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SOUTH KOREA
RESEARCH REPORT

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9, 10 March 2015, The Crawford School of Public Policy, Australian National University.

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“Korea has a lot of good resources, technology and people.
It takes only some small improvements here and there
and it could be very successful.
We have lots of ideas: I believe it will happen in Korea.
We have proved that we can do it.
We have created something out of nothing
in the last 50 years in time.
It’s the question of how quickly we can do it.”

Interviewee

Key Features

South Korea (Korea) Economy

- Korea is the 15th largest economy in the world by nominal Gross Domestic Product (GDP) and 12th by purchasing power parity (PPP).
- The Korean economy is dominated by high-technology industries in particular: electronics, telecommunications, auto production, steel, shipbuilding and chemical production and by the chaebol: large, family-owned conglomerates of which the top 10 account for 80 per cent of the country's GDP.

Research Spending

- Research spending in Korea is very high – three quarters of it occurs within the private sector and well over half goes on experimental developmental research.
- Government expenditure on research and development (R&D) is among the highest in the world. However, it is divided up between many government departments and appears to lack coordination.

Commercialisation of the Research Ecosystem

- The ecosystem was reportedly very strong prior to the end of the tech boom.
- One weakness is the lack of a mergers and acquisitions (M&A) culture, and Initial Public Offerings (IPOs) taking a long time.
- Entrepreneurship is lacking, due to previous recent history (2001 tech losses).

Supply Side

- Korean universities and government-funded research institutes (GRIs) lack: expertise and the business mindset of organisations in charge of technology commercialisation; and the commercialisation capabilities to create new markets and jobs using knowledge and technology accumulated from various R&D activities.[1]
- The lack of expertise in the Technology Licensing Offices (TLOs)[2] in universities and GRIs has led to poor performance in technology transfer and commercialisation.
- Academics in universities have little, if any, incentive to commercialise their research.

Demand Side

- The dominance of the chaebol creates opportunities and challenges. It has seemingly limited the opportunities and funding for SMEs; as many chaebol have their own R&D and the incentive to partner with universities and GRIs is potentially limited; but they represent a potential distribution opportunity for new ideas and could assist with commercialisation if effectively leveraged.
- The current system for businesses to engage with universities is not business friendly, discouraging businesses from engaging.
- If anything happened to the chaebol, this could have a negative impact on Korean industry.
- The exit opportunities for commercialised research ventures are limited.

[1] STEPI Insight: Measures to Promote Technology Commercialisation at Universities & GRIs: Nov 2013: Yoon Jun Lee and Seon U Kim
[2] Technology Licensing Office (TLO) system for universities and GRIs promotes and facilitates university and GRIs-based technology commercialisation

Policy

- The Korean Government's Creative Economy platform is a central, three-year plan involving US$74 billion of R&D investment, designed to improve linkages between industry, academia, research institutes and local communities.
- It includes a range of policies designed to support the commercialisation of research, including deregulation aimed at removing barriers to entrepreneurship.
- Greater support for basic research in high-performing universities, but less so for weaker ones.

Key Talking Points

- Can the Korean Government encourage a more entrepreneurial attitude that supports ideas generation and their commercialisation across key stakeholders (universities, GRIs, TLOs, students)? And as part of that how can the cultural/ generational resistance to working in SMEs be addressed.
- Will the high level of funding being allocated to R&D help produce the Creative Economy (per the government's agenda)?
- Is the government being overly directive in R&D, leading to inefficiencies and potentially distorting the market, rather than allowing market forces to determine success/failure?

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1 Introduction

Background of this research project

In December 2014, the British Council (BC) engaged EduWorld to conduct a research project with the following objective:

- **To examine how national policies, as a sub-set of national pre-conditions, affect commercialisation outputs of research.**

This was to support the British Council's Global Education Dialogue (GED), a high-level discussion between higher education professionals and policymakers from Australia, the UK and the East Asia Region, held in Canberra, Australia in March 2015.

The Council identified four regions[3] on which to focus: the **United Kingdom** (primarily England and, to a lesser extent, Scotland), **South Korea**, **Brazil** and **Hong Kong**, each of which is actively looking at the commercialisation outputs of research, albeit at very different stages of development and, of course, within a different set of national conditions.

Following an initial consultation involving interviews with senior stakeholders in universities in the UK and Australia to direct and refine the focus of the research in line with the objectives of the GED, the research comprised two components conducted concurrently over the 10 weeks of the project.

1. Primary research in the form of in-depth interviews with between five and eight stakeholders in each of the four countries.[4]
2. Secondary research, namely a review of a wide range of publications from many sources including government departments, parliamentary reviews, universities, funding agencies, non-government organisations, businesses, consultancies and media relating to the commercialisation of research.

This report focuses on the findings in relation to South Korea.

There is a large body of literature on the topic of commercialisation of research in South Korea (Korea). However, changes within the structure of government in terms of the responsibilities for the various elements of the commercialisation ecosystem have meant that any description of policies and responsibilities is soon outdated. This has presented a major challenge as we have set about undertaking a review of government policy and its impact on the commercialisation of research within Korea.

For the objectives of this paper, we have tried to synthesise the most appropriate documents and data to inform the audience and stimulate discussion. To achieve this, we have reviewed a wide range of publications from various sources including government ministries, the OECD, universities, funding bodies, non-government organisations, businesses, consultancies and media. A full bibliography is provided at Appendix 1.

[3] While Hong Kong is a Special Administrative Region of the People's Republic of China, it is referred to as a 'country' in this report for the purposes of comparison with the relevant countries.
[4] A list of the job titles and organisations of participants is provided within this report. Participants were assured that their names would not be used and that any comments would not be attributed to individuals.

To supplement the secondary research, we undertook primary research comprising interviews with key senior stakeholders involved in the commercialisation of research in the Korea. We would like to thank the interviewees for their time, insightful input and their recommendations of relevant individuals for us to interview and suggestions regarding sources of further information. It must be noted that we faced greater challenges in exploring the situation in Korea than we did in either the UK or Hong Kong, both in terms of identifying the right person to participate in the research and securing an interview given the tight timelines for this project.

This report is in three sections.

- The first section provides information about Korea's performance in the latest Global Innovation Index.

- In the next section, we provide our overview of the South Korean Government's policies relating to the commercialisation of research, including a review of the government strategies in this area. We then outline some of the key funding schemes that relate to the commercialisation of research.

- The final section is built around the more subjective findings of our primary research. We have included the interviewees' opinions and insights, together with additional relevant content from our literature review in this section.

Report Limitations

EduWorld has taken all reasonable care in researching and preparing this report. EduWorld has necessarily had to rely and base opinions upon various external third party data and information sources when preparing this report and in reaching the opinions, views and assumptions expressed in this report.

To the extent that such reliance on third party source data and information has occurred, EduWorld has assumed the accuracy, reasonableness and reliability of the source data and information without independent verification.

While at the date of this report, EduWorld is not aware of any reason why any of the third party source data and information referred to or used in this report is not accurate, reasonable or reliable for the purposes for which this report has been prepared, EduWorld does not and is unable to represent that such third party information and data is accurate, reasonable or reliable and the report is released upon this basis.

2 South Korea and the Global Innovation Index

The Global Innovation Index (GII)

The Global Innovation Index (GII)[5] recognises the key role of innovation as a driver of economic growth and well-being. It aims to capture the multi-dimensional facets of innovation to be applicable to developed and emerging economies alike. In doing so, it helps policymakers and business leaders move beyond one-dimensional innovation metrics towards a more holistic analysis of innovation drivers and outcomes.

Figure 1: South Korea GII Key Indicators 2013 and 2014

South Korea Statistics				
Key Indicators				
Population (millions)	**50**			
GDP (US$ billions)	**1,221.80**			
GDP per capita, PPP$	**33,189**			
	2014		**2013**	
GII Indicator	**Value or score (0 - 100)**	**GII Rank**	**Value or score (0 - 100)**	**GII Rank**
Global Innovation Index (out of 143)	55.3	16	53.3	18
Researchers, headcounts/mn pop	7698	8	n/a	n/a
Gross expenditure on R&D, % GDP	4.4	1	3.7	3
GERD performed by business, % GDP	3.1	2	2.8	2
GERD financed by business, %	76.5	4	71.8	3
University/industry collaboration^	61.3	25	61.7	24
GERD financed by abroad, %	0.2	92	0.2	85

South Korea, with a population of 50 million and a GDP per capita in excess of US$33,000 was ranked in 16th place in the 2014 GII tables; two positions higher than in 2013.

