

Innovation World – South Korea, Russia and Brazil and the Race for the Future

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Outline

- Background and study questions
- Methodology
- Innovation systems
- National Innovation Systems of
 - South Korea
 - Russia
 - Brazil
- Overarching trends – looking across the three countries
- Summary

Background and study questions

- The Office of the Director of National Intelligence (ODNI) asked the IDA Science and Technology Policy Institute to examine the innovation policies of South Korea, Russia, and Brazil
- Study looked at
 - Drivers behind a country's innovation goals
 - Mechanisms used to execute innovation policies
 - Trends that indicate the effectiveness of the mechanisms/policies
 - Socio-cultural characteristics relevant to innovation

Methodology

- Structured discussion with country experts

	Non-profit	Industry	Govt	Academic	Total
South Korea	8	2	2	0	12
Russia	3	3	4	2	12
Brazil	3	3	4	6	16

- Survey of open literature
- Data sources: NSF Science and Engineering Indicators, World Bank and OECD databases, CIA World Factbook

Innovation systems – leveraging endowments

- Innovation : *“introduction of a new, or improved upon, product, process, model, or service in any field that produces a new advantage or value, and is either widely disseminated into the market, or influences the market such that economies are impacted”* (OECD 2005)
- National Innovation Systems: STPI framework



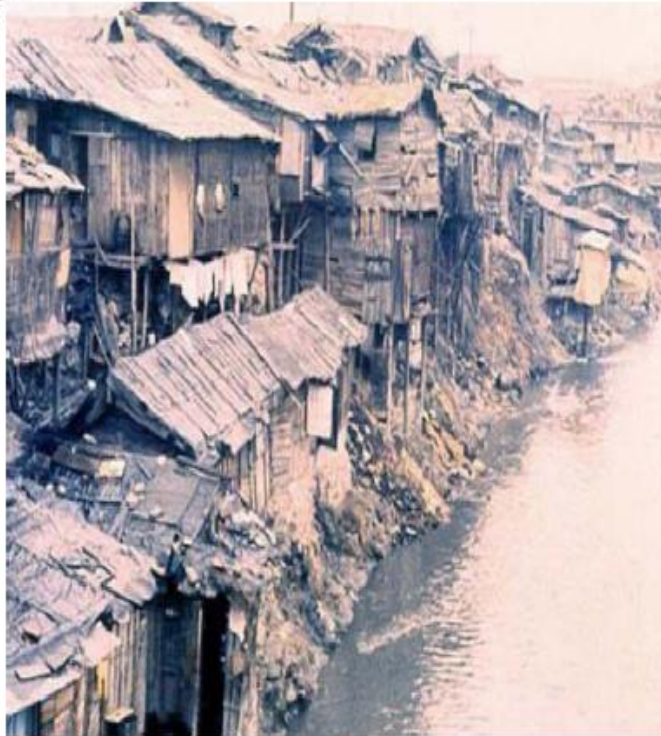


**THREE COUNTRY STUDIES:
SOUTH KOREA
RUSSIA
BRAZIL**



South Korea

South Korea, 1960-2010: rapid rise



Chong-gye stream, Downtown Seoul (1950s)



Chong-gye stream, Downtown Seoul (2000s)

- South Korea in 1960: income per capita on par with least developed countries
- South Korea in 2011: income per capita higher than the EU average (\$32,100 vs. \$31,550)

South Korea's economy

- GDP per capita (2011 USD): \$32, 100
- Industry is dominated by conglomerates (“chaebol”) - Samsung, Hyundai, Pohang Iron and Steel Company (POSCO) and LG Electronics
 - Top 30 companies account for > 80% of exports
 - Leadership in: information technology, steel, automotive, ship building, consumer electronics
- High-value added manufacturing industries; global supply chains
- Services sector relatively small

