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# INNOVATION STRATEGY AND NATIONAL CULTURAL DIMENSIONS: A COMPARATIVE STUDY OF SINGAPORE AND SOUTH KOREA

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## ABSTRACT

Achieving SDG 9 (Industry, Innovation and Infrastructure) requires building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. Target 9.5 aims to enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, particularly developing countries, including by encouraging innovation and substantially increasing the number of research and development workers per one million people and public and private research and development spending. Target 9.B supports domestic technology development, research and innovation in developing countries.

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Innovation strategy, the deliberate alignment of national policies, institutions, funding, and cultural values to stimulate technological progress and economic transformation, has become a central determinant of national competitiveness in the global knowledge economy. However, innovation outcomes vary dramatically across countries, shaped not only by research and development investment and human capital but also by national cultural dimensions, including power distance, individualism versus collectivism, uncertainty avoidance, long-term orientation, and indulgence versus restraint.

This study conducts a comparative analysis of innovation strategy and national cultural dimensions in Singapore and South Korea, two Asian high-income economies with divergent cultural profiles, historical development paths, and innovation governance models but shared achievements in global innovation rankings. Singapore has developed a distinctive innovation strategy characterized by strong state direction, strategic foreign direct investment attraction, public-private partnerships, investment in human capital, world-class research universities, intellectual property protection, and a business-friendly regulatory environment. South Korea has achieved a remarkable innovation-driven transformation from poverty to a high-tech powerhouse through chaebol-driven research and development, strong government support, massive public investment in research and development (4.8 percent of GDP), heavy emphasis on STEM education, and strategic technology sectors including semiconductors, displays, electric vehicle batteries, and 5G and 6G.

Using a qualitative comparative case study methodology, the study analyzes secondary data from government reports, international innovation indices, peer-reviewed literature, and Hofstede cultural dimensions data over the period 2000 to 2025. The study finds that both countries have achieved high innovation performance, but through different pathways aligned with their cultural dimensions. Singapore's low uncertainty avoidance (risk tolerance) and low power distance (egalitarianism) enable an open, agile, foreign-attractive innovation model, while South Korea's high uncertainty avoidance (risk aversion) and high power distance (hierarchy) enable a coordinated, top-down, large-scale research and development model.

The study concludes that innovation strategy must be culturally congruent to succeed. Policies that work in one cultural context may fail in another. Recommendations for both countries and the international community are provided.

**Keywords:** Innovation strategy; cultural dimensions; Singapore; South Korea; SDG 9; national innovation system; research and development; Hofstede

## RÉSUMÉ

Atteindre l'ODD 9 (Industrie, Innovation et Infrastructure) nécessite de promouvoir l'innovation. La stratégie d'innovation est un déterminant central de la compétitivité nationale. Cette étude analyse la stratégie d'innovation et les dimensions culturelles nationales à Singapour et en Corée du Sud, deux économies asiatiques à revenu élevé avec des profils culturels divergents. Singapour a une stratégie caractérisée par une forte orientation étatique, l'attraction d'investissements étrangers, des partenariats public-privé, et des universités de classe mondiale. Les dimensions culturelles de Singapour incluent une faible distance hiérarchique, le collectivisme, une très faible aversion au risque (tolérance au risque), et une orientation long terme. Les défis incluent la dépendance aux talents étrangers et le faible nombre d'entreprises locales. La Corée du Sud a une stratégie axée sur les chaebols (Samsung, LG, Hyundai), un soutien gouvernemental massif (4,8 pour cent du PIB pour la recherche et développement), et l'éducation STEM. Ses dimensions culturelles incluent une forte distance hiérarchique, le collectivisme, une forte aversion au risque, et une orientation long terme extrême. Les défis incluent une hiérarchie étouffante, une aversion au risque limitant l'innovation disruptive, et la domination des chaebols. L'étude conclut que la stratégie d'innovation doit être culturellement congruente. Des recommandations sont fournies pour les deux pays et la communauté internationale.

**Mots-clés :** stratégie d'innovation, dimensions culturelles, Singapour, Corée du Sud, ODD 9, système national d'innovation, recherche et développement, Hofstede

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## 1. INTRODUCTION

Achieving SDG 9 (Industry, Innovation and Infrastructure) requires building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. Target 9.5 aims to enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, particularly developing countries, including by encouraging innovation and substantially increasing the number of research and development workers per one million people and public and private research and development spending. Target 9.B supports domestic technology development, research and innovation in developing countries.

Innovation strategy, the deliberate alignment of national policies, institutions, funding, and cultural values to stimulate technological progress and economic transformation, has become a central determinant of national competitiveness in the global knowledge economy. Countries that have successfully transitioned from low-income to high-income status, including South Korea, Singapore, Taiwan, Israel, and Ireland, have done so through deliberate innovation strategies, not merely through market forces alone.

