National report on innovations in Russia, 2016

Open Innovations Forum – Supporting materials

October 26, 2016
Why are innovations so important?

What are countries - leaders in innovations doing?

How much is Russia lagging behind leaders?

How is innovations policy formed in Russia?

What was done over the course of last year?

What should government focus on today?

How to set goals and measure progress?

How to ensure change management?
Report provides regularly updated dashboard for policy adjustment

First release 2015

- Responsible parties
- Goals and timeline
- Tracking

- Analysis from a bird's eye view
- Methodology
- High-level priorities

- Quantitative indicators of innovation development
- Dashboard for regulatory bodies

- Update and prioritization of government policy
- Action plan
2015 report measured state of innovation system in Russia - benchmarked against leading countries.

INNOVATIONS PYRAMID

ECONOMIC IMPLICATIONS OF INNOVATIONS
RESULTS OF INNOVATIONS
INNOVATION ACTIVITY

INNOVATIONS FUNNEL

IDEA / INVENTION
COMMERCIALIZATION
INNOVATION
GLOBAL MARKETS LEADERSHIP
LABOR PRODUCTIVITY
EMPLOYMENT IN AN INNOVATION-DRIVEN ECONOMY
RANKING IN GLOBAL INNOVATION INDEX

MARKETS
INFRASTRUCTURE
CULTURE
KNOWLEDGE
INSTITUTIONS
Report of 2016 helped to assess progress achieved

### Economic implications

<table>
<thead>
<tr>
<th>Long-term</th>
<th>Global leadership in hi-tech markets</th>
<th>Labor productivity in overall economy</th>
<th>Labor productivity in non-resource industries</th>
<th>Growth of total factor productivity</th>
<th>Russia’s rank in Global Innovation Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/a</td>
<td>Employment in innovative economy</td>
<td></td>
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</tbody>
</table>

### Stages

**Results of innovation**

<table>
<thead>
<tr>
<th>Laggards</th>
<th>Idea/Invention</th>
<th>Commercialization</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patents granted</td>
<td>Venture investment volume</td>
<td>Size of innovative economy</td>
<td></td>
</tr>
<tr>
<td>Quality of patents granted</td>
<td>Venture investment by corporate funds</td>
<td>Hi-tech export</td>
<td></td>
</tr>
<tr>
<td>Conversion of patent applications into patents granted</td>
<td>Efficiency of VC funds’ capital employed</td>
<td>IP export</td>
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**Innovation activity**

<table>
<thead>
<tr>
<th>Current</th>
<th>Idea/Invention</th>
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</tr>
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<tbody>
<tr>
<td>National patenting activity</td>
<td>Number of startups</td>
<td>ROI in innovation</td>
<td></td>
</tr>
<tr>
<td>Research cooperation</td>
<td>Investment in intangible assets</td>
<td>Efficiency of state support provided to exporters</td>
<td></td>
</tr>
<tr>
<td>R&amp;D spending</td>
<td>Demand for technologies</td>
<td>Number of innovative companies</td>
<td></td>
</tr>
<tr>
<td>R&amp;D spending by private sector</td>
<td>Available financing by VC funds</td>
<td>FTE employed by innovative companies</td>
<td></td>
</tr>
<tr>
<td>R&amp;D spending by public sector</td>
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### Drives

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</tbody>
</table>

### Innovation environment

<table>
<thead>
<tr>
<th>Outrunning</th>
<th>Idea/Invention</th>
<th>Commercialization</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migration of human capital</td>
<td>Availability of scientists and engineers</td>
<td></td>
<td></td>
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<tr>
<td>Cluster maturity (geographical concentration of suppliers and auxiliary products manufacturers)</td>
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</tbody>
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### Drivers

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</tbody>
</table>

1. Gap dynamics vs. other countries (when significant, i.e. 5%). 2. Considered if data was updated in original data source since 2014.

Source: BCG analysis

1. Hypothesis or expert assessment due to lack of data
### Good news – innovation environment improved!
But activity did not get better

#### Mixed dynamics: modest improvement in exports but deterioration in patents and venture

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<th>Innovation</th>
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<td>Number of patents granted abroad (PCT)</td>
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<td></td>
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<tr>
<td>R&amp;D spending by public sector</td>
<td></td>
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</tr>
</tbody>
</table>

#### Noticeable improvement, esp. in institutions and knowledge

- **Russia’s rank in Global Innovation Index**
- **Government’s participation in demand for innovative products**

#### Key Indicators

- **Availability of funding (venture capital, private equity, loans)**
- **Competition intensity**
- **Customer maturity**
- **Cluster maturity (geographical concentration of suppliers and auxiliary products manufacturers)**
- **Quality of education**
- **Quality of research institutes**
- **Quality of investor rights protection**
- **Company registration simplicity**
- **Assessment of environmental policy**
- **eGovernment development**
- **Assessment of tax and fiscal environment**
- **State administration efficiency**
- **Quality of investor rights protection**
- **Insolvency resolution simplicity**
- **Government development**
- **Creation of public-entrepreneurship relations**
- **R&D spending by public sector**