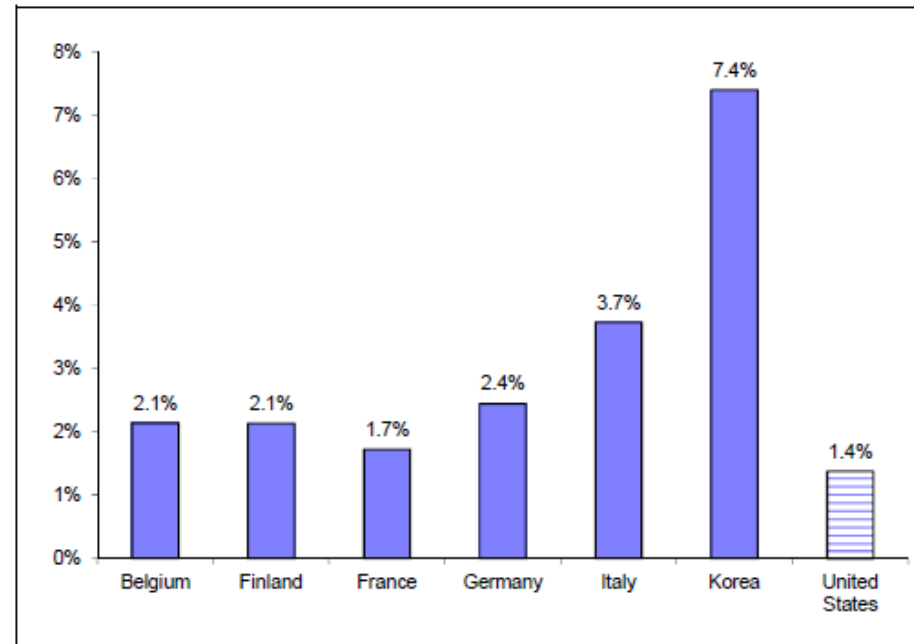
Innovation policies and strategy

- Top-down industrial policy; dominant companies handpicked to lead in 1960s
- S&T-based, export oriented focus from outset
- Consistent, long-term investment in S&T-driven growth
- 1960 – early 1970s: Institutes of science and technology established (KIST, KAIST)
- 1980s: private sector leads R&D spending
- 5-year Science and Technology Basic Plans implemented since 1990s
- Consistent focus on developing workforce for the “Innovation Economy”

Innovation success story: fast follower to first mover

- Moved up value chain from reverse engineering to fast follower to first mover
 - High levels of private R&D investment
 - Conglomerate structure
 - Western business practices with Japanese model of manufacturing
 - Some risky bets (flat panel display market; rivalry with Apple)
- Manufacturing leadership through capital investment + specialization + economies of scale
- Highly integrated into global supply chains

Investment in Manufacturing Fixed Capital as a Share of GDP, 2009



Source: OECD, National Account Statistics, "Detailed National Accounts: Capital formation by activity" and "Gross Domestic Product."

- **Ranked # 2 in innovation behind the US***
- **50% global market share in shipbuilding**
- **Samsung – largest electronics company**
- **Hyundai – 8th largest auto maker**

*Bloomberg Innovation Ranking



Russia's economy

- Per capita GDP (2012 USD): \$18,000
- Holds world's largest natural gas and oil reserves
- Most of civilian industry is in large State Owned Enterprises (SOEs) in resource extraction and processing
 - SOEs are inefficient, not competitive
- Domestic manufacturing sector mainly in low-value-added goods
 - R&D and technology development weakly linked to production
 - Manufacturing value added of high-tech products is half of Brazil's and one seventh of China's
- Knowledge-intensive and service sectors relatively strong

Innovation policies and strategy: isolated innovation zones, weak links to production economy

- Soviet Era S&T build-up – R&D personnel up to 2.8 million
 - R&D primarily for military purposes
- 1990s
 - 1991: USSR dissolves into 15 republics
 - Downsizing of R&D, brain drain begins
- 2000s onwards
 - First efforts at strategic policy, competitive public funding
 - Public-private collaboration (Russian Venture Corporation)
 - Creation of special zones
 - Program to attract foreign scientists to universities in 2010
- Recent technology focus areas: ICT, space, nuclear energy, energy efficiency, healthcare and pharmaceuticals

Innovation is despite government

- Legacy of Soviet Era endures - tradition of private property ownership and commercialization of intellectual property lacking in Russia
- Despite scientific talent, capacity and sophistication of commercial sector not conducive to innovation and competitiveness
 - Weak drivers (competition, customer demand)
 - Weak mechanisms (research-industry linkages, avenues for commercialization)
 - Weak framework conditions (trade and tax laws, IP protection, cost of doing business, bureaucracy)
- Pervasive corruption, bureaucracy
 - Business investment in R&D extremely low