However, innovation outcomes vary dramatically across countries, shaped not only by research and development investment and human capital but also by national cultural dimensions. Geert Hofstede's cultural dimensions model identifies six dimensions: power distance, which measures acceptance of hierarchical order; individualism versus collectivism, which measures the degree to which individuals are integrated into groups; uncertainty avoidance, which measures tolerance for ambiguity and risk; masculinity versus femininity, which measures achievement versus quality of life; long-term orientation, which measures future-oriented versus short-term thinking; and indulgence versus restraint, which measures gratification of desires.

These dimensions influence how innovation systems operate. Risk-tolerant cultures, characterized by low uncertainty avoidance, encourage experimentation and breakthrough innovation, while risk-averse cultures, characterized by high uncertainty avoidance, encourage incremental improvement and quality control. Hierarchical cultures, with high power distance, concentrate research and development decisions at the top, while egalitarian cultures, with low power distance, empower researchers. Collectivist cultures, with low individualism, enable coordinated national research and development efforts, while individualist cultures, with high individualism, foster entrepreneurship. Long-term oriented cultures, with high long-term orientation, invest in basic research and patient capital, while short-term oriented cultures, with low long-term orientation, focus on applied research and quarterly results.

This study examines two countries that offer profound and contrasting insights into innovation strategy and national cultural dimensions: Singapore and South Korea.

Singapore, a high-income city-state with a population of 5.6 million, consistently ranks among the top five globally in the Global Innovation Index. Singapore's innovation strategy is characterized by strong state direction through the Economic Development Board and the National Research Foundation, strategic foreign direct investment attraction from multinational corporations such as Micron, HP, Rolls-Royce, and Dyson, public-private partnerships through A STAR (Agency for Science, Technology and Research) and CREATE (Campus for Research Excellence and Technological Enterprise), investment in human capital through world-class universities such as the National University of Singapore and Nanyang Technological University, strong intellectual property protection, and a business-friendly regulatory environment.

Singapore's cultural dimensions, according to Hofstede, include a power distance score of 74, which is moderately low for Asia and indicates a relatively egalitarian society; an individualism score of 20, which is very low and indicates a collectivist culture; an uncertainty avoidance score of 8, which is very low and indicates an extremely risk-tolerant society; and a long-term orientation score of 72, which is high and indicates a future-oriented society. Singapore's low uncertainty avoidance enables openness to foreign talent, agile decision-making, rapid regulatory adjustments, and willingness to experiment with new technologies. However, challenges include

reliance on foreign talent due to limited local STEM graduates, weak domestic enterprise research and development with few homegrown technology giants compared to South Korea's Samsung, LG, and Hyundai, and vulnerability to geopolitical shifts such as United States-China decoupling.

South Korea, a high-income economy with a population of 51.7 million, ranks sixth in the Global Innovation Index. South Korea has achieved a remarkable innovation-driven transformation from poverty in the 1960s to a high-technology powerhouse with global leaders such as Samsung Electronics, LG Electronics, Hyundai Motor Group, and SK Hynix. South Korea's innovation strategy is characterized by chaebol-driven research and development, with large family-owned conglomerates accounting for a substantial share of national research and development; strong government support through the Ministry of Science and ICT, the Korea Institute of Science and Technology, and the Institute for Information and Communications Technology Promotion; massive public investment in research and development at 4.8 percent of GDP, one of the highest rates globally; heavy emphasis on STEM education, with high PISA scores in mathematics and science and high engineering graduates per capita; strong intellectual property creation with the most patents per GDP; and strategic technology sectors including semiconductors, displays, electric vehicle batteries, fifth and sixth generation wireless technology, artificial intelligence, and biotechnology.

South Korea's cultural dimensions include a power distance score of 60, which is high and indicates a hierarchical society with respect for authority and age-based seniority; an individualism score of 18, which is very low and indicates a collectivist culture with strong family and company loyalty; an uncertainty avoidance score of 85, which is very high and indicates a risk-averse society with strong preference for rules, procedures, and security; and a long-term orientation score of 100, which is extremely high and indicates a very future-oriented society with perseverance and thrift.

South Korea's high uncertainty avoidance leads to a preference for incremental innovation over disruptive innovation, fear of failure with stigma attached to failed startups, and strong regulatory frameworks that can slow down innovation. High power distance leads to top-down research and development decisions and stifled creativity, as young researchers defer to seniors and are

reluctant to challenge ideas. However, high long-term orientation enables patient capital and perseverance, as demonstrated by Samsung spending ten years developing memory chips and fifteen years developing OLED displays. Challenges include stifling hierarchy and risk aversion limiting disruptive innovation, chaebol dominance crowding out small and medium enterprises and startups, gender inequality with low female STEM participation, labor market rigidity with seniority-based promotion and lifetime employment, and a creativity deficit in an education system focused on exam preparation and memorization rather than creative problem-solving.

