SK	Chey, Tae-won	1960	54	65

3.8 Wealth Disparity

The disparity between the poor and the well to do is growing in Korea. Korea ranked fifth out of 28 Asian countries in a recent report on income disparity from the Asian Development Bank Institute (reported by Yonhap News on 10 March 2014). Korea was one of 12 Asian economies that experienced growing inequality over the 20 year period from 1990 to 2010. The government is struggling with remedies to the disparity.

4

Political Environment



4.1 Central Government Leadership

Korea's industrialisation from the 1960s was driven by an autocratic central government. Through a series of 5-year economic development plans, the government laid out what industries would be developed and supported. Predictability, stability and availability of resources (particularly a capable, hardworking, willing workforce) resulted in rapid development of the country.

Political leaders were charismatic 'father' figures who attracted groups of followers to support them. When elected, they controlled resources that were allocated to their supporters. Political parties were support groups for popular leaders with policies that were ambiguous and blurred and subject to sudden, radical change. (The New Politics Alliance for Democracy negotiated the FTA with the United States but as soon as it went into opposition, vigorously opposed it.)

New parties continue to form, merge and split (and change names with dizzying frequency) but there has been an increasing consistency to the organisations over the past 10 to 15 years. Beginning with the presidential election of 2002, both major political parties polled their members to select candidates among competing contenders rather than candidates forming their own parties.

Many citizens still look to the government to take leadership in industry but in reality the economy is now too complicated and developed for government technocrats to lead. The government today, rather than taking a progressive role leading the country into the future, focuses on preserving the status quo. Regulations are obstacles to change protecting existing stakeholders and inhibiting innovation and change. The long term consistency of 5-year plans has been replaced with a series of policy directives that expire at the end of each five-year presidential term or even more frequently when the relevant minister is replaced.

4.2 Regionalism

Because political parties were support groups for charismatic leaders, they have had a strong geographic orientation. The nominally conservative Saenuri Party traces its origins to the southeast and the New Politics Alliance for Democracy dominating the southwest. With half the population of the country now living in the greater Seoul (capital city) area and with few ties to the geographic origins of their parents and grandparents, regionalism is starting to diminish. It is noteworthy that a Saenuri candidate won a seat in the New Politics Alliance for Democracy's stronghold of Suncheon on 30 July 2014.

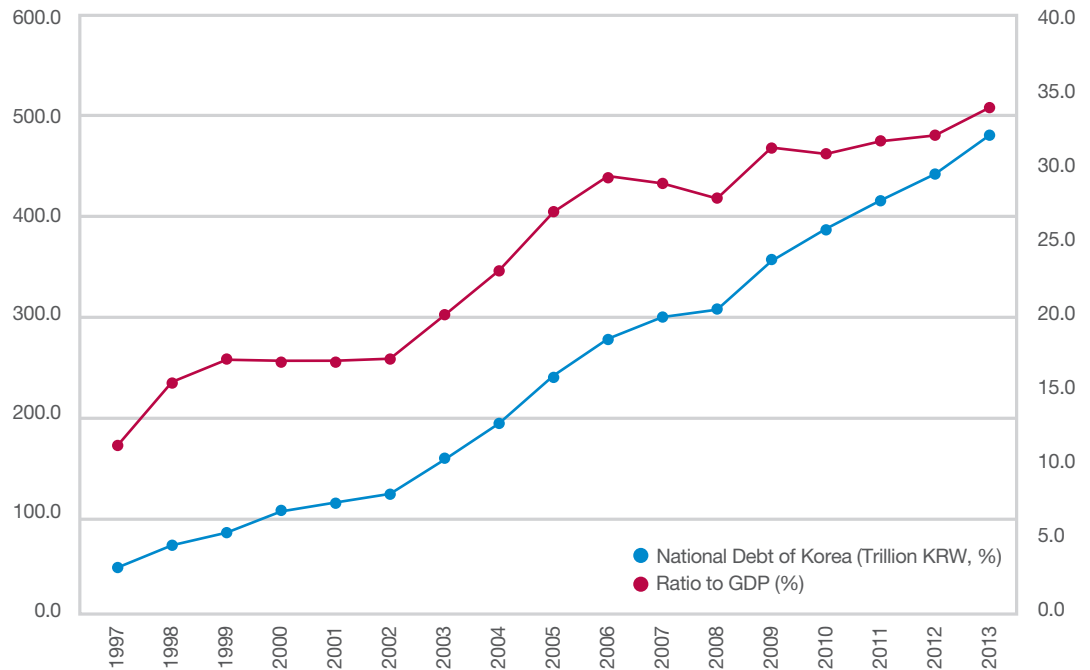
In 10 years' time (two presidential election cycles), in line with changes in society, the public will be more concerned about the substance of policies than on ties to a specific geography.