Brazil



Brazil's economy

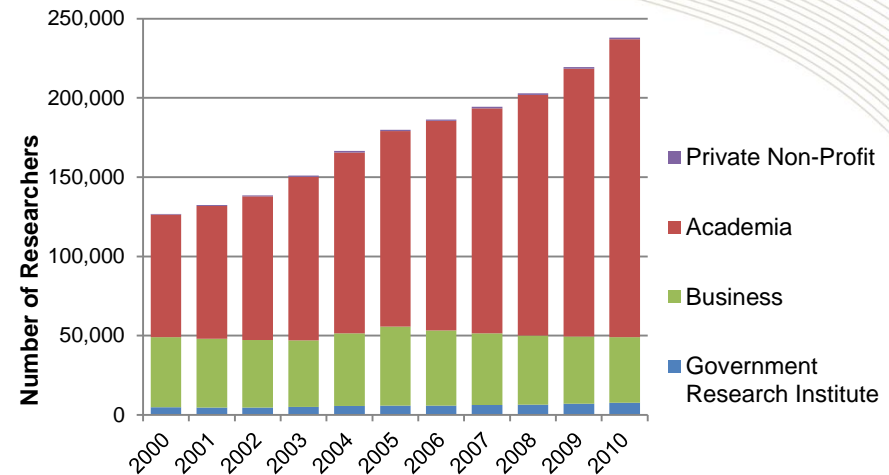
- Per capita GDP (2012 USD): \$12,100
- Largest economy in Latin America; 6th largest nominal GDP in the world
- Natural resource dependent – commodities account for 48% of economic output
- Strong S&T-based sectors developed with state support – Oil and gas, agriculture, aircraft manufacture, mining, automotive, biofuels, equipment and machinery
- Strong manufacturing base
- Well developed services sector

Innovation policies and strategy: patchwork of policies

Year	Policy	Purpose
1999	Sectoral Funds for Science and Technology	Funds science, technology, and innovation in 15 thematic areas
2003–2006	Industrial, Technological and Foreign Trade Policy (PITCE)	Aims to grow exports, promote innovation capacity in firms, regional development, and capital goods; targets specific priority areas
2005	Law of Goods (Law n.º 11.196)	Provides fiscal incentives to firms conducting R&D and hiring graduate students
2006	Law of Innovation (Law n.º 10.973 and Decree n.º 5563)	Public-private partnerships for technology commercialization
2006	Economic Subvention Program	Provides grants for innovative projects provided directly to firms; targets strategic sectors
2007–2010	Action Plan for Science, Technology and Innovation for National Development (PACTI)	Coordination of national innovation system and increase private R&D spending
2008–2010	Policy of Production Development (PDP)	Increasing exports and small businesses; provides direct funding to 25 strategic sectors
2011–2014	Greater Brazil Plan	Promotion of domestic industry, includes some protectionist measures (taxes, local content requirements)
2012-2014	Greater IT Plan	Enhance ICT infrastructure, create public-private partnerships, invest in start-ups
2013-2015	Business Innovation Plan	Stimulate private R&D/innovation through collaboration with research institutes, grants, loans, VC funding

Mixed impact of innovation laws

- Big education push
- Doubling of PhDs over past decade
 - 80% preferentially join academia
 - Cultural bias
 - Low demand in industry
 - Weak university-industry links
- Business innovation unchanged
 - Successful sectors precede innovation policies
 - Elsewhere, technology acquisition and adaptation to regional markets
 - Low interest in R&D-based innovation
- High cost of doing business (~70% tax rate in 2000s, inflexible labor laws)
- Protectionist policies in response to foreign competition
 - Disincentive to invest in long-term R&D-based technology and innovation
- **Brazil's industry growing, not necessarily more competitive**



Source: Brazilian Ministry of Science, Technology and Innovation

COMPARING FIVE TRENDS ACROSS THE COUNTRIES

- CULTURAL CHARACTERISTICS**
- GOVERNANCE AND FRAMEWORK CONDITIONS**
- EDUCATION AND WORKFORCE**
- BUSINESS INVESTMENT IN R&D**
- RESEARCH-INDUSTRY LINKAGES**