A number of factors contributed to South Korea's ranking:

- Gross expenditure on R&D at 4.4 per cent – the highest of the 143 countries reviewed in the GII;
- Its business sector is the fourth most active on the GII list in financing R&D;
- 2nd place for performing R&D; and
- 8th place for the number of researchers per million of the population.

[5] The Global Innovation Index 2014: The Human Factor in Innovation is the result of collaboration between Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO) as co-publishers, and their knowledge partners.

3 South Korea Background[6]

3.1 Country Overview

When looking at the policies relating to the commercialisation of research in South Korea, it is important to understand the recent history of the country, perhaps more so than for the other countries we have reviewed for this project.

South Korea has a population of 50 million inhabiting a land area less than half the size of the UK. Having undergone a process of remarkable change and development since the end of the Korean War, the country now ranks as one of the leading developers and exporters of technology.[7]

Korea is the 15th largest economy in the world by nominal GDP and 12th by purchasing power parity (PPP). South Korea's economy is dominated by high-technology industries, principal among them electronics, telecommunications, auto production, steel, shipbuilding and chemical production.

The economy has undergone a rapid transformation over the last 50 years, growing by an average of seven per cent annually, contracting in only two of those years. Korea has transformed from a country receiving aid to one that is disbursing it.

Korea's initial rapid growth was characterised by both political authoritarianism and extensive state intervention in the economy. In the 1970s and 1980s, Seoul channelled massive amounts of capital through subsidies and low-interest-rate loans into trusted family-led chaebol or conglomerates. The preferential treatment enabled the chaebol (which today includes Hyundai and Samsung) to grow into massive business empires whose brands are now recognised and envied around the world.[8] The top 10 chaebol account for a remarkable 80 per cent of Korea's GDP.

However, the ongoing dominance of the chaebol reportedly poses challenges to regulators seeking to make Korea's markets more competitive. Moreover, the reliance upon a small number of companies presents enormous economic risk. For example, Samsung alone accounts for around 20 per cent of national GDP.[9]

Korea's rate of economic growth has slowed in recent years with the IMF forecasting it to be 3.7 per cent in 2014 and 3.0–3.5 per cent a year over the long term.

However, with economic growth has come rising labour costs, and expansion within other economies means that Korea now has some serious competition from China and other countries in the Asian region.

South Korea has benefited from its geographical location, wedged as it is between the economic giants of China and Japan. Factories in China have relied on South Korean machinery, so a Chinese slowdown is likely to have an adverse impact on Korean makers of capital equipment and intermediary industry products.

[6] Unless otherwise indicated, information on Korea's economy, policies and political structure comes from the following sources: Universities Australia (2014), University research: policy considerations to drive Australia's competitiveness
[7] www.gov.uk/government/priority/uk-science- and-innovation-network-working with korea#science-and-innovation-in-korea
[8] http://www.foreignaffairs.com/articles/140335/marcus-noland/six-markets-to-watch-south-korea
[9] http://www.theatlantic.com/business/archive/2012/07/whoa-samsung-is-responsible-for-20-of-south-koreas-economy/260552/

From the early 1960s to the late 1990s, there has been a rapid expansion of the Korean labour force, a relatively low number of dependents per worker and a major increase in the educational level of its workforce. However, these favourable demographics are now reversing and in 2010, Korea's 'core productive population', that is people aged 25-49, fell for the first time. At the current rate, the population will start to decline by 2030, falling below current levels by 2050.

Within Korea there is national consensus that research, science and technology are central to Korea's transition to a knowledge economy and the Government's current science and technology plan (explored in Section 3.5) indicates the areas where government support will be focussed.

3.2 Research Spending

Overall Research Spending

Korea's expenditure on R&D is among the highest across the developed nations. In 2013, it invested 4.4 per cent of its GDP on R&D, maintaining its position as the fifth largest R&D investor in the world after the United States, China, Japan and Germany.

The government's goal is to further increase this percentage so that by 2017, it will invest 5 per cent of the nation's GDP in research and development.[10] This figure is particularly interesting when compared with the UK at 1.72 per cent and the EU estimate of 2.06 per cent.

Business R&D (BERD)

- The vast majority of expenditure of R&D in Korea occurs in the private sector (74.7 per cent in 2012)[11].
- The business sector R&D intensity (BERD as a percentage of GDP) has increased to 3.25 per cent in 2012 from 2.8 in 2010 and 2.09 in 2005.[12]
- The majority or Korean R&D is funded by and performed in the industrial sector. For 2010, this was 72 per cent and 80 per cent respectively. Furthermore, 88 per cent of it is in manufacturing (in 2010), which is second only to Germany.
- Just under half (48 per cent) was carried out in a single sector (radio, television and communication equipment), by far the largest share among the OECD countries.[13] For example, Samsung had a US$14 billion R&D budget in 2014.[14]
- The number of researchers in business enterprises in 2011 saw an increase by 10.8 per cent (24,458 persons) on the previous year reaching 250,626 persons.

[10] Source: OECD (2014), 'Commercialising publicly supported research' in *Industry and Technology Policies in Korea,* OECD Publishing
[11] Erawatch
[12] *ibid*
[13] http://www.oecd.org/sti/outlook/e-outlook/sticountryprofiles/korea.htm
[14] http://www.bloomberg.com/graphics/2015-innovative-countries/

- Interestingly, however, the majority (64.1 per cent) of the total number of doctorate researchers (52,287 persons) still work at universities and colleges.

Public Research

- Around one-quarter of Korea's R&D is funded by the government (27 per cent). Only a tiny proportion comes from overseas (0.2 per cent).

- Out of total Korean expenditure on R&D, 12.5 per cent went into Government Research Institutes (GRIs) and 9.5 per cent into universities.

- GRIs are the main recipients of public R&D and support – receiving 38.4 per cent of public R&D in 2011. Universities received 25.4 per cent and companies 21.7 per cent.

- In 2011, there were 41,619 government-funded research projects in Korea, implemented under 493 programmes, involving spending of KRW 14.85 trillion (US$13.5 billion at today's rates).

- Business funds a relatively high proportion of research in higher education institutions: 11.3 per cent, compared with OECD average of 6.0 per cent.

- Within Korea, basic research accounts for 18.1 per cent of spending, applied research 20.3 per cent, and experimental development 61.6 per cent.

- In 2012, the highest investment technology area was information technology accounting for 34.2 per cent, followed by 12.8 per cent on nanotechnology, 10.7 per cent on environmental technology and 7.7 per cent on biotechnology.

- R&D expenditure of the Seoul metropolitan area in 2011 accounted for 64.3 per cent of the total R&D investment in the country. The Daejeon area, in which the biggest science and business cluster is located, accounted for 11.2 per cent.

3.3 Policy Overview

Government R&D investment priorities

In the R&D sector, Korea's R&D investment priorities are to:

- Develop basic technology and new growth-generation industries;
- Stimulate low carbon green growth; and
- Enlarge international collaboration and public welfare.

Stimulate Private R&D investment

The Korean Government policy also aims to stimulate greater private R&D investments through a matching fund system, various financial schemes such as technological value-based loans, diverse tax incentives and public procurement policies.

International Cooperation

The Korean Government has also emphasised international cooperation for promoting cross-border flows of knowledge in accordance with increasing globalisation.

3.4 Ministry Responsibilities for Research

The Ministries responsible for aspects of the Korean research system – and the structure of the ministries themselves – have undergone various changes over the last few years: some of these changes appear to have been motivated by political reasons, rather than any substantial concerns or evidence about the performance of the previous structures. The changes have impacted on the way that research is organised, funded and, in turn, the commercialisation of research.

At the operational level, the key ministries include the following three ministries.

- **Ministry of Strategy and Finance (MOSF),** which has the power to allocate government R&D budget.
- **Ministry of Trade, Industry and Energy (MOTIE)** via which funds for technology transfer and commercialisation are mainly channelled[15] and which is responsible for the development of traditional industrial know-how, cutting-edge R&D and strong pro-business policies. It is also mandated to engage in energy cooperation programmes, expand renewable resources and to craft environment-friendly economic policies.
- **Ministry of Science, Innovation and Future Planning (MSIP)** has some proportion of the funding for technology transfer and commercialisation, and responsibility for the development of fundamental and mega science and for the management of the 25 GRIs.

[15] STEPI Insight: Measures to Promote Technology Commercialisation at Universities & GRIs: Nov 2013: Yoon Jun Lee & Seon U Kim

MSIP has the authority both to coordinate nearly 80 per cent of governmental R&D budgets for all ministries through the National Science & Technology Corporation (NSTC). With more strength than in its previous incarnation, it has roles and functions including evaluation, inter-departmental coordination and planning and implementing R&D programmes to facilitate what is being referred to as the 'Creative Economy.'