#### No indicator update

- Source: BCG analysis
- Updated in original data source since 2014

#### Entries (when applicable)

- No indicator update
- Indicated for new data since 2014
- No dynamics
- Significant negative dynamics
- Significant positive dynamics
- Mixed dynamics
- Largest gap vs developed countries
- High current value
- Insufficient data

#### Hypothesis or expert assessment due to lack of data

1. Gap dynamics vs. other countries (when significant, i.e. 5%) 2. Considered if data was updated
Until recently little attention was paid to mature businesses

State initiatives in innovation system today

LAUNCHED BEFORE 2015 – IN PROGRESS

- Innovation Development Strategy 2020¹ - Update
- GP² “Science and Technology Development”
- Fed. Law No.270³
- GP² “Economic development and Innovative Economy”
- Innovation Development Strategy Update
- GP² “Industry Development”

LIMITED ACTIVITY BEFORE 2015

LAUNCHED IN 2015-2016

- Integration of RVC
- Scientific and technological development strategy
- Reorganization of research institutes under Federal Agency for Scientific Organizations
- Federal Law On Scientific, Research, Technological and Innovation Activities
- Children's technology parks Kvantorium
- Strategy, Project Management Office, roadmap – National Tech Initiative
- Development of industry venture capital funds
- Agency for tech development⁵
- Special Investment Contract⁶
- Project “National Champions”
- Mandatory purchase of innovative products⁷
- Foreign patenting support

1. Strategy of Innovative Development  
2. Government Program  
5. Agency for Technological Development  
6. Special Investment Contract  
7. Approved Resolution No. 1442 regulating volume of purchase of high-tech and innovative products, including from SMEs; Order No. 475-p signed approving the list of state-owned companies that must do such purchasing
Focus was on measures that have lagging or limited effect

**THREE CAUSES FOR WEAK RESPONSE**

- Fundamental science and education development is oriented on a long-term perspective
  - A long-term effort to study human genome – but only recent development of CRISPR/Cas9 technology to edit it
- Creation of favorable innovation environment leads to innovation activity increase with time lag
  - According to GII "Rule of Law" index Russia moved 8 places up in 2016, however entrepreneurs need time to perceive changes
- Support of tech projects and start-ups has limited effect in the absence of internal demand
  - Russian start-ups move abroad in the absence of local demand for their technologies

**EXAMPLES**

**How to convert efforts in tangible outcomes?**
We propose focusing on corporate channel—it will activate other channels

INNOVATION CREATION CHANNELS

ENTREPRENEUR

VENTURE

CORPORATE

IDEA/INVENTION

COMMERCIALIZATION

INNOVATION

"Garage Innovation"

Seed investment

Initial stage investment

Early stage investment

Competitive Product

Share buyback

Corporation VC, purchase of IP

M&A

IPO

Spin-off

R&D

Competitive Product/improvement of production process

CORPORATE CHANNEL CAN COVER LACK OF DEMAND FOR TECHNOLOGIES AND FAST-GROWING COMPANIES
It will help debottleneck “corporate” and “venture” critical paths of innovation system...

LOGICAL MAP OF INNOVATION SYSTEM INTERDEPENDENCIES

Notes. Countries included in the sample: Finland, Germany, Norway, S. Korea, Switzerland, UK, the Netherlands, Israel, Ireland, Italy, Chile, Australia, US, Canada, China.

Color code is the same as in National report 2015 except for dark red color (used for statistical indicators with lagging by over 5x).

1. Average value of countries (n=15) outruns Russia’s indicator value (for statistical and mixed indicators).

Source: National report on innovation in Russia 2015; BCG analysis.
... And resolve "open loop" of innovation system problem, discovered in Report-2015

- Economic implications
  - Long-term: n/a
  - Short-term: Global leadership in hi-tech markets

- Drivers
  - R&D creation drivers are not transformed into competitive and demanded inventions
  - Brain drain: Russia lags far behind leading innovative countries in talent attraction and retention
  - Low adoption of technology by business: no demand for innovation as a key competitiveness factor
  - No vehicle for innovative SME growth and/or start-up exit

- Stages
  - Idea/Invention
    - Return on R&D spend
    - Conversion of patent applications into patents granted
  - Commercialization
    - Number of startups
    - Investment in intangible assets
  - Innovation
    - Number of innovative companies
    - FTE employed by innovative companies

- Reasons of "open loop" in innovation system
  - Brain drain: Russia lags far behind leading innovative countries in talent attraction and retention
  - Low adoption of technology by business: no demand for innovation as a key competitiveness factor
  - No vehicle for innovative SME growth and/or start-up exit

- Covered by tools in focus of “corporate” channel
  - R&D creation drivers are not transformed into competitive and demanded inventions
  - Brain drain: Russia lags far behind leading innovative countries in talent attraction and retention
  - Low adoption of technology by business: no demand for innovation as a key competitiveness factor
  - No vehicle for innovative SME growth and/or start-up exit
Focus on large enterprises can potentially bring quick and substantial results

Targeting large enterprises in Russia means working directly with the dominant part of the economy.