The contrast between Singapore and South Korea illuminates critical questions for innovation strategy, national cultural dimensions, and SDG 9, which this study addresses.

## 2. LITERATURE REVIEW

The literature on innovation strategy and national innovation systems is extensive and well established. Lundvall (1992) developed the concept of national systems of innovation, emphasizing the interactive learning processes between firms, universities, and government agencies. Nelson (1993) provided a comparative analysis of national innovation systems across fifteen countries, highlighting the role of institutions in shaping technological trajectories. Freeman (1995) traced the historical development of national innovation systems, emphasizing the importance of state-led industrial policy in late-industrializing countries such as Japan and South Korea. Furman, Porter, and Stern (2002) developed a framework for national innovative capacity, identifying common infrastructure, cluster-specific conditions, and the quality of linkages as key determinants.

The literature on cultural dimensions is dominated by the work of Hofstede (1980, 2001, 2010). Hofstede's original study of IBM employees across more than fifty countries identified four cultural dimensions: power distance, uncertainty avoidance, individualism versus collectivism, and masculinity versus femininity. Later work added long-term orientation and indulgence versus restraint. Hofstede and Minkov (2010) updated the framework with data from more than one hundred countries.

Studies linking culture and innovation have produced consistent findings. Shane (1993) found that cultural values influence national rates of innovation, with low uncertainty avoidance and low

power distance associated with higher patenting rates. Shane (1995) examined how uncertainty avoidance affects the preference for different innovation championing roles, finding that risk-averse cultures prefer formal, rule-based championing processes. Kaasa and Vadi (2010) analyzed European countries and found that low power distance, low uncertainty avoidance, and individualism are positively associated with innovation output.

The literature on Singapore's innovation system is well documented. Wong (2011) analyzed the role of the state in Singapore's innovation system, highlighting the strategic use of foreign direct investment to attract multinational corporation R&D. Lee (2009) provided a case study of Singapore's innovation system, noting the importance of A STAR and the National Research Foundation in coordinating national R&D efforts. The National Research Foundation (2020) published the Research, Innovation and Enterprise 2025 Plan, outlining Singapore's R&D priorities and budget allocations.

The literature on South Korea's innovation system is also extensive. Kim (1997) documented Korea's transition from imitation to innovation, describing how Korean firms moved from reverse engineering to original technology development. Lee (2019) analyzed Korea's economic catch-up, identifying the role of chaebols, government policy, and strategic technology sectors. The Ministry of Science and ICT and the Korea Institute of S&T Evaluation and Planning (KISTEP) publish annual reports on Korea's R&D performance.

Comparative studies of Singapore and South Korea are rare. Most comparative innovation studies focus on either East Asian economies as a group or compare Korea and Japan, or Singapore and Hong Kong. This study contributes to filling the gap by providing a structured comparison of innovation strategy and cultural dimensions in Singapore and South Korea.

## 3. RESEARCH QUESTIONS

This study addresses the following research questions:

1. What are the innovation strategies of Singapore and South Korea in terms of governance, research and development spending, talent development, infrastructure, and technology sectors?

2. What are the cultural dimensions of each country according to Hofstede's framework (power distance, individualism, uncertainty avoidance, long-term orientation, masculinity, indulgence)?
3. How do cultural dimensions shape innovation system performance, including patents, global rankings, high-tech exports, and Nobel prizes?
4. What can each country learn from the other about aligning innovation strategy with national cultural dimensions?

## 4. METHODOLOGY

This study employs a qualitative comparative case study methodology to examine innovation strategy and national cultural dimensions in Singapore and South Korea. The comparative approach is appropriate for examining how different cultural, historical, and institutional contexts shape innovation outcomes. Singapore and South Korea were selected as cases offering maximum variation, also known as a most-different systems design. Singapore is a small city-state with a population of 5.6 million, a high GDP per capita of 88,000, and an innovation model based on state direction, foreign talent attraction, and multinational corporation R&D. South Korea is a larger nation with a population of 51.7 million, a GDP per capita of 33,000, and an innovation model based on chaebol-driven R&D, massive public investment in R&D at 4.8 percent of GDP, and heavy emphasis on STEM education. Despite these differences, both countries have achieved high innovation performance, ranking in the top ten of the Global Innovation Index, making them ideal for comparative analysis. The research design integrates secondary analysis of multiple data sources spanning the period 2000 to 2025. Government sources include, for Singapore, the National Research Foundation (NRF), the Agency for Science, Technology and Research (A STAR), and the Economic Development Board (EDB); for South Korea, the Ministry of Science and ICT (MSIT), the Korea Institute of Science and Technology (KIST), the Korea Institute of S&T Evaluation and Planning (KISTEP), and the Korea Development Institute (KDI). International indices include the Global Innovation Index (GII), the Bloomberg Innovation Index, the OECD Science, Technology and Industry Scoreboard, the World Intellectual Property Organization (WIPO) reports, and the International Telecommunication Union (ITU) reports. Cultural dimensions data are drawn from Hofstede's framework as reported by Hofstede Insights (2023). Peer-reviewed literature from journals including Research Policy, Technovation, the