Other ministries with significant research responsibilities include:

- Ministry and Health and Welfare;
- Ministry of Environment;
- Ministry of Defence;
- Ministry for Ocean and Fisheries; and
- Ministry of Agriculture, Food and Rural Affairs.

3.5 Recent Research Policy Developments

President Park Geun-hye Park assumed the presidency in February 2013 and soon after announced her plan to build a 'Creative Economy' for Korea – her vision for economic revival and job creation. To support this, she implemented a number of actions, which are discussed below.

Creation of Senior Secretary to the President for National Future and Strategy

A new position was created at the Office of the President – the Senior Secretary to the President for National Future and Strategy. This position is responsible for identifying and developing new growth engines towards the new concept of a Creative Economy based on science and technology and ICT, and for developing future strategies and ensuring their due implementation. This was supported by the formation of a new Ministry – MSIP. The recently established MSIP has the authority both to coordinate nearly 80 per cent of governmental R&D budgets for all ministries through the NSTC and to plan and implement R&D programmes related to facilitation the creative economy.[16]

Third Korean Science and Technology Basic Plan

In June 2013, the government announced its strategy for R&D support in the Third Korean Science and Technology Basic Plan, including its commitment to invest KRW 81 trillion (US$74bn) of the government's budget in R&D between 2013 and 2017. This represents a significant increase on the KRW 60 trillion (US$54bn) of government R&D investment of the previous administration (the Lee Myung-bak Administration).[17]

Overseen by the NSTC, the new 'High Five Strategy' will focus on the translation of research output into **new products, the generation of science and technology related jobs and small to medium-sized enterprises, and increased support for basic sciences**. Thirty technologies have been identified as economic priorities.

[16] *ibid*
[17] Erawatch

Key targets to be achieved by 2017 include:[18]

1. Join the top seven most innovative nations in science and technology
2. Create 640,000 new jobs in science and technology
3. Raise the R&D contribution to economic growth to 40 per cent

Aligning strongly with the UK's 'Eight Great Technologies' and industrial strategies, Korean Government support is to be concentrated upon the healthcare, biosciences, ICT and new materials research sectors.

The Third Science and Technology Plan laid out five strategic technology areas, with investment across 30 main technologies:

- Creation of IT convergence new industry – 10 technologies
- Future growth potential area – 12 technologies
- Clean environment – four technologies
- Achieving healthy and long-life era – six technologies
- Realising safe society – six technologies.

The government has also laid out plans to expand the scope of R&D linkage programmes amongst ministries in pan-ministerial new drug development and plant R&D.

Comprehensive Plan for Development of Regional Science and Technology

With an historic concentration of economic activities in the Seoul metropolitan area, recent government policy has focused on investing in regional science and technology programmes. In July 2013, the government also announced the 'A Comprehensive Plan for the Development of Regional Science and Technology' (2013–2017*),* involving related ministries and all regional governments.

The plan outlines eight agendas:

- Expanding regional-centred R&D;
- Strengthening the capacity for R&D planning and management of regions;
- Supporting international R&D of regions;
- Advancing regional R&D system;
- Specialised R&D investment in region, by region;
- Nurturing regional human resources and job creation;
- Diffusing regional technology culture; and
- Activating university–industry-government collaboration.

It is expected to expand R&D investment in regions in the future and to strengthen regional R&D and business capacity.

[18] Korean Innovation Centre, Korean R&I Policy, Basic plan for Science and Technology in Korea, Source: http://www.kiceurope.eu/policy/sub2.php

Increased Funding for SMEs [19]

In December 2014, under the '2015 Policy Fund Management Plan for Loan Support for SMEs', the government committed funds totalling more than KRW 3 trillion (US$2.bn) for SMEs including KRW 835 billion (US$757m) of new foundation funds for companies at the growth stage.

In addition, tax breaks for angel investors have been expanded and there are plans to establish a government-run Future Creation Fund, which, along with private contributions, will hold KRW 200 billion (US$177m) in seed money.

Tax incentives are planned for sellers or buyers of companies that are four to nine years old and a similar KRW 300 billion (US$266m) fund.

KONEX[20] (Korea New Exchange)

Also to support SMEs, KONEX (Korea New Exchange) was launched in July 2013 as a specialised market facilitating the direct financing for small- and medium-sized startup companies (startup SMEs). It is expected to play an important role in creating the environment necessary for innovative and creative economic development. Launching the KONEX market for startup SMEs is one of the priority tasks of the Korean Government to strengthen the foundations of the capital markets and help SMEs access funding to support their growth.

3.6 Public Sector Research: GRIs, Universities and the Institute for Basic Science

Public Sector Research Organisations

Korea has three types of public sector research organisations:

1. Government-funded research institutes (GRIs)
2. National/public research institutes (N/PRIs)
3. Non-profit research institutes.

Two research councils under the MSIP have managed the GRIs since February 2013:

- The Korea Research Council for Industrial Science and Technology (ISTK); and
- The Korea Research Council for Fundamental Science and Technology (KRCF,www.krcf.re.kr).

[19] http://www.businesskorea.co.kr/article/8153/sme-funds-smes-enjoy-over-3-trillion-won-support-funds-42-higher-last-year
[20] Overview of the KONEX Market: Korean Exchange

3.6.1 Government Research Institutes (GRIs)

From the mid-1960s, the GRIs have been a major source of technology and innovation development: particularly when university research was still weak. Although more recently, the government appears to be increasingly favouring strengthening R&D capabilities in universities, which are considered the 'natural' sites of skills development and knowledge transfer.[21]

In 2014, there were 27 GRIs with 13,000 employees, mostly focused on basic science or industrial technology operating under the Korea Research Council of Fundamental Science and Technology (KRCF) and the Korea Research Council for Industrial Science and Technology (ISTK).

The GRIs, which form the nucleus of public sector research, receive on average 50 per cent block funding through the MOSF and the research councils, as well as funds from many other ministries through the project-based competitive funding system. Many of their projects are related to joint research among industry, academia and research institutes.

However, despite their significant funding and central role, the R&D productivity of the GRIs in the science and technology field is less than one-third that of comparable public research institutes in the US.[22] Generally, technology incubation by the GRIs has been sluggish, although their output over the period 2010–2013 showed a slight increase.[23] This relatively weak performance appears to be a product of: poor performance in technology commercialisation management; poor IP management; and the absence of an R&D system that enables immediate utilisation of their scientific base for industrial purposes.[24]

In July 2013, the new government laid out a development plan designed to change the roles, missions and management systems of GRIs towards a more mission-oriented and open system using: a stricter evaluation system; more efficient human resources; improved organisational management; and a more stable research environment by the GRIs themselves with support from the MSIP. As part of its national agenda, the government also announced "strengthening the role of GRIs as a mediator in industry-academia cooperation and a sponsor of SMEs".

The government strongly wants the GRIs to contribute to the development of the Creative Economy and is considering merging the two research councils into one to further integrate the GRIs.

[21] Jörg Mahlich and Werner Pascha (2012), *Korean Science and Technology in an International Perspective*
[22] STEPI Insight: Measures to Promote Technology Commercialisation at Universities & GRIs: Nov 2013: Yoon Jun Lee & Seon U Kim
[23] *ibid*
[24] *ibid*

3.6.2 Institute for Basic Science (IBS)

The government has recognised the importance of keeping a balance between basic, applied and experimental research in continuing the country's economic success – and specifically the need for a stronger basic science platform for future technological development.[25]

In 2012, it committed to increasing its basic research capabilities and outputs through establishing the Institute for Basic Science (IBS) – a network of 50 research centres. Modelled after the Max Planck Society (Germany) and RIKEN (Japan), the government committed to invest US$3 billion between 2012 and 2015 in 25 autonomous institutes and the construction of a rare isotope accelerator.

The IBS encourages 'creativity and adventure' in long-term research and argues that research performance should not be measured by publications (Park 2012).

A core group of the institutes will be constructed together with the IBS headquarters – the International Science Business Belt (ISBB) – in Korea's science city of Daejeon, with the remaining institutes to be located at research institutions and universities. The ISBB will be a mega science and business complex, intended to house world-class basic science research organisations and related business facilities. The ISBB is due to open in 2017 in a 3.6 square-kilometre area of Daejon. However, development has apparently been delayed due to disagreements about budget responsibility.

3.6.3 University System

Korea has a large and highly diversified higher education system. There are approximately 350 higher education providers – universities, colleges, junior colleges, graduate schools, cyber universities, industrial universities and universities of education.