Expert view of how socio-cultural characteristics influence attitudes towards innovation

- South Korea
 - Homogenous society
 - Need for security - reflected in career choices
- Russia
 - Diverse population
 - Mistrust of government - success is viewed as resulting from connections
- Brazil
 - Diverse population
 - Expectation of protectionism from state, both at societal and industrial level

Innovation governance and framework conditions

- South Korea
 - Governance: Ambitious policies; consistent, targeted funding
 - Framework conditions: Strong
- Russia
 - Governance: Does not address underlying weaknesses
 - Framework conditions: Very weak, largely not addressed
- Brazil
 - Governance: Policies relatively new; mixed results
 - Framework conditions: Weak, but being addressed

Education and Workforce Development

- **South Korea**
 - Highly developed education system; 65% of population has a university degree (highest in the OECD)
 - Emphasis on acquiring education overseas
 - Increasing emphasis on problem solving-based curriculum
- **Russia**
 - Soviet Era strengths in STEM eroded by mass emigration
 - Breakdown of education system - hard to gauge capability
 - Recent emphasis on business education, international engagement
- **Brazil**
 - Attainment of universal childhood education a big win
 - Push on college graduation rates; policies are in the right direction
 - Programs to send students overseas – “Students without Borders”

Document count country rankings

1996	2001	2006	2012
1 United States	1 United States	United States	1 United States
2 Japan	2 Japan	1 States	2 China
		2 China	5 Japan
		5 Japan	
8 Russia	6 China		
9 China			
.....	9 Russia		11 South Korea
.....		12 South Korea	13 Brazil
.....	14 South Korea	14 Russia	
.....		15 Brazil	16 Russia
.....	17 Brazil		
20 South Korea			
21 Brazil			

Publication and citation counts

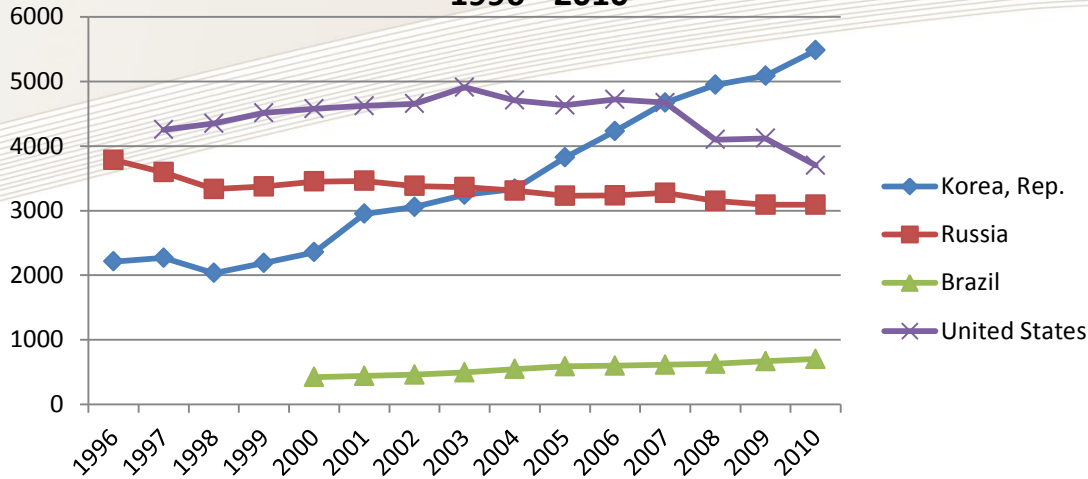
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.....			8 Japan
.....	13 China		13 South Korea
16 Russia		14 South Korea	
19 China	16 South Korea	17 Brazil	17 Brazil
	20 Russia		
22 South Korea		24 Russia	22 Russia
24 Brazil	23 Brazil		

Source: SCImago Journal Rank (SJR)