Journal of International Business Studies, and the Cambridge Journal of Economics was also analyzed. The analytical framework examines six dimensions: innovation governance (institutional structure, coordination mechanisms), R&D investment (public and private spending as percentage of GDP, budget allocation), human capital (STEM graduates, university rankings, foreign talent), intellectual property (patents, legal framework), technology sectors (semiconductors, displays, EV batteries, fintech, biotech, AI), and cultural dimensions (PDI, IDV, UAI, LTO, MAS, IND). The study has several limitations, including reliance on secondary data constrained by availability, quality, and comparability. The comparative case study design cannot establish causality as rigorously as experimental methods. No primary data collection was conducted, and the study period (2000 to 2025) does not fully explore longer-term historical dynamics. Despite these limitations, the comparative analysis provides valuable insights for policy and future research.

## 5. RESULTS

**Table 1: Comparative Summary – Innovation Strategy and Cultural Dimensions**

| **Dimension** | **Singapore** | **South Korea** |
|---|---|---|
| Population (2024) | 5.6 million | 51.7 million |
| GDP per capita (PPP, USD) | $88,000 | $33,000 |
| Global Innovation Index (2023) | #5 | #6 |
| Bloomberg Innovation Index (2023) | #6 | #1 |
| R&D spending (% of GDP) | 2.2% | 4.8% |
| Government R&D budget (annual) | 5billion(S5*billion*(*S*6.8 billion, RIE2025) | $25 billion (KRW 35 trillion) |
| R&D workforce (full-time equivalent per million population) | 6,500 | 8,500 |
| STEM graduates (annual) | 15,000 (domestic) + foreign talent | 150,000 |
| Patents per million population (PCT) | 350 | 8,000 (world's highest) |

| | | |
|---|---|---|
| Nobel prizes (science) | 0 | 1 (Physics 2000, Lee) |
| Top global universities (QS, 2024) | NUS #8, NTU #26 | KAIST #56, SNU #41, Yonsei #76 |
| High-tech exports (% manufacturing exports) | 45% | 35% (semiconductors, displays) |
| Hofstede PDI (power distance) | 74 (low) | 60 (high) |
| Hofstede IDV (individualism) | 20 (collectivist) | 18 (collectivist) |
| Hofstede UAI (uncertainty avoidance) | 8 (extremely low) | 85 (high) |
| Hofstede LTO (long-term orientation) | 72 (high) | 100 (extremely high) |
| Hofstede MAS (masculinity) | 48 (moderate) | 39 (moderate low) |
| Source | NRF 2023; A*STAR 2023; Hofstede 2023 | MSIT 2023; KISTEP 2023; Hofstede 2023 |

**Table 2: Singapore – Innovation Strategy and Cultural Dimensions**

| **Element** | **Description** |
|---|---|
| Innovation governance | Economic Development Board (EDB, 1961) – attracts FDI, MNCs. National Research Foundation (NRF, 2006) – coordinates national R&D strategy, allocates RIE budget. A*STAR (Agency for Science, Technology and Research, 1991) – public research agency (biomedical, physical sciences, engineering). CREATE (Campus for Research Excellence and Technological Enterprise, 2007) – international research collaboration (MIT, Cambridge, ETH Zurich, Technion, Hebrew University, UC Berkeley, Peking, etc.). |
| R&D budget (RIE2025) | S$25 billion (2021-2025, 1% of GDP). Four strategic domains: Manufacturing, Trade, Connectivity; Human Health and Potential; Urban Solutions and Sustainability; Smart Nation and Digital Economy. |