The vast majority (85 per cent) of higher education institutions are privately run, with about 175 private and 40 public universities. However, commentators have noted that Korea's education system relies heavily on rote learning and cramming for exams, leaving little room for creative thinking and an exploratory spirit.[26] Recent years have seen the government attempt to address these issues. In 2011, 'The Second Basic Plan for Nurturing Human Resources in Science, Engineering and Technology over the period of 2011–2015' included modifying textbooks to increase interest, understanding and potential of Science, Technology, Education, Arts and Mathematics among school students at all levels.

Despite its size, diversity and the high tertiary participation rates, Korea's university system is, reportedly, not highly rated: the World Competitiveness Yearbook ranks Korean universities in terms of how well they meet the needs of a competitive economy, as the eighth lowest in the OECD, despite the high level of spending (at 2.6 per cent of GDP in 2009, the highest in the OECD). Some of the reasons cited for this include: the size of faculty has not kept pace with rising enrolments; the share of part-time faculty has risen; and the quality of students has become more diverse with an increased proportion of students from vocational high schools.[27]

[25] UK Science and Innovation Network: Working with Korea, https://www.gov.uk/government/priority/uk-science-and-innovation-network-working-with-korea
[26] Youngjoo Ko & HoChull Choe, Korea Research Institute of Chemical Technology (2011), Mini Country Report: S Korea, Erawatch
[27] Jones, R.S. (2013), 'Education Reform in Korea', *OECD Working Papers*, No. 1067, OECD Publishing,

With respect to research outputs and technology transfer, there are a few pertinent observations:[28]

- The volume of papers and patents produced by Korean universities has increased in recent years;
- Technology transfer and/or business incubation performance of Korean universities has been relatively limited, albeit gradually improving, since the enactment of the Technology Transfer Promotion Act in 2000; and
- Korea's performance still lags behind those of other advanced economies.[29] For example, one indicator showing the level of knowledge transfer between universities and companies in Korea remains at 5.19 (25th globally), despite the fact that the country is ranked 6th in terms of R&D investment size and 2nd in terms of the ratio of R&D investment in the total GDP.[30]

One of the key barriers cited as hindering technology transfer and commercialisation of universities is the lack of expertise and business mindsets of the Technology Licensing Offices (TLOs), as well as the actual number of staff. Of a recent survey of 576 TLO professionals at Korean universities, only 13 per cent were lawyers, patent lawyers, CPAs, professional engineers and certified public tax accountants. The average number of staff in a Korean TLO is five, less than half the average of their American counterparts.[31]

3.7 Policies relating to Technology Transfer and Commercialisation of Research

Funds for technology transfer and commercialisation are being channelled mainly through the MOTIE, while some of the funding is provided by the MSIP and the Korea Intellectual Property Office (KIPO). In addition to the schemes already mentioned, it is worth highlighting a few others.

Promote Collaboration and Technology Transfer[32]

The government provides a range of programmes for both universities and SMEs to promote collaboration and technology transfer. The programmes provide funds to develop technology-licensing institutes within universities and establish technology-holding companies to facilitate the commercialisation of university research results.

Supporting Innovative Firms to Facilitate Commercialisation

A new R&D programme introduced in 2012, provides grants of about KRW 30 billion (US$27m) to help tech-based firms in the process of introducing new products or transferring from PRIs. The programme comprises three components.

- *Investment linkage activity*. A key criterion for funding is that firms must submit an investment plan from investing institutions and formally collaborate with PRIs in the commercialisation.

[28] STEPI Insight: Measures to Promote Technology Commercialisation at Universities & GRIs: Nov 2013: Yoon Jun Lee & Seon U Kim
[29] *ibid*
[30] World Competitiveness Year Book 2012
[31] Association of University Technology Managers, www.autm.net
[32] OECD (2014), *Op. Cit,* Chapter 4: Commercialising publicly supported research in Korea.

- *Technology transfer activity.* This is primarily aimed at commercialising technology transferred from PRIs to firms. The government funds PRIs when they collaborate with firms to which they already transferred research for commercialisation.
- *Business model development.* This focuses on helping firms with weak business capabilities to develop a business model. It is composed of two components. The government provides funds when business accelerators (BA) propose good business models for technology-based firms, and when the technology-based firms work together with the BAs to commercialise the business models.

Plan to Develop Business Ideas

In July 2013, MOTIE announced its Plan to Develop Business Ideas (into marketable products) – which will designate institutions for supporting firms to develop business ideas in specific industries, through supporting obtaining IP, creating business models and building prototypes.

MOTIE will designate institutions for supporting firms to develop business ideas in 10 industries: home appliances; design engineering; household supplies; bio-health; knowledge services; information technology; automobile–aerospace; energy; machine shipbuilding plant; and platform services. In addition, MOTIE plans to introduce a certification system for the Good Business Idea Product. Once a product based on creative business ideas receives the certification, the government will promote sales of the product through a range of measures, such as public purchasing.

Financing the Commercialisation of Research Results

Various funds, including the New Growth Engine Investment Fund, aim at promoting growth in 17 promising technologies and sectors, using a combination of government and private investment.

The fund comprises four components: green growth; high-tech convergence; bio-technology and research and business development. The government has invested KRW 20 billion in each of these four areas, with a further KRW 100 billion coming from private investment institution. The funds are provided to technology-based firms to assist the commercialisation of their developed technologies.

Other initiatives include the ‘Death Valley Fund’, a KRW 20 billion fund, which does not specify any investment areas and the ‘R&D Commercialisation Bank’ programme, in which two designated commercial banks use the returns from government R&D funding deposits to provide loans to firms at reduced rates.

Further Policies

The Park Geun-hye Administration has promised to provide the necessary support to professors and researchers for business incubation and technology transfer by announcing a national initiative called the ‘Creation of Ecosystem for Creative Economy through the Linkage between Industry, Academia, Research Institutes and Local Communities’.[33]

[33] Yoon Jun Lee & Seon U Kim (2013) Promoting Technology Commercialisation of Universities and Government-funded Research Institutes, STEPI Insights.

3.8 Interactions between Business, Universities and Government

The European Commission's Erawatch outlines four policy measures that have been designed to encourage networking amongst SMEs, universities and research institutes.[34]

- **Industry–academia–research institute joint technology development programme**
  - Encouraging SMEs to utilise quality resources of universities and research institutes
  - Support up to 75 per cent of R&D cost
  - Total support fund: KRW 59bn, US$53m

- **Joint SME in-house research institute installation programme**
  - Encouraging SMEs to build in-house research institute in collaboration with universities and research institutes
  - Total support fund: KRW 31bn, US$28m

- **Industry–university cooperation facility support programme**
  - Utilising university research facilities for SMEs' research activities
  - Support labour cost, material cost, and equipment rental cost

- **Pooling research equipment programme**
  - Utilising cutting-edge research equipment of university and research institute for SMEs' research activity
  - Total support fund: KRW 10bn, US$9m

3.8.1 Institutions for Technology Transfer and Commercialisation

The Korean Institution for the Advancement of Technology (KIAT) promotes, transfers and commercialises developed technology. The institute also: evaluates and manages regional industry support projects; upgrades innovation through international joint R&D and cooperation; supports MOTIE's industrial technology policy through research and statistical analysis; and undertakes other studies.

The Technology Licensing Office (TLO) system for universities and GRIs was introduced in 2006 with the aim of promoting and facilitating university and GRIs-based technology commercialisation. At the time of publication of the most recent OECD report on the topic (2014), there were 172 TLOs (121 in universities and 51 in GRIs and other non-profit research institutes).

The government encourages GRIs and universities to set up Technology Holding Companies (THCs) dedicated to facilitating the commercialisation of research results from universities. In the past few years, several THCs have been established to promote knowledge-based start-ups. Some belong to single universities, some to several universities and techno parks.

Some maintain a TLO for technology licensing and a THC to support technology-based start-ups. There are currently 23 THCs: they can set up their own subsidiary companies, create joint ventures and take equity in start-ups.

[34] http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/kr/country?section=PolicyMix&subsection=InteractionBetweenKnowledgeTrianglePolicies

4 Perspectives on Commercialisation of Research in South Korea

Numerous stakeholders interact with government to advise and influence on policy affecting business–university collaborations and the commercialisation of research. In our primary research for this project, we spoke with senior stakeholders working in the following organisations and institutions to provide insights into the subject.