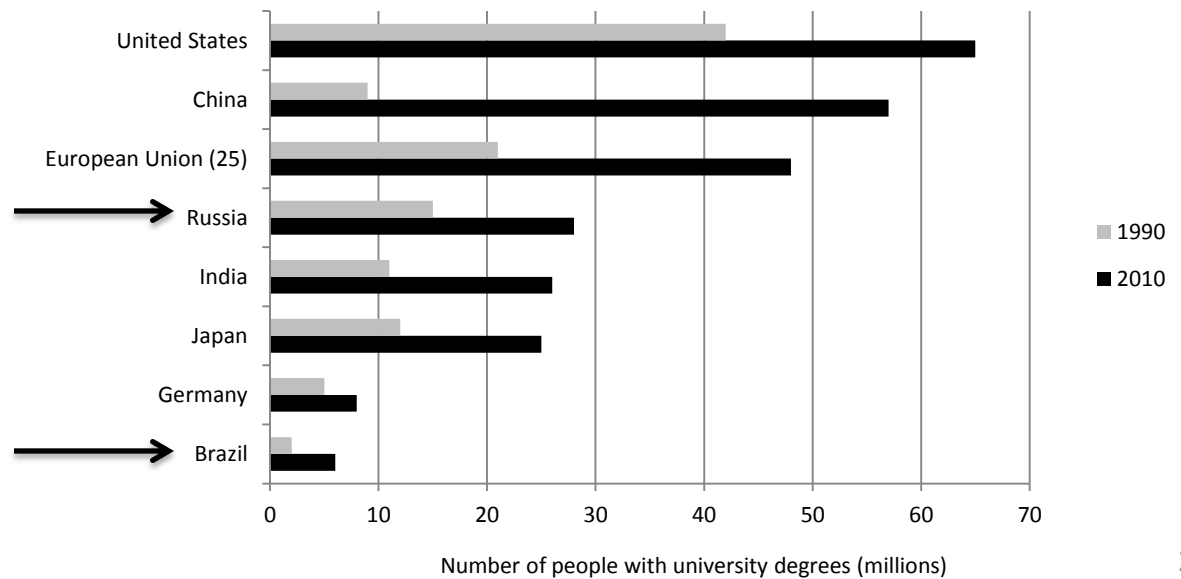
Education and Workforce Development

Number of researchers per million population, 1996 - 2010



Source: World bank

Number of people with university degrees, 1990 and 2010



Source: Barro and Lee, Deutsche Bank

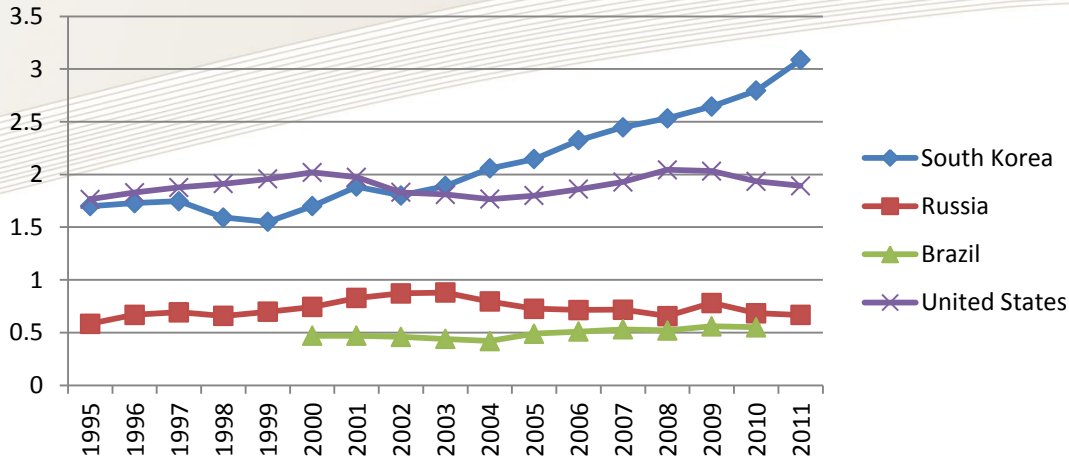


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Industry Participation in R&D-based innovation

- South Korea
 - Leads in BERD as % of GDP; concentrated in few firms
 - Samsung, Hyundai, POSCO, LG : 70% of R&D budget
- Russia
 - Industry participation in R&D very low– despite patenting rate comparable to OECD countries
 - Underdeveloped commercial sector; R&D – production gap; adverse governance conditions - **Policies do not address this**
- Brazil
 - State-supported development + protectionist policies : negative influence on firms investment
 - Low involvement in global supply chains outside oil and gas sector
 - Concerns about competition from China
- All three countries: Benefits of government policies reaped disproportionately by larger companies; SMEs are relatively weak