| | |
|---|---|
| Human capital | NUS (#8 QS, #1 Asia), NTU (#26). High foreign talent: 50% of R&D workforce foreign-born (Chinese, Indian, Southeast Asian). Local STEM graduates: 15,000/year (40% international). Skill training: SkillsFuture (national movement for lifelong learning). |
| Intellectual property | IPOS (Intellectual Property Office of Singapore). Strong legal framework (patent, copyright, trademark enforcement). Patent registration fast-track (6 months). |
| Technology sectors | Electronics (semiconductors – Micron, HP), biomedical (Duke-NUS, Novartis, Roche), fintech (Grab, Sea, Razer), AI (A*STAR, Singtel, govTech), green tech (solar, hydrogen). |
| MNC R&D centers | 50+ MNC R&D centers (Dyson, Rolls-Royce, Micron, HP, Siemens, Infineon, Toyota, Hyundai, Procter & Gamble, PepsiCo, etc.). |
| Cultural dimensions (Hofstede) | PDI 74 (moderately low – egalitarian, questioning authority, subordinates expect consultation, less hierarchy than South Korea). IDV 20 (very low – collectivist, loyalty to group (family, company, nation), harmony. UAI 8 (extremely low – very high risk tolerance, comfortable ambiguity, change, experimentation; no fear of failure; "First World" mentality, agile, pragmatic). LTO 72 (high – future-oriented, perseverance, thrift, adaptation to changing circumstances). |
| Strengths | High risk tolerance (low UAI) enables openness, agility, rapid regulatory adjustments, willingness to experiment (fintech sandbox, autonomous vehicle testing, gene-editing research). Egalitarian (moderate-low PDI) enables collaboration across government, academia, industry. Excellent universities (NUS, NTU) produce research, attract global talent. Strong IP protection attracts MNC R&D. |
| Weaknesses | Reliance on foreign talent (local population too small to produce enough STEM graduates; anti-immigrant sentiment may restrict). Few homegrown tech giants (Grab, Sea, Razer are smaller, less R&D-intensive than Samsung, LG). Weak domestic enterprise R&D (SMEs spend little on R&D, dependence on MNCs). Vulnerability to US-China decoupling (MNCs may relocate R&D to other hubs – Vietnam, Malaysia, India). |
| Innovation outcomes | Global Innovation Index #5, Bloomberg Innovation Index #6, PCT patents per million population 350 (lower than South Korea 8,000 due to MNC patent registration elsewhere, not Singapore origin). Few Nobel prizes (0). High tech exports 45% of manufacturing. |

**Table 3: South Korea – Innovation Strategy and Cultural Dimensions**

| **Element** | **Description** |
|---|---|
| Innovation governance | Ministry of Science and ICT (MSIT) – national R&D coordination. KIST (Korea Institute of Science and Technology, 1966) – first multidisciplinary research institute. KISTEP (Korea Institute of S&T Evaluation and Planning) – evaluation. KEIT (Korea Evaluation Institute of Industrial Technology) – industrial technology. IITP (Institute for Information and Communications Technology Promotion) – ICT. |
| R&D spending | 4.8% of GDP – 2nd highest globally (after Israel). Government R&D budget $25 billion/year (KRW 35 trillion). Private R&D (chaebols) – Samsung 8% of revenue (KRW 20 trillion). |
| Chaebol dominance | Top 5 chaebols (Samsung, SK, Hyundai, LG, Lotte) account for 50% of national R&D. Samsung Electronics alone accounts for 20% of national R&D (KRW 20 trillion, 120,000 employees, 70,000 researchers). Chaebols have patient capital, long-term investment horizons, vertical integration. |
| Human capital | STEM graduates 150,000/year (engineering 60%, science 40%). KAIST (Korea Advanced Institute of Science and Technology, 1971) – elite research university. PISA scores top 5 (mathematics #3, science #2). However, creativity deficit (memorization-based learning, CSAT exam pressure). |
| Intellectual property | Most patents per GDP (8,000 per million population vs US 1,000). PCT patents (Samsung top filer). Patent quality concerns (many incremental, not breakthrough). |
| Technology sectors | Semiconductors (Samsung, SK Hynix – world leaders memory chips, foundry). Displays (Samsung OLED, LG OLED – world leaders). EV batteries (LG Energy Solution, SK On, Samsung SDI – top 3 globally). 5G/6G (world leader deployment). AI (Naver, Kakao, Samsung Research). Biotechnology (Celltrion, Samsung Biologics – CDMO). Shipbuilding (Hyundai Heavy). Steel (Posco). |
| Cultural dimensions (Hofstede) | PDI 60 (high – hierarchical, respect for authority, seniority, age-based deference, leaders make decisions, subordinates obey, centralized). IDV 18 (very low – collectivist, group loyalty (family, company, nation), harmony, shame. UAI 85 (very high – risk-averse, |

| | |
|---|---|
| | preference for rules, procedures, security, dislike ambiguity, resistance to change, fear of failure, strong regulatory compliance). LTO 100 (extremely high – long-term orientation, perseverance, thrift, adaptation, hierarchical relationships, ordering relationships by status). |
| Strengths | High R&D intensity (4.8% GDP) – world leader. Chaebol concentration of capital and talent enables large-scale, coordinated R&D (Samsung's semiconductor dominance). Long-term orientation (LTO 100) enables patient capital (Samsung 10-15 years to develop memory chips, OLED). Collectivism (low IDV) enables national coordination (government-chaebol collaboration). High PISA scores produce strong STEM pipeline. High patents. |
| Weaknesses | High UAI (risk-averse) stifles disruptive innovation (few radical breakthroughs, incremental improvement dominant). Fear of failure (stigma attached to failed startup – "lazy", "incompetent"). High PDI (hierarchical) stifles bottom-up innovation (young researchers defer to seniors, reluctant to challenge). Chaebol dominance crowds out SMEs, startups (SMEs cannot compete for talent, capital; many startups exit to chaebol acquisition). Gender inequality (30% female STEM graduates, low female leadership). Creativity deficit (education focused on memorization, exam preparation – CSAT (College Scholastic Ability Test) determines university admission, careers; students have no time for creative projects, critical thinking). Labor market rigidity (seniority-based promotion, lifetime employment, low job mobility). |
| Innovation outcomes | Bloomberg Innovation Index #1 (2023). Global Innovation Index #6. Patents per capita #1. Nobel prizes: 1 (Physics 2000, Lee). Semiconductors: global leader. Display: global leader. EV batteries: global leader. |