- Head, Science and Innovation Network, Foreign and Commonwealth Office, Korea
- Professor, KAIST and Honorary President, Korea Venture Business Association
- Head, Korea Desk, OECD
- VP, Research, KAIST
- CEO, Korean Science and Technology Holdings, a business that specialises in assisting in the commercialisation process

We have used the insights gleaned from talking to these industry experts and supplemented them with relevant findings from our literature review to provide an additional perspective on how the process of commercialisation of research is proceeding in Korea. This includes identifying any barriers to commercialisation and some commentary on the impact and effectiveness of government policy in this area.

Throughout this section, we have included verbatim comments from the interviews. We believe this serves to provide authenticity to our reporting, as well as enabling for a subtlety of meaning that might be lost in summarising the comments. The language used by the articulate and highly experienced respondents who took part in the primary research was not always succinct and there seem to be two main reasons: firstly, for some of our interviewees English is not their first language; and secondly (and even for those respondents who do speak native, fluent English), the enormity of the subject matter and its complexities mean it seemed difficult to always provide concise responses.

In the case of Korea, where for most of our interviewees Korean is their first language, respondents were given the option to provide written responses to our questions – which two of them chose to do.

4.1 Overall Perspective

An overview of the commercialisation of research is provided in a recent paper from the OECD.[35]

- As already indicated, Korea ranks very high among the OECD countries in terms of total investment in R&D. But it ranks low when it comes to R&D productivity. Addressing this paradox would go a long way towards creating another venture boom and attaining President Park Geun-hye's vision for making Korea a 'creative economy'.

- According to a recent OECD report on Korea's innovation policies, the nation spent US$49.2 billion in R&D in 2012, ranking sixth among the OECD's 34 members. When seen in terms of R&D spending as a share of GDP, Korea's 4 per cent was second only to Israel's 4.4 per cent.

- But Korea's performance in R&D productivity leaves much room for improvement. In noting this, it is also important to highlight that it is not the case that Korea's investment in R&D produces little output. The nation's research institutes, private or public, produce a large volume of papers and patents. For instance, the OECD report states Korea performs well in terms of the total number of scientific publications, ranking for some years around 12th globally. It also shows that Korea is a leading country internationally in regards to the number of patent applications filed by universities and private research institutes. The problem is the low level of commercialisation of these R&D outputs. For instance, only one in four technologies developed through state-funded R&D projects is transferred to private companies. The rate of commercialisation is even lower. Fewer than one in ten such technologies actually make it to the market in the form of services and products.

- Aware of the problem, the government has been stepping up efforts to facilitate the commercialisation process. It has set up various institutions and programmes to this end, including:

  - Startup incubation centres;
  - Industry–academic collaboration foundations;
  - Technology Licensing Offices (TLOs) at universities; and
  - Technology Holding Companies (THCs).

- But its efforts to date have had limited successful. One reason is the **lack of cooperation among the government agencies involved in these efforts**. For instance, a company that is supported by one government agency cannot expect to receive support from another when its current support programme is discontinued.

[35] Report from the *Korea Herald*, as reported in the *China Daily*. The original report *Industry and Technology Policies in Korea* (May 2014) is available at http://www.keepeek.com/Digital-Asset-Management/oecd/science-and-technology/oecd-reviews-of-innovation-policy-korea-2009_9789264067233-en#page6

- Commercialising R&D outputs takes much time and involves risks. **So companies need support throughout the entire commercialisation process, ranging from the startup phase to the final stage of bringing their products to the market. This means government agencies need to change their approaches and set up a collaborative and integrated support system.**

- The OECD report offers a comprehensive set of advice for the Korean Government. For instance, it recommends that the government:

  - Establish a more business-friendly education system;
  - Address cultural and other barriers to startups;
  - Support public-private innovation partnerships; and
  - Promote technology financing to help small and medium-sized companies secure funding based on accurate appraisal of their technologies (citing the fact below – for many SMEs, the lack of funding is the biggest obstacle to commercialisation of their R&D outputs).

- The government also needs to promote **technology financing to help SMEs secure funding based on accurate appraisal of their technologies**. For many SMEs, lack of funding is their biggest obstacle to commercialisation of their R&D outputs.

Another OECD report is equally clear on the measures that Korea needs to take[36] highlighting similar points as follows.

- The return from Korea's large investment in R&D is limited by weaknesses in the innovation system and in framework conditions, reflecting stringent product market regulations and low inward foreign direct investment.

- Moreover, the creation of new enterprises is hampered by problems in the **venture capital market and SME financing.** The productivity gap between large firms and SMEs reflects weaknesses in services, where productivity is only about half of that in manufacturing. A **comprehensive strategy to develop a creative economy, including measures to improve the innovation system and framework conditions and to develop a vibrant venture business sector and stronger SMEs, is a priority**.

A report undertaken by the European Commission's Erawatch Network,[37] (much of which is echoed in our interviews below) reveals similar weaknesses and challenges in Korea's innovation system including:

- Weak coordination amongst ministries;
- Lagging capacities to conduct basic and fundamental research;
- Lack of creative human resources;
- Gaps between the chaebol and SMEs;
- Weak knowledge circulation and commercialisation of research outputs; and
- Imbalances between Seoul metropolitan area and other areas.

[36] OECD, Overview of Economic Survey of Korea, http://www.oecd.org/korea/economic-survey-korea.htm
[37] Youngjoo Ko and HoChull Choe (2011), *Op. Cit.*

But the Erawatch report also highlights some noticeable strengths:

- Strong consensus by successive governments and people on the increasing investments in science and technology for economic growth;
- One of the highest levels of GDP expenditure on R&D in the world;
- High levels of business enterprise expenditure on R&D;
- A highly educated labour force;
- Large firms that are internationally competitive;
- The ability to adapt to be competitive in fast-moving markets and rapid technological change; and
- Strong ICT infrastructure.

4.2 General Issues facing Korea that Impact on the Commercialisation of Research

The interviewees wanted to discuss some of the major cultural and structural issues that they believed impacted on the likely success of Korea's attempts to build an effective ecosystem to support the commercialisation of research. Discussion of these issues was more evident in Korea than in the other countries where we conducted research.

4.2.1 Current Situation

Most respondents had a positive attitude towards Korea's likely success in this area and thought that it was only minor adjustments that were required.

> *"Korea has a lot of good resources, technology and people. It takes only some small improvements here and there and it could be very successful. We have lots of ideas: I believe it will happen in Korea. We have proved that we can do it. We have created something out of nothing in the last 50 years in time. It's a question of how quickly we can do it."*

However, others were less positive: they thought the model that had brought Korea prosperity was no longer applicable. They felt that the country needed to take a new approach and make changes at both a broader educational and structural level.

> *"Korea is a catch-up country. It has never been colonised – so it's not that open to foreign workers or investment. It's a closed country that has caught up by reverse engineering. Now it's a leader in so many industrial areas and the company research is applied. But when you're at the frontier, you need the basic research to go forward. You can no longer depend on applied research."*

> *"Start with universities, try to partly focus on the best ones and reward research that's useful and then try to change admissions systems and let the creative students in, and then the financial markets try to move away from the investment. We're talking about a society-wide change."*

According to one of our respondents, Korea had previously had a thriving ecosystem to support the commercialisation of research. Then, after the collapse of the tech bubble, Korea entered an 'ice period', but the recovery is now, reportedly, underway.

"In 2000, we had a very strong ecosystem. I believe it was the leading country in the venture industry, but after the IT collapse bubble in 2001, the Korean Government entered a 10-year ice period. Now we need to recover the original ecosystem and it is on the way. We are recovering, probably two-thirds of the way there."

However, at least one respondent highlighted that there was a need for caution in trying to too closely mimic the policies of other countries.

"I'm familiar with what works in the US – so, as you pointed out, it's very difficult to transfer any system that works in one culture to another one and expect it to work. I know. I founded companies in both places. They are not alike, they are very different, in terms of operation, in terms of everything. Korea needs to create a model that will work in Korea."

Having said that, according to one respondent, the lessons of Korea are considered to be more applicable to developing countries than to those economies that already have substantial private industry. Some of the lessons that are transferable include having special legislation for high-tech promotion in Korea – an Act that was reportedly passed in 1997 – that provides guidance on how to get people together, to raise investment funds and to find the space to launch ventures.

4.2.2 Chaebol

During any discussion about the economy in Korea, the role of the chaebol arises. At a basic level, there was a concern that if any of the chaebol faltered, it would have a profound impact upon the overall economy (given earlier comments about the enormous component of GDP generated by this small group).

"So much is done by a half dozen, huge companies. If any one of them went anywhere south, it would do irreparable damage."

Interestingly, most people thought they **acted as a brake on Korea's ability to develop a successful innovation ecosystem**.