4.3 Cash Strapped Government

During the period of rapid industrialisation, the government maintained a relatively balanced budget. If spending exceeded revenues, the growing economy would compensate in future years. A steady, centrally managed inflation insured that debts became cheaper over time. This picture changed dramatically during the Asian financial crisis of 1997/8 when the government bailed out the financial institutions, absorbed the debts of failed corporations and shored up others. Last year, the national debt was 420.7 trillion won or 34% of GDP. The burden of the national health care system is growing and social welfare commitments in an aging society are projected to far exceed revenues. At current growth rates, national debt will exceed GDP by 2030. The government is seeking ways to reduce expenditures and increase revenues.



National Debt of Korea
(Trillion KRW, %)



Source: Statistics Korea

4.4 Public Sector Challenge to Meet the Needs of Citizens

Many public services are struggling to meet the needs of the public. Government policies attempting to reduce speculation on real estate investment have generated resentment by both speculators and individual citizens. Unions have felt betrayed by government's support for industry while corporations believe that the government has been overly accommodating to unions. The elderly, without an adequate safety net feel that their lifetime of sacrifice for national development is unappreciated. The single (5-year) term limit on the president has imposed a short-term focus on policy. Ministers and other government officials seldom serve for more than 2 years before being replaced. The political environment faces a challenge of how to develop and implement policies across administrations.

4.5 Government Embracing Change

For Korea to emerge as an advanced economy leading developments in new industries and to retain its strong position as a global middle power, the government needs to develop policies that encourage and support innovation. Frequently, policies are designed

to protect existing stakeholders and as a (usually unintended) result, inhibit the efforts of entrepreneurs who are exploring new opportunities. For example, big data and the ability to analyse and capitalise on big data will be the key to success in many industries. Reacting to public fears of misuse of personal data (often exacerbated by the media), storage, access to and use of big data is severely restricted in Korea. New transportation solutions such as Uber have been prohibited by the Seoul city government. Efforts by banks to increase efficiency by reducing branches have been blocked by the government concerned about the impact of layoffs on unemployment. The recently elected Superintendents of Education have announced that they would standardise education and eliminate private schools to promote equality and fairness. While the desire for equality is admirable, this 'anti-elitist' position will reduce opportunities for creativity and innovation. The city has reduced the shopping hours of hypermarkets inconveniencing millions of consumers and undermining the incentive by retailers to invest in new technologies and innovative solutions. While all these policies are motivated by sound objectives, the unintended impact is often to hinder innovation and stifle industrial creativity.



5

Education Environment

5.1 Traditional Education

Historically, education was reserved for the brightest young men in the community. They spent hours listening to ‘learned old men’ and reading and replicating the ‘classics’, the literature of the ancient scholars. Through a series of examinations, good students were recruited to study with more famous scholars in larger cities and the brightest moved to the capital city where they had a chance to sit for national examinations to become government officials.