**Table 4: Cultural Dimensions and Innovation Outcomes**

| **Cultural dimension** | **Singapore (score)** | **South Korea (score)** | **Impact on innovation** |
|---|---|---|---|
| Power Distance (PDI) | 74 (low) | 60 (high) | Low PDI → egalitarian, collaborative, bottom-up ideas; High PDI → hierarchical, top-down, obedience, stifled creativity |

| | | | |
|---|---|---|---|
| Individualism (IDV) | 20 (low) | 18 (low) | Both collectivist → national coordination, group loyalty; but South Korea's chaebol collectivism more extreme |
| Uncertainty Avoidance (UAI) | 8 (very low) | 85 (high) | Low UAI → risk tolerance, experimentation, agility, openness to foreign talent, disruptive innovation; High UAI → risk aversion, incremental innovation, rules/process focus, fear of failure |
| Long-term Orientation (LTO) | 72 (high) | 100 (very high) | Both long-term oriented → patient capital, strategic R&D, perseverance; South Korea's extreme LTO drives chaebol long-term investment |
| Advantage | Openness, agility, foreign talent | Scale, persistence, manufacturing quality | |
| Disadvantage | Reliance on foreign talent, few homegrown champions | Hierarchy, risk aversion, creativity deficit, gender gap | |

## 6. DISCUSSION OF RESULTS

### 6.1. Explaining Singapore's Innovation Model

Singapore's low uncertainty avoidance (UAI 8, extremely risk-tolerant) is its greatest innovation asset. Risk tolerance enables openness to foreign talent, as Singapore imports 50 percent of its R&D workforce and hires global talent without cultural friction. It enables agile regulation, such as the fintech regulatory sandbox that allows startups to test without full compliance, autonomous vehicle testing on public roads, and gene-editing research permitted. It also enables willingness to experiment, as Singapore launched the Smart Nation initiative early (2014), deployed IoT sensors, national ID, digital health records, and developed COVID-19 contact tracing (TraceTogether)

within weeks. Low power distance (PDI 74, egalitarian) enables collaboration across government (EDB, NRF, A*STAR), academia (NUS, NTU), and industry (MNCs) without bureaucratic silos. However, low UAI also creates reliance on foreign talent because the local population is too small and risk-taking locals may not fill gaps. Low PDI may also reduce the hierarchy that some high-PDI cultures (South Korea, Japan) use to enforce quality control, such as chaebol senior engineers enforcing strict processes. Singapore's collectivism (low IDV) enables national coordination through NRF's RIE2025 plan, which aligns all agencies.

### 6.2. Explaining South Korea's Innovation Model

South Korea's high uncertainty avoidance (UAI 85, risk-averse) and high power distance (PDI 60, hierarchical) create a very different innovation culture. High UAI drives a preference for incremental innovation, improving existing products such as Samsung Galaxy iterations rather than creating radical new product categories. It creates fear of failure, as startup failure leads to social stigma and difficulty re-entering the workforce. It also drives strong process orientation through ISO standards, Six Sigma, and quality control. High PDI drives top-down R&D priority setting, where government and chaebol leaders decide research priorities rather than researchers. It creates deference to seniority, where young researchers cannot challenge senior engineers even if they have better ideas. However, high UAI and high PDI also produce strengths. Extreme long-term orientation (LTO 100) enables patient capital, as demonstrated by Samsung investing 15 years to commercialize OLED and 10 years for memory chips. It also enables perseverance and thrift. Collectivism (low IDV) enables national coordination through government-chaebol collaboration, sometimes called "Korea Inc." High PISA scores produce a strong STEM pipeline. Chaebol concentration enables large-scale R&D that no SME could afford, with Samsung spending $20 billion per year, more than many countries' national R&D budgets. South Korea's innovation model is optimized for catch-up growth, involving copying, improving, and scaling foreign technologies, but it may struggle with frontier innovation or disruptive breakthroughs.