"They are good companies in certain areas, such as manufacturing, sales and marketing. But they don't see too much of an innovation. They're not used to that."

While they have large R&D budgets, including some from government, it goes towards applied research, which is less at the cutting edge and not towards the kind of basic research undertaken in the universities.

"A lot of R&D money is coming from the government and it goes to R&D activities from companies not for basic research. There is very little money flowing to academia."

The need to reduce reliance upon the chaebol was a major consideration in trying to help build a commercialisation ecosystem where the SME sector played a bigger role.

"One of the things the current Korean Government is trying to do – it's a form of economic democratisation – is to try to reduce the reliance on Samsung and LG. It's because of China and other countries that are charging up behind them. Korea recognises they cannot be in the same global leadership in the industries that they are forever. They have to move into higher value-add industries because they can't compete with the likes of China, India in terms of human resources – they have to do it for simple economic reason. If they leave it as it is now with China, which is churning out 300,000 science graduates per year, [China] can catch up quickly."

However, on the upside, in relation to the commercialisation of research, it was thought that the chaebol's highly developed distribution network could offer access to a global market.

4.2.3 Startups

Some of the respondents talked about how Korea could move away from the chaebol-dominated economy and support new startups.

"KAIST is the university that has provided the skilled manpower for the original industrialisation for the country. I still feel it should do the same for the next phase of the Korean economy. We need to get away from a few big companies that dominate the Korean economy – instead of that we need to have very many value-making startups. The Institute of Entrepreneurship is trying to do this by, firstly, encouraging an entrepreneurship culture amongst young people by helping them to go into startups. Secondly, by creating a small ecosystem to help the entrepreneurs to develop their idea, funding and mentoring and ways to exit. And finally, looking at globalisation – Korea basically has no domestic market, so we need to think how we're promoting in the global market."

There were examples listed of successful startups.

"That's not to say there aren't smart SMEs. They are small startups that went big. It's just there's not a lot of them."

SME Innovation Performance

However, SME innovation performance, for the most part, still falls short of that of the chaebol. Some of the reasons for this have already been discussed in the report and include the fact that: that R&D investments of chaebol are designated to their own research institutes; talented human resources in science and technology are reluctant to engage with SMEs; and technology transfer from universities and the public sector research organisations to SMEs are unsatisfactory.[38]

[38] *ibid*

4.2.4 Labour Market Mobility

Another issue discussed was the lack of labour mobility in Korea, whether in a university, Government Research Institute or business, much of which was attributed to a culture of mentoring/patronage.

> *"There's not enough labour mobility generally – once you find a mentor, you stay with them. People don't move from Government Research Institutes. Even in businesses they don't move on. A typical pattern is if you get a PhD you follow your mentor, people in GRIs stay there and in the business sector too."*

There was, it was reported, very little movement between the sectors.

> *"There's very little interchange. People who have worked in national universities are civil servants and that leads to problems getting a job outside."*

4.3 Supply Side Considerations

4.3.1 General Comments

One of respondents (himself an academic who had founded numerous successful businesses) felt strongly that the push has to come from the researchers: in his mind, the motivation to develop things that were useful to the market meant they would end up having better ideas.

> *"It was only after we decided that we would make a product that we made the real research – if you give the motivation to the research engineers, they will drive it."*

The OECD analysis indicates that the research system is heavily skewed towards thematic R&D, which is largely applied and development-oriented with a focus on industrial technologies.[39]

Our respondents concurred: they thought the output of universities was not necessarily what was required to build an economy based on innovation.

> *"The current government is doing the right thing in the change to commercialisation, but it still needs to be focusing on the supply side because there is still a big gap in terms of the research results from some of the universities."*

[39] OECD, STI Country Profile: Korea, http://www.oecd.org/sti/outlook/e-outlook/sticountryprofiles/korea.htm

4.3.2 Imbalances on the Supply Side

Too much research is done in the corporations, not enough in the universities and there are not enough linkages between the two.

> *"Ten per cent of R&D is done in universities – it's half the average for the OECD. That's the thing that is most problematic,* ***there's so few linkages between what unis do and what business do: they do 97.3 per cent inside the corporations and 1.5 per cent inside the universities."***

Moreover, the very smartest researchers tended not to stay within universities, but rather ended up working for the chaebol.

> *"The best and brightest are going into the chaebol – they get more reward than remaining within the institutions."*

4.3.3 Basic versus Applied Research

Moreover, as discussed in other countries, respondents were keen to stress that it was not appropriate for all researchers to be working towards commercialising their output. Instead, there should be a diversity of ways in which their work is evaluated.

> *"It won't be the focus for everybody. Not all of them should be evaluated on the same metric. I advised the government to bring in the diversity of the metrics, so the people who are interested can do that. You shouldn't say they should all focus on commercialisation: you do introduce a metric that will work for some people who are interested in commercialising the research results – an additional metric."*

Indeed, again as seen elsewhere, it was thought that basic research was required to make the types of massive, game-changing discoveries that could drive an innovation system.

> *"What we've seen in the last five years is a general appreciation that their basic science plan has not been stronger. They can't keep making incremental changes, [they] need the big breakthroughs and they have been putting funding into basic science issues."*

4.3.4 Lack of Incentives to Commercialise

From the supply side, researchers have little or no motivation to commercialise their research, with promotion being dependent upon their written output.

> *"On the supply side, a lot of professors are encouraged to invent and publish papers – that's a measure of their accomplishments."*

However, we were told, this is starting to change with the government introducing incentives for researchers to commercialise their technology (although we were unable to ascertain precisely what these might entail).

"On the supply side, up to now, the major incentive for the research engineers and professors was their articles, their SSCI[40] articles for their promotion. The patents are not considered as important as their articles: commercialisation of the technology is not counted. It should be changed. Now the government wants to take it into consideration and they are starting to look at that. I think we should provide a big incentive to the commercialisation of technology and the major incentive would be the promotion for the academics."

Research has shown that incentives within Korean institutions can impact their innovativeness.[41] Specifically, it was found that inter-institutional collaboration in Korea in the first decade of the 21st century was negatively influenced by national science and technology research policies that evaluated domestic scientists and research groups based on their international publication numbers, rather than on the level of cooperation among academic, private and public domains.

In their written responses to our questions, one respondent indicated that allowing researchers to own options or stocks would encourage commercialisation of research.

"If regulation the researchers may have stocks or stock options set up clearly (currently it varies with research institutes), R&D commercialisation will be promoted better because they will be motivated."

4.3.5 Encouraging Institutions to Commercialise Research

There appears to have been initiatives at an institutional level to encourage Korean universities to be more self-sufficient in the hope that this might drive more innovation.

"In the last few years, we have seen a very deliberate decision to start to reduce funding a lot of the national research institutes and universities in order to try to encourage the use of the IP and their research results."

Government Regulation on Universities

According to our respondents and also various commentators, one of the key barriers to the effective commercialisation of research in Korea is the abundance of regulatory red tape. As a recent report noted:

*But increasing productivity requires more than just technological innovation; it also takes **encouraging innovation in emerging sectors while terminating inefficient practices throughout the economy**. In South Korea's case, the area that needs the most help is the heavily regulated service sector. If the government were willing to lower barriers to entry, the ongoing development of the country's financial sector could help restructure the service sector by making more capital available to underwrite innovation and boost investment.[42]*

[40] Social Science Citation Index
[41] Park, Han Woo & Leydesdorff, Loet (2010), Longitudinal Trends in Networks of University-Industry-Government Relations in South Korea: The Role of Programmatic Incentives
[42] Marcus Noland (2014), http://www.foreignaffairs.com/articles/140335/marcus-noland/six-markets-to-watch-south-korea

Universities that want to start up businesses reportedly face regulatory obstacles.

> *"A good example would be the Electronics and Research Institute (ETRI). They've been told to go off and take profit from their inventions. But what that isn't being translated to is an easing of the environment at the back end. They need to have the permission to make the money, but they're not easing off the regulations."*

Some institutions have joined together in an association to lobby government.

> *"Universities are tied by red tape as to how they're able to make a profit…The universities themselves are trying to get around it by creating separate entities – Technology Holding Companies. There's a body that represents them: the Korean Association of Technology Holdings. There's around 35 members. They have had to create these entities – not dissimilar to Cambridge/ISIS and Imperial Innovations – selling IP into TTOs which then has the ability to license it. That's how they're getting around it. When you've got the unis meeting together, they are more likely to have an impact."*

Literature on the subject confirms the technology transfer performance of universities has gradually improved since the enactment of the Technology Transfer Promotion Act of 2000.[43] The number of technology transfer contracts signed by four-year colleges increased by 10.9 per cent from 2007 to 2011 and their income from technology license fees by 192.3 per cent. However, as already indicated, the technology transfer performance of Korean universities is reported not to be at the level of advanced countries. Among the obstacles hindering technology transfer and commercialisation of universities are **lack of expertise and business mind-set of TLOs**. It is reported that the TLOs lack autonomy and, hence, entrepreneurship, while Technology Holding Organisations (THOs) have only limited access to investment funds.