Following 35 years of Japanese colonial rule, at the time of liberation (1945) there were only a handful of Koreans with a university education. Devastated by the Korean War, in the post war period, resources for education were very scarce. Nevertheless, free, universal education was established for both boys and girls which proved to be one of the keys to successful industrialisation. Initially, children studied for three years, then six (albeit divided into morning and afternoon sessions). As resources became available, universal education was expanded to middle school and secondary school. Educating women was crucial as understanding of sanitation and nutrition immediately translates into healthy youth. With a scarcity of teachers, large classes and few text books, there was heavy emphasis on rote learning of concrete subjects such as math and science. The discipline and repetitive nature of the education was ideal preparation for the regimented life of an industrial economy.

5.2 Education in Transition

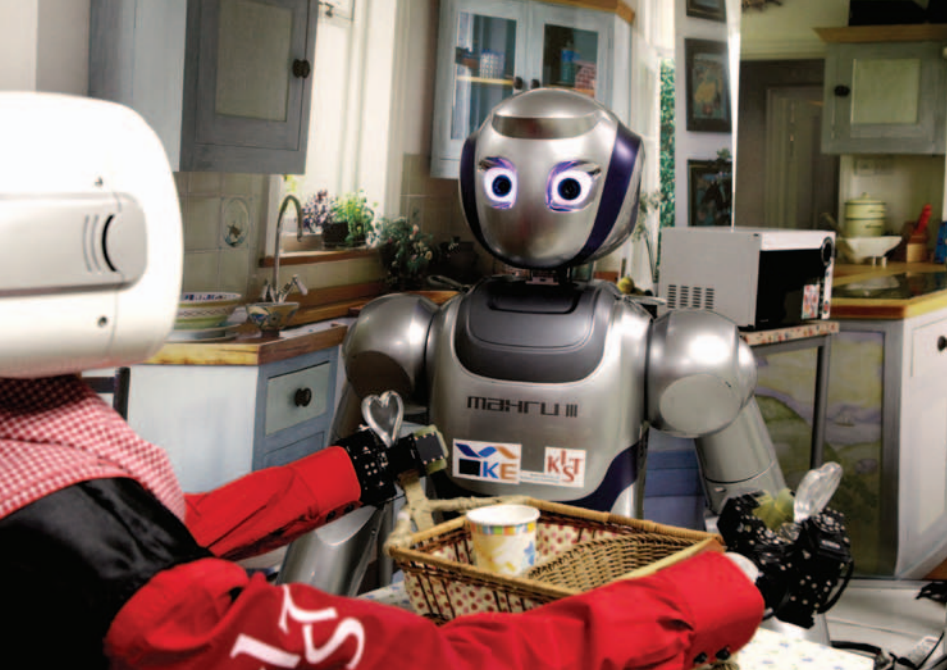
The traditional rote learning was well designed for preparing labour for repetitions tasks in a manufacturing oriented industrialised world. Students were expected to learn what they were taught and discouraged from having original thoughts. Anything strange or different was discouraged. This learning method is not appropriate for an integrated, competitive world. Today education is in need of reform as it fails to teach the skills needed in a competitive, knowledge based, post-industrial economy. The focus must shift from “know what” to “know how”, particularly, learning how to learn. Korea is particularly weak at ‘soft subjects’. This is evident in business skills. Korean corporations have a high number of patent applications and approvals but the commercialisation rates are low and their balance sheets reflect very low levels of intangible assets. The educational system must adapt to teaching how to generate, develop, recognise and appreciate creative and innovative solutions.

Shrinking Classes

A major impact of Korea’s low birth rate is a dramatic decline in school age children. The Ministry of Education’s statistics indicate that in 2013 the number of children in first year of elementary school was 31% lower than the number in the final year of high school (436,308 v.s. 633,676). As a result, class sizes are declining and a number of schools are closing. In 10 years’ time, there will be less than 2/3 the number of students compared to 5 years ago.