Business expenditure on R&D (BERD) as a percent of GDP, 1995-2010

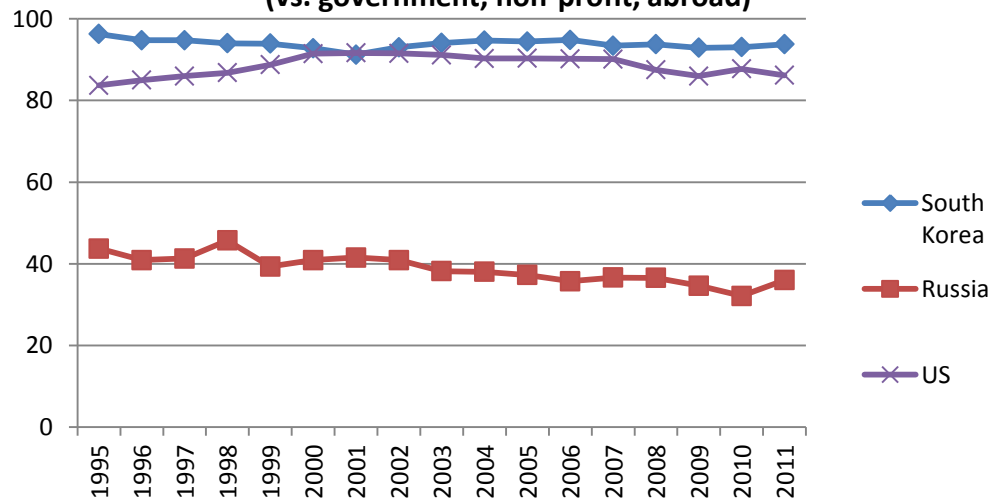


Business investment in R&D

Source: OECD Database

Comparable data for Brazil not available in OECD database, data from Brazilian Institute of Geography and Statistics – IBGE – was used

Percent of BERD financed by industry (vs. government, non-profit, abroad)



Source: OECD Database

Research-industry linkages; researcher supply to industry

- **South Korea**
 - Research-industry partnership strong till 1990s; thereafter Government Research Institutes looking for new role.... (big science, space)
 - Best and brightest seek employment at the biggest companies
- **Russia**
 - R&D in research institutes (Russian Academy of Sciences) – disconnect from production sector
 - Government Research Institutes and State Owned Enterprises (SOEs) attract talent; short supply in rest of industry
- **Brazil**
 - Gap in university-industry linkages; basic research not being transitioned out of universities
 - Most PhDs join academia; low industry demand for researchers

Use of Information and Communication Technology (ICT) changes innovation

- Enables non-production, knowledge-intensive sectors in goods and services
 - Taps into human capital wherever available
 - Small footprint
 - Growing role in informal economy – particularly services
 - Platform for future modes of innovation
- ICT sector in Russia – bottom-up, growing, innovation economy
 - 42% of private venture investment in 2010; Entrepreneurs turning VC
 - Informal service economy where mistrust of formal institutions exists
 - QIWI – reverse ATM machine (adds cash to prepaid card)
 - Ozono (Russian Amazon) – accepts cash (only) on delivery
- Brazil
 - \$210 billion IT market; 5th largest market, e-commerce
 - 74 techparks , collaborations with multi-nationals.... But no globally competitive firms yet...

Summary

- South Korea
 - Long-term strategy for leadership – high-risk ideas, science-based
- Russia
 - Governance and framework conditions
 - Growth of IT sector; investment by multi-nationals
- Brazil
 - Transition from regional dominance to global competitiveness
 - Growing trade relationship with China

Conclusion: overarching trends

1. Culture and governance fundamental to innovation
2. Education and research-industry linkages
3. Business interest and investment in innovation
4. Top-down planned economy: divide between big firms and small to medium enterprises
5. Growing forces
 - IT-based non-production, knowledge-intensive sectors
 - Multi-national corporations and global investment – low-end production vs. R&D

THANK YOU!

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Questions

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