According to the written input from one of our respondents, universities are limited by how they can fund their startups.

> *"The regulation says that universities must invest not in cash but in kind to set up their own startups. That means they do not have enough budget to operate and research for the future growth. So the regulation needs to reflect what companies really want, including budget issues."*

[43] The objectives of the law are 1) to promote technology transfer to private sector and commercialisation of technologies developed at public research institutes and 2) to promote smooth transactions, transfer and commercialisation of technologies developed in the private sector (responsible ministry: MOTIE): Source Yoon Jun Lee and Seon U Kim, *Op. Cit.*

4.4 Demand Side

4.4.1 The Lack of an Entrepreneurial Spirit

One of the main barriers for Korea in commercialising its research, already highlighted in this report, and which our interviewees reinforced, was that the country is **lacking in entrepreneurs and an entrepreneurial spirit.**

> *"We need a lot of people looking for research ideas – like in Silicon Valley – where there is venture capital all over the place looking for technologies to invest in. It's the first step towards commercialisation. Currently, even though there are a lot of activities going on in Korea, it's all institute or government focus. We need people who make money from it to be involved."*

Although in contrast (or maybe a form of clarification), as one respondent told us, there is no lack of entrepreneurs within Korea: there is apparently a culture of retirees investing in small businesses (the retirement age in Korea is 55 years, moving to 60 in 2016 for larger companies and 2017 for smaller ones). This, however, does not provide a model that would appeal to younger people.

> *"Korea has a lot of entrepreneurs. But they do that when they have nothing else to do. At 55, when you retire, you get your lump sum – you buy a chicken stand and use that to generate income in retirement. So, for young people entrepreneurship doesn't sound good."*

Having been among the nations that boomed during the tech boom of the late 1990s, the Korean technology sector took a major knock with the bursting of the 2001 tech bubble. This has led to reticence on the part of young Koreans to take risks, and to calls from some of our respondents for the government to implement measures that would 'support failure'.

> *"Korea has made big success in the year 2000 – there were more than 5,000 startups in Korea – one of the reasons we became a leading country. But after that, some of them were bankrupt with the 2001 collapse of the bubble. From that, young people have learned it is dangerous and that if they have a failed startup, that they cannot make their career path. We need support for the failures – it is the major obstacle."*

> *"One of the difficulties we have, and it takes time: we need to have more entrepreneurs in Korea. In recent cultures, which shift every 10 years, the young people want to get a safe job in a big company. We need to change it by creating success stories, that's the way to diffuse the culture."*

The risks for people wishing to start businesses are significant, and with SMEs raising 99 per cent of their combined KRW 472 trillion (US$418bn) through loans, there is little chance of rebounding from bankruptcy.[44]

[44] http://www.washingtonpost.com/business/south-korean-president-park-geun-hye-has-a-start-up-plan-for-robust-economic-growth/2013/06/12/1727b276-d1d8-11e2-a73e-826d299ff459_story.html

For most young people, we were told, there was little aspiration to start up businesses, rather their preference was to secure a 'safe job' in one of the well-respected chaebol.

> *"There's a huge cultural disconnect. If you are 26-year-old uni graduate, you are not wanting to join an SME. You want to go to LG, Hyundai: to a good company with a good reputation. You won't risk joining a startup. So there's a huge disconnect between what industry and government wants, and what the public want."*

As another report recently stated: *Pundits in Korea tend to see reforming the chaebol as a separate task from Park's effort to build a 'creative economy', but it's not**. Innovative startups can't thrive as long as the chaebol continue to rely only on their in-house networks of suppliers**. Korea will never develop its own Steve Jobs or Bill Gates as long as getting a job at LG, Samsung or Hyundai remains the only acceptable goal for college graduates.*[45]

Some of the respondents talked about their work in institutions to address the barrier of a lack of entrepreneurial spirit.

> *"We're trying to do this in my university, to try to diffuse the entrepreneurship amongst young people. It will take a long time."*

The issue of entrepreneurship has been addressed in research that aims to assess and compare the entrepreneurial competitiveness of KAIST (Korea Advanced Institute of Science and Technology) and MIT (Massachusetts Institute of Technology) from entrepreneurship education and research commercialisation standpoints. The assessment results have provided KAIST with strategic directions for implementation of new measures to enhance its entrepreneurial competitiveness.[46]

MIT is held up as an example of an institution that has produced large amounts of research that have been commercialised. One of the reasons behind this is perceived to have been the levels of entrepreneurial education offered to students. Learning from this, KAIST, it is reported, has set about trying to build a similar model, comprising three key initiatives.[47]

[45] Wiliam Pesk 'Koreans Find Breaking Up With Chaebol Hard to Do', Bloomberg, 8 July 2013, http://www.bloombergview.com/articles/2013-07-08/koreans-find-breaking-up-with-chaebol-hard-to-do

[46] Hyungseok Yoon and Joosung J. Lee (2013), 'Entrepreneurship Education and Research Commercialisation of Engineering-Oriented Universities: An Assessment and Monitoring of Recent Development in Korea', https://www.academia.edu/4872225/Entrepreneurship_Education_and_Research_Commercialisation_of_Engineering-Oriented_Universities_An_Assessment_and_Monitoring_of_Recent_Development_in_Korea

[47] Byoung Yoon Kim and Sung-Mo "Steve" Kang (2014) 'From conception to reinvention: KAIST advances Korean economic development' KAIST, published in *Academic Research and Economic Development*, Volume 4, Issue 1, 2014, http://academicexecutives.elsevier.com/articles/conception-reinvention-kaist-advances-korean-economic-development

Case Study: KAIST

A new 'Startup KAIST' movement aims to nurture an entrepreneurial culture, create an ecosystem for startups and promote go-global strategies. It is challenging, encouraging and assisting young people to generate creative ideas and put them into practice, or possibly start a new industry. The idea is to create a highly supportive environment for financing, product development and manufacturing, marketing, business development and even the exit strategy.

KAIST will engage different interest groups to help the entrepreneurs. An international strategy — which includes getting financing, selling products and exiting in the global market — is a must, considering Korea's very limited domestic resources and market. KAIST plans to establish a new Institute of Entrepreneurship to coordinate existing programmes and create new functions to educate and support entrepreneurs. Eventually it can become a 'creative economy' model for all of Korea.

It is hoped that KAIST's role in creating "K-Valley" (in the R&D district known as Daedeok Science Town) will be similar to Stanford University and Silicon Valley. The area is home to 30 national research laboratories, five universities (including KAIST), and more than 1,000 companies and corporate research laboratories which can provide a synergetic environment for commercialising R&D results.

4.4.2 Financial Markets

Many of our respondents in Korea felt that a major barrier to the successful commercialisation of research was the lack of an adequate 'exit' or 'recovery' market that could provide a way for researchers to take their ideas out to investors and for investors to cash in.

> *"Another problem is the exit market. In Korea, there is no exit market besides doing an IPO (Initial Public Offering). Ideally, you want for good companies to be bought out by bigger companies, but Korea doesn't have that market, or practically none."*

> *"We need government policy to help provide the financial support. The best country in the world for this recovery market – I mean for the IP market, or merger and acquisition market is the US – the UK is also OK and China is doing well – but in Korea, the investment market is not very developed. I think the biggest impact may come from developing the technology transporting market. The major way would be to develop an M&A (mergers and acquisitions) market."*

> *"When you have big business looking to acquire SMEs and there's a lot of M&A activity, that's going to drive things."*

> *"In the US, after a venture starts, they can merge or they have an IPO. But in Korea, there is no culture of M&As and the IPOs take a long time."*

Small Domestic Market

Another perceived brake on innovation within Korea was the relatively small size of Korea's domestic market.

> *"The other thing that I think is an issue – is because Korea is in itself a small domestic market – it's sometimes very difficult to convince overseas investors to invest in Korea. It's far away and has a small domestic market. People who don't hesitate in investing in China have to figure out how to deal with that in globalising the market and the companies."*

4.5 Government Policy

As outlined earlier, the Korean Government is providing large amounts of funding for innovation and has taken a strong lead in directing where and how this funding should be spent. This was felt by our interviewees as having some distinctly positive and negative aspects including the following aspects.