Universities VS. Technical Schools

As discussed in “Cultural Environment” (section 2. above), the ‘Korean dream’ is diversifying. For some students, tremendous investment



in education has failed to translate into better prospects for high status jobs or life time earnings. There is a slight but discernible trend away from studying at 4 year universities to technical education.

Internet Education

The University is no longer the sole source of knowledge and it is no longer necessary to physically attend university to obtain a university level education. Most universities are uploading at least some of their course work including some of the most prestigious universities in the world. The pool of online courses and Massive Online Open Courses (MOOC) is growing rapidly though there are concerns over completion rates and quality is mixed. Coursera (www.coursera.com) provides a platform for partner institutions to deliver on-line learning and has already uploaded more than 700 courses from 11 of the world's top universities.

Language

Korea has a unique language and the alphabet (*hangul*) is the world's most phonetically accurate alphabet (and the only scientifically created one). While this is a source of great pride, when combined with geographical isolation, Koreans have been poor at foreign language acquisition. English language education has been 'talking about English' rather than learning how to use it. Koreans currently spend \$8 billion annually on language learning but the real progress is coming from young people in their 20s and younger travelling overseas to study, work and live. The English language level is improving rapidly and in 10 years' time, the language barrier, a major obstacle to internationalisation of business, will be greatly reduced.

Innovation

Confucianism emphasised hierarchy, group orientation and conformity to achieve order and stability. However, the system suppressed debate, conflict and free intellectual interaction which are vital components for generating innovation and creativity. Declining Confucian order and increasing ethnic diversity will open the door for creativity and innovation.

The Future of Education

Korean education scores well on math, reading and science among OECD countries on PISA (Program for International Assessment). Yet, the education system in Korea is under threat and in need of reform. There is an oversupply (too many schools and universities) and shrinking demand (the absolute number of students will drop 30% in the coming 10 years just as fewer students are electing to invest in a 4 year liberal arts education). The availability of online education at virtually no cost will also squeeze traditional universities. Universities will have to differentiate themselves to compete. Educational institutions must shift from imparters of knowledge to teachers of critical thinking. While some universities have begun specialising, a significant shakeout will take place over the coming decade.

The government has instructed universities to reduce their tuition undercutting their financial base. (Universities in Korea rely on tuition for over 60% of their income.) The recently elected Superintendents of Education have declared that they will standardise the curriculum of schools (reducing creativity and innovation) and have vowed to close all private schools. Given the current political environment, the changes needed to drive Korea's economy future will be challenging to implement.