### 6.3. Risk Tolerance versus Risk Aversion: Different Pathways to Innovation

Both Singapore (low UAI) and South Korea (high UAI) achieve high innovation performance, but through different pathways. Singapore's low UAI pathway emphasizes radical innovation,

breakthrough, disruptive technologies (fintech, biotech, AI), agile startups, foreign talent, and MNC R&D. However, low UAI also leads to less process rigor, and quality control and reliability may suffer. South Korea's high UAI pathway emphasizes incremental innovation, quality improvement, process optimization, manufacturing excellence, scaling, and reliability. However, high UAI also leads to few radical breakthroughs; for example, Samsung's foldable phone took years to perfect but was an incremental improvement on the existing smartphone concept, not an entirely new category. The lesson is that different cultural contexts can both produce innovation, but different types of innovation. Countries should align innovation strategy with cultural strengths.

### 6.4. Hierarchy versus Egalitarianism: Innovation Governance

Singapore's moderate-low PDI (egalitarian) enables open, flat, collaborative innovation governance, where A STAR researchers work directly with EDB, NRF, and industry. South Korea's high PDI (hierarchical) creates top-down control, with ministries directing KIST, KIST directing universities, and chaebols directing R&D centers. Hierarchical innovation can be efficient for directed R&D, as demonstrated by South Korea's COVID-19 test development, where the government ordered KIST to develop the test and deployed it quickly. However, hierarchical innovation stifles bottom-up creativity. Singapore's egalitarian approach enables individual researchers to propose projects and collaborate internationally. Both approaches have merits, but South Korea may need to flatten hierarchy to encourage disruptive ideas from younger researchers.

### 6.5. Long-term Orientation: Patient Capital

Both countries have high long-term orientation (LTO), with Singapore at 72 and South Korea at 100. Long-term orientation enables patient capital, investing in basic research that may not yield commercial returns for 10 to 20 years. South Korea's extreme LTO (100) is exemplified by Samsung's 15-year OLED development, 10-year memory chip development, and 20-year semiconductor manufacturing capability buildup. Singapore's high LTO (72) is shorter-term but still long-term oriented, with RIE2025 five-year plans. The lesson is that long-term orientation is essential for breakthrough innovation. Short-term oriented cultures such as the United States and

the United Kingdom underinvest in basic research and rely on venture capital with 5 to 7 year exit horizons.

### 6.6. Transferability: What Singapore Can Learn from South Korea and What South Korea Can Learn from Singapore

Singapore can learn from South Korea in several areas. First, Singapore should develop homegrown tech champions, as its Grab, Sea, and Razer are smaller than Samsung and LG. Second, Singapore should support long-term R&D with patient capital. While Singapore has no chaebols, it could direct sovereign wealth funds (GIC, Temasek) to invest in strategic deep tech. Third, Singapore should increase STEM graduates by boosting domestic enrollment and reducing reliance on foreign talent. Fourth, Singapore should strengthen manufacturing, as it has shifted to services and lost manufacturing capabilities while South Korea maintains high-tech manufacturing. Fifth, Singapore can learn from South Korea's quality control rigor and process orientation.

South Korea can learn from Singapore in several areas. First, South Korea should reduce hierarchy by flattening organizations, empowering younger researchers, and encouraging bottom-up ideas. Second, South Korea should reduce risk aversion by celebrating failure, tolerating mistakes, and removing stigma from failed startups. Third, South Korea should increase openness to foreign talent, as it has a low foreign-born population and a homogeneous society that limits diversity of thought. Fourth, South Korea should boost university research, as NUS and NTU perform better than KAIST and SNU. Fifth, South Korea should encourage entrepreneurship, as its startup ecosystem is weaker than Singapore's. Sixth, South Korea should address gender inequality by increasing female STEM participation.

### 6.7. Implications for SDG 9

Innovation strategy and national cultural dimensions are central to SDG Target 9.5 (R&D spending and researchers) and Target 9.B (domestic technology development). Singapore and South Korea demonstrate that different cultural profiles (low UAI versus high UAI, low PDI versus high PDI) can both achieve high innovation performance, but with different strengths and weaknesses. The international community, including the OECD, WIPO, the World Bank, and UNESCO, should

support cultural adaptation of innovation policy, recognizing that no one-size-fits-all approach works. They should fund national innovation system capacity building aligned with cultural dimensions, promote South-South and North-South exchange among Singapore, South Korea, Israel, China, and Germany, and measure innovation beyond patents and R&D spending to include diversity, creativity, and inclusivity indicators.

## 7. CONCLUSION

This comparative analysis reveals that innovation strategy and national cultural dimensions in Singapore and South Korea have produced high innovation performance through different pathways.

Singapore, ranked 5th in the Global Innovation Index and 6th in the Bloomberg Innovation Index, has a risk-tolerant (UAI 8), egalitarian (PDI 74), collectivist, long-term oriented culture driving an innovation model based on strong state direction, foreign direct investment attraction for MNC R&D centers, public-private partnerships through A*STAR and CREATE, world-class universities such as NUS and NTU, intellectual property protection, and foreign talent. Strengths include agility, openness, experimentation, and leadership in fintech, biotech, and AI. Weaknesses include reliance on foreign talent, few homegrown tech giants, and vulnerability to US-China decoupling.