4.5.1 Positive Elements

- **Creative Economy**

There was some support for President Park's 'Creative Economy' platform, at the very core of which is the idea of 'venture creation'.

> *"The first policy [to consider] is her [President's] strong initiative – the Creative Economy. And every time she mentions the core element is Venture Creation."*

More generally, a picture was painted of a forward-looking, hard-working country[48] that recognised the need to change in order to ensure future success.

> *"There's always been a fairly steady government push to enhance industry, looking at which industries to promote and always looking 10 years into the future. The attitude is, we are doing well now, so where else next? There's always a look forward, rather than just what do we need now?"*

- **Willing to Change**

Korea, we were told, was not afraid to make big changes when required.

> *"When it does take a conscious decision to do this – it throws the world at it. Korea is a place of wonderful clash – they are desperate to hold on to the past, but it's also one of the fastest developing countries in the world. They take the ball and off they go. As an observer, there's a willingness to have a go at absolutely everything. They'll identify all sorts of industry areas – there's a desire*

[48] According to a recent OECD report, Koreans are the hardest working people: In 2012, each waged Korean employee worked for 2,092 hours, which was 420 hours more than the OECD average, compared with 1,765 for Japanese workers, and 1,334 for the Dutch. Source:http://www.businesskorea.co.kr/article/3366/work-life-balance-korean-workers-show-lowest-productivity-oecd-despite-long-overtime

to be good at everything – and they will put a lot of money against a lot of problems – there is a wasteful system sometimes. But once they have something, they pool a lot of money and resources into the things that work."

Another perceived positive for Korea is its willingness to quickly absorb new technologies.

"New technologies are so rapidly integrated; they're five years ahead of everything else in terms of test systems. They can quickly figure it out and they are willing to take the risks. Government can support large risks in technology. So there is rapid prototyping in market places – they are quick to find out what works…whatever they are doing here, they are just able to significantly shorten the trial and error processes…it would need an economist or an organisational behaviourist or social scientist type to see what are the real reasons behind all of this."

- **Encouraging Foreign Investment**

Moves to expand Korea's market opportunities by opening it up to overseas investment (as reported, currently a tiny proportion of R&D spending) are welcomed.

"The government is enhancing and encouraging programme startups to go abroad for big success with proper financial and marketing support through global partnerships. That is the most important thing considering the small market in Korea."

4.5.2 Negative Elements

- **Support for Failure**

A few people mentioned the need for more support for 'failure', for example easing some of the stipulations required for bank loans, making potential entrepreneurs less likely to fear losing everything if their investments did not work out. The government was, reportedly, starting to introduce these kinds of policies.

"The government needs to start to support for the failure, so when they borrow money from the bank, up to now every entrepreneur must provide the security. And now the government is releasing that regulation."

"For small business they use their houses as collateral. What we need is a venture business."

- **Removal of regulations**

Korea is, apparently, trying to remove regulation, including any that might restrict the commercialisation of research, including those relating to KOSDAQ.[49]

> *"It's interesting seeing what we are doing around better regulation. There's a one in-two out with regard to policies and that's being rolled that out across the whole government and every ministry, being asked to remove unnecessary regulation."*

> *"The government is re-regulating KOSDAQ, so less regulation and more flexibility. It was bigger than AIM in 2000. It will grow again."*

- **Lack of coordination**

As reported, the Korean Government has the world's highest level of government expenditure on R&D (1 per cent of GDP). However, according to some of our respondents, the spending is spread across too many ministries and, therefore, is not as effective as it might be.

> *"In Korea, the government invests more than 1 per cent to R&D to investment – it's the highest in the world. But it isn't very coordinated. It is divided by many different departments – technology, defence – more than 10 ministers. It does need coordination…It is impossible to focus it, there are many different objectives of the research project. We need one coordinating person just like the Office of the Chief Scientist in Israel."*

Another respondent was more brutal in his assessment – he thought that the government was talking too much but not doing enough.

> *"There are too many people talking about it in Korea. The current government is pushing for a Creative Economy and so everybody's talking about it, including the government officers. It's good that the government and a lot of policymakers realise what needs to be done and what's important – but I don't feel that they know how to do it."*

- **Interventionist/micromanagement**

Among our respondents, there was widespread concern that the Korean Government was too involved in the issues of innovation and that this was not an efficient or effective way to bring new ideas to the market.

> *"The government way is to zigzag. They are not like the private sector, which is more likely to go directly to the answer. They [the government] want to be involved in all the decisions that are being made."*

> *"What you don't see here is a very strong autonomous decision basis for scientific research. It's a bit similar to the way the European programmes work. The broad programmes are selected from the top."*

[49] KOSDAQ is a trading board, originally set up as a separate entity from the Korean Exchange and benchmarked from the NASDAQ. It now operates as an SME markets division of the Korean Exchange.

Another issue was the Korean Government's tendency to try to 'pick a winner': this was contrasted with the US approach, where as it was described to us, from the outset there is more competition, which ultimately results in better outcomes.

> *"Once we select one research project – we select only one, there is no competition. In the US, they select three or four and after a year they select two. And then, finally, they select one. We need competition."*

> *"The government is putting a lot of effort into directing the researchers in HEIs and GRIs and often the companies. The Korean Government is much more into directing the money and managing the money and the policy, which I think is a bad idea. It was a good idea 30 to 40 years ago when Korean industry and the infrastructure were not very strong. But the best way now is for the government to provide the environment and resources to the groups of people or institutions to determine their ways and plans to commercialise the technology or do the R&D – rather than government managing the detail of where it should be spent …that model of government intervention worked very well for the initial industrialisation. It's different now and the companies know better and the researchers even know better…"*

There was some cynicism about the government's claims to have a 95 per cent success rate at choosing projects – 'success' being something that was adjudicated by experts who had been selected by the government and, therefore, might not be completely independent in their appraisal. One such example was the investment in the International Science Business Belt (ISBB).

> *"The ISBB is a monumental investment. It's US$3 billion over five years, they're building a particle accelerator and chucking a lot of money at it. There are differing opinions as to whether it's worthwhile. There is an argument that it's taking money away from basic research, while others are saying it's next best thing since tinned spam. It's been quite controversial – my opinion is I think it's a smart move."*

The situation was contrasted with that of China.

> *"And China is doing it pretty well, even though it's a communist government, the ways the markets manage this, the way the companies run is very capitalistic. There's a lot of political agenda happening around this movement in high technology startup business. "*

There was a concern that the government's spending had distorted the market.

> *"The traditional channels where the investors can cash in – more than half is government money; they put money into these capital investment funds and they pick the companies."*

> *"Government always wants to pick the sectors – sometimes they pick the wrong sector and they waste the money. The idea of governments picking winners – for economists, that's ludicrous. You need to leave it venture businesses."*

- **Political and Short-Term**

One of the problems with government being so closely involved in the area was that it brought issues of science, technology and innovation too closely into the political sphere. The short-term machinations could have a negative impact on the long-term policy requirements of the issues of commercialisation.

> *"Not many higher-ranking government officers stay in the position for more than a year. Most of their objectives are very short-term projects and the commercialisation of technology is not a short-term project. It's a long-term project, because in different cultures, you first have to create a culture in which people will try adventurous things."*

> *"Every president reorganises it a bit – they are in the same building as before but they just changed their name. Every new president wants to make their mark, so they spend the first five years moving the chairs around."*

Another political obstacle within Korea was the historic division between Science/Technology and Education.

- **Startup Market Fund**

Instead, it was argued, the government should leave the decisions to the market.

> *"They should have a 'create fund' for startup companies and let the market play the role of commercialising the product."*

> *"I completely agree that the country has to go for many startup companies. There are important government roles, like regulation and appropriately changing the rules and managing the rules and becoming an umpire for everyone to keep the rules. They need to create initial funds until the market catches up – until the investment funds can be formed naturally in the market. They can play an initial role – but it's not appropriate for the government to come up with schemes of how to do it and to choose WHO should be involved, because it will turn out to be not very productive – I believe in the market."*

- **Efficiency Versus Regional Considerations**

One of the challenges reportedly faced by the Korean Government was how to run the most efficient ecosystem while providing support for regional areas. An issue raised earlier in the report and one where the government is currently allocating funds to address.

> *"The top 10 universities – they're all in Seoul. The others are out in the backwaters and there's great pressure to keep them for regional development. So, the government wants to disperse education around the country to try to drive regional development. They're faced with a choice of trying to make best universities better or helping the backward regions to develop."*

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