6

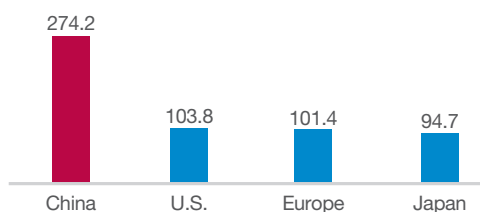
Geo-Political Environment

6.1 China

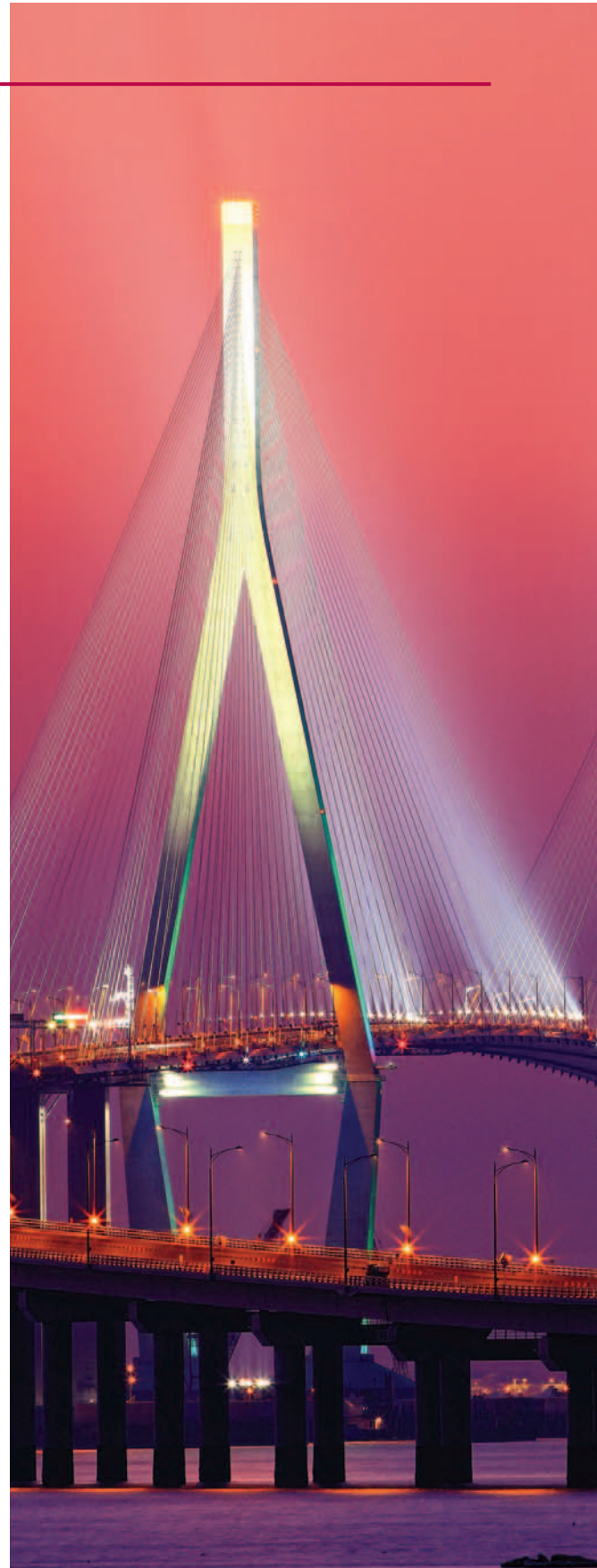
Korea was a colony of Japan in the pre-industrial colonial period but the influence of Japanese established institutions and Japanese educated technical, political and economic leaders left its mark well into the 1980s. When Korea began to industrialise in the 1960s, the United States was the major aid donor and primary market for Korean exports. Korea remains closely allied to the United States politically, economically (and militarily). Until the mid-1990s, Korea's economy was tied closely to these two countries. However, today, Korea's economic well-being is inseparable from China. Over the past 20 years, trade with China has gone from virtually zero to where it is Korea's most important trading partner today. China accounts for nearly a quarter of all imports and exports (with a slight balance in favour of Korea) and almost equals trade with the US, the EU and Japan combined. China is Korea's factory. Most assembly operations by Korean companies, large and small, have been moved overseas, primarily to China where labour assembles Korean branded products, approximately half of which is re-exported to third country customers.

China's role in moderating the excesses of North Korea is also important to the south. Korea has no choice but to rebalance its international alliances and put greater weight on its relationship with China.

Korea's Trading Volume
(Unit: Billion USD, 2013)



Source: Chosun Ilbo "Xi, Jinping to visit Korea" 3 July 2014





The Future of China's Economy

China is both a major driver for the Korean economy as well as the greatest threat to Korea's manufacturing base. The future of China will have major implications on this economy. Will China continue to grow steadily over the next 10 years? Expert opinions differ sharply.

Negative view: The dramatic disparity in wealth between the haves and have-nots, corruption by government officials, urban rural disparity, ethnic conflicts, poverty of the Western regions all cause tremendous strains to the cohesion of Chinese society. One of the biggest tensions is caused by disenfranchisement of displaced people who receive little or no low compensation when the land they farm is taken in support of central government purposes. Government officials and entrepreneurs profit at their expense giving rise to protests, strikes and social instability. Politically, the Chinese economy has reached the level where the middle class will be impatient to participate in the political process. (One industry insider noted that there are over 300 protests each day by citizens unable to express their dissatisfaction through the political process.) Slower economic growth in China will exacerbate political tensions. A major domestic political upheaval in China will have major impact on Korea both politically and economically.