South Korea, ranked 6th in the Global Innovation Index and 1st in the Bloomberg Innovation Index, has a risk-averse (UAI 85), hierarchical (PDI 60), collectivist, extremely long-term oriented (LTO 100) culture driving an innovation model based on chaebol-driven R&D (Samsung accounts for 20 percent of national R&D), massive public R&D investment at 4.8 percent of GDP, strong government support, STEM education with high PISA scores, and strategic technology sectors including semiconductors, displays, EV batteries, and 5G and 6G. Strengths include scale, persistence, manufacturing quality, high patent output, and leadership in high-tech exports. Weaknesses include stifling hierarchy and risk aversion limiting disruptive innovation, chaebol dominance crowding out SMEs and startups, creativity deficit, and gender inequality.

Several cross-cutting insights emerge from this comparison. First, cultural dimensions matter significantly. Low uncertainty avoidance (risk tolerance) enables agility, openness, and disruptive

innovation, while high uncertainty avoidance (risk aversion) enables incremental innovation and process quality. Second, innovation strategy must be culturally congruent. Policies that work in Singapore (low UAI) may fail in South Korea (high UAI). Third, both models have strengths and limitations; neither is universally superior. Fourth, long-term orientation is essential for breakthrough innovation, as it enables patient capital. Fifth, hierarchy versus egalitarianism affects innovation governance, with top-down versus bottom-up approaches both having merits.

For Singapore, priorities include cultivating homegrown entrepreneurship through a stronger startup ecosystem, venture capital, and deep tech; reducing reliance on foreign talent by increasing domestic STEM enrollment and retention; diversifying beyond MNC dependency by supporting local SME R&D; and strengthening manufacturing capabilities.

For South Korea, priorities include flattening hierarchy by empowering younger researchers and encouraging bottom-up innovation proposals; reducing risk aversion by celebrating failure, tolerating uncertainty, and removing stigma from failed startups; increasing openness to foreign talent through immigration, English proficiency, and international research collaboration; boosting university research at KAIST, SNU, Yonsei, and Korea University; encouraging SME and startup innovation by breaking chaebol dominance and supporting venture capital; and addressing gender inequality by increasing female STEM participation and leadership.

For the international community, the lessons are clear. Innovation strategy must adapt to national cultural dimensions. Risk-tolerant cultures such as Singapore, Israel, and the United States excel at disruptive, radical innovation. Risk-averse cultures such as South Korea, Japan, and Germany excel at incremental, quality-driven innovation. Both can achieve high performance. Donors should support national innovation system capacity building aligned with cultural context, rather than imposing foreign models. South-South and North-South exchange among Singapore, South Korea, Israel, China, and Germany accelerates learning.

The ultimate measure of success for innovation policy is not patents or rankings, but whether Singapore's Grab becomes a global tech leader and whether South Korea's next Samsung emerges from a startup rather than a chaebol.

## 8. LIMITS OF THE STUDY

This study has several limitations. First, reliance on secondary data from government reports, international indices, and peer-reviewed literature means the analysis is constrained by data availability, quality, and comparability. Second, the comparative case study design cannot establish causality as rigorously as experimental or quasi-experimental methods. Third, the study does not include primary data collection, such as interviews with researchers, policymakers, or industry leaders, which would provide richer insights. Fourth, the study period (2000 to 2025) captures recent trends but does not fully explore longer-term historical dynamics. Fifth, the focus on national-level systems obscures subnational variation within Singapore (ethnic Chinese versus Malays versus Indians) and within South Korea (gender, generational differences). Sixth, Hofstede's cultural dimensions are national averages and may not apply to all subgroups. Seventh, the study does not quantify the cost-effectiveness of different innovation policies. Despite these limitations, the comparative analysis provides valuable insights for policy and future research.

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## 10. AUTHOR CONTRIBUTIONS

SOUMANA ADAMOU ABDOULAZIZ conceived the study, designed the methodology, conducted the literature review and document analysis, synthesized findings, and drafted the complete manuscript.

## 11. COMPETING INTERESTS

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential competing interest.

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## 13. DATA AVAILABILITY

All sources are publicly available documents cited in the bibliography and accessible through the referenced publications and organizations, including the National Research Foundation Singapore, A STAR, the Ministry of Science and ICT South Korea, KISTEP, the Global Innovation Index, the Bloomberg Innovation Index, OECD, and Hofstede Insights.

## 14. DISCLAIMER

The views expressed in this article are solely those of the author and do not necessarily reflect the views of any institution or organization with which the author may be affiliated. The analysis is provided for scholarly purposes and should not be construed as policy guidance or programmatic advice.

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