Many experts believe that the Chinese leadership have the foresight, intelligence and will to effectively manage the transition to a more participatory form of government and social equality without major disruption to economic activity. The central government will be able to keep the economy growing at a rate of 7% ~ 7.5% annually until 2020 and beyond.

China as a Market

Like all developing nations, the investment component of GDP in China has been high. However, with growing urbanisation (60%) and affluence, by 2020, total consumption in China will be US\$10 trillion or two thirds of the US. 78% of this will be private consumption.

It is a common belief among Korean producers that their future depends on successfully launching in the Chinese market. With only 50 million consumers, the domestic market is very limited and Korean companies need to go overseas to grow steadily. The similarity of cultures and geographic proximity make China a natural export market. The trend will continue. Not just a few big companies are successfully penetrating the Chinese market but even small and medium size companies are achieving success there. While Chinese consumers generally prefer Chinese products, a number of scandals where improper food ingredients led to sickness and death, Korean brands have benefitted. For example, Orion, a snack and noodle company has been active in China since 1997 achieving 709% revenue growth in the market over 5 years from 2007 to 2012. A Korean milk company ships fresh milk to China by ferry on a daily basis and reached retail shelves within 3 days. Even though the cost is many times higher than domestic milk, within 3 years, sales have exceeded 9 billion KRW (£ 5 million) annually.

The two countries are currently negotiating a Free Trade Agreement which if successful, will make the Chinese market virtually a second domestic market for Korean firms. The Korea Institute for International Economic Policy (KIEP) predicted that a Korea-China FTA would increase Korea's GDP by 2.28% ~ 3.04% within 10 years from implementation.

6.2 North Korea

Fascination, fear, curiosity, horror, threat, opportunity, any mention of North Korea conjures up a jumble of often conflicting thoughts and emotions. In reality, no-one knows what the future holds and there have been significant events in the north over the past two years that have led many to believe that change is imminent. However, the overwhelming consensus of the individuals interviewed for this project was that there would be no change in the coming decade. No party with the power to influence the situation in the north wishes a dramatic change in the status quo. At the same time, by the very nature of its unpredictability, something COULD happen at any moment and any change would have monumental impact in Korea, in the region and in the world. If North Korea becomes open for business on reasonably 'normal' terms, a plethora of opportunities would present themselves.



Resources: Coal, precious metals, rare earths, and other natural resources are abundant in North Korea. The infrastructure to access and extract the resources would have to be established.

Labour: The north represents a vast pool of labour that could meet the needs of south Korean industry. Utilising northern labour would be politically more attractive than the social disruption associated with migrant labour from elsewhere in Asia.

Logistics: Land access to Asia and Europe (rail & truck) would benefit Korea's trade.

Tourism: The largely unspoilt mountains, beaches, lakes and rivers would provide attractive tourist destinations boosting leisure travel from the south as well as China. Infrastructure investment would be required.

Construction: The infrastructure in the north is limited, of poor quality and deteriorating. Both construction and financing the construction would be required.

Education: Isolated from the world for generations, one of the most challenging needs will be teaching the population to survive in a complex and competitive world. Providing members of the next generation with the basic skills to make them productive members of society will be equally demanding.

Military: The two Koreas allocate a large share of their national budgets on the military. Reduction or elimination of the military threat would reduce Korea's spending freeing up additional funds for reconstruction and welfare.

Contact Details



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& Investment

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UKTI

UK Trade and Investment is the government department that helps UK based companies succeed in the global economy and assists overseas companies to bring their high quality investment to the UK. Companies seeking to capitalise on opportunities in Korea are encouraged to coordinate their efforts with the knowledgeable experts at UKTI in Korea

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