Share of GDP

<table>
<thead>
<tr>
<th>Country</th>
<th>Small and medium enterprises</th>
<th>Large enterprises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>21%</td>
<td>79%</td>
</tr>
<tr>
<td>Country average</td>
<td>42%</td>
<td>58%</td>
</tr>
<tr>
<td>South Korea</td>
<td>48%</td>
<td>52%</td>
</tr>
<tr>
<td>UK</td>
<td>51%</td>
<td>49%</td>
</tr>
<tr>
<td>Germany</td>
<td>53%</td>
<td>47%</td>
</tr>
<tr>
<td>Australia</td>
<td>58%</td>
<td>42%</td>
</tr>
<tr>
<td>Sweden</td>
<td>59%</td>
<td>42%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>59%</td>
<td>41%</td>
</tr>
<tr>
<td>Finland</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>Israel</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>Norway</td>
<td>61%</td>
<td>39%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>63%</td>
<td>37%</td>
</tr>
<tr>
<td>Italy</td>
<td>68%</td>
<td>32%</td>
</tr>
</tbody>
</table>

Target Japan and South Korea – not the US or Europe
Focus on large enterprises can potentially bring quick and substantial results given high share of public sector in large enterprises, the government has extra leverage over them.

Target Japan and South Korea – not the US or Europe.
Russia's large enterprises are not innovative

PATENTS ARE FEW AND/OR UNWANTED

Russia's large enterprises are not innovative

PATENTS ARE FEW AND/OR UNWANTED

Russia's large enterprises are not innovative

PATENTS ARE FEW AND/OR UNWANTED

Innovations are the only way to regain markets

AUTO: LOSS OF DOMINANT POSITION IN DOMESTIC MARKET

Share of Russian cars (excl. assembly) in domestic market (%)

Source: Rosstat, the UAC, the Ministry of Energy of the Russian Federation, the annual report of OJSC Aeroflot
Innovations are the only way to regain markets

AVIATION: RUSSIAN AIRLINES CHOOSE FOREIGN SUPPLIERS

Aeroflot Group fleet (%)

Source: Rosstat, the UAC, the Ministry of Energy of the Russian Federation, the annual report of OJSC Aeroflot
Innovations are the only way to regain markets

OIL: LACK OF INNOVATIONS WILL COST 6% OF PRODUCTION LOSS WITHIN 10 YEARS

Long-term oil production forecast in Russia, 2012-2040 (mln t)

- Energy Strategy-2035 implementation scenario
- Non-development of offshore/shale oil scenario

32 mln t (6%)

Source: Rosstat, the UAC, the Ministry of Energy of the Russian Federation, the annual report of OJSC Aeroflot
Innovation breakthrough ideas are available for immediate implementation

<table>
<thead>
<tr>
<th>INDUSTRY EXAMPLES</th>
<th>POSSIBLE DEVELOPMENT AREAS</th>
<th>SUCCESSFUL PROJECTS</th>
</tr>
</thead>
</table>
| OIL & GAS         | • Development of non-capital-intensive innovative products: software, geophysics, sensors, electronics  
                    • Development of had-to-recover reserves  
                    • Recovery factor growth at existing fields  
                    • Connected car technologies  
                    • Advanced driver assistance systems  
                    • Driverless vehicles in agri and mining  
                    • Electro / hybrid cars  
                    • Innovative components for global producers (e.g. durable fuel systems, fire prevention systems, etc.)  
                    • Special-purpose civil airplanes and helicopters  
                    • Innovative solutions for large enterprises: automation, satellite positioning, high-precision farming  
                    • Domestic crop and seed selection  | • Tatneft: most innovative Russian oil company, esp in bituminous oils  
                    • Driverless car prototypes  
                    • LADA Connect  
                    • ADAS / connected car startups  
                    • Sukhoi Superjet (SSJ) & MC-21  
                    • Airbus components by Irkut  
                    • VSMPO-AVISMA titan production  
                    • Successful satellite monitoring and big data analysis systems |

| AUTO              |                                 |                      |
|                   |                                 |                      |

| AVIATION          |                                 |                      |
|                   |                                 |                      |

| AGRI              |                                 |                      |
|                   |                                 |                      |
We used Four-S approach to identify existing barriers to innovations

- Lack of strategic approach to industrial standards
- No commitment to reduce support of loss-making productions
- Insufficient support of innovations, including high-tech exports
- Limiting the number of subcontractors as a result of the vertical integration of big businesses
- Lack of funds for innovations
- High barriers to entry
- Innovations are not on the C-executives' agenda
- Dilution of responsibility in the medium-term horizon
- Lack R&D project management skills
- Internal processes complicate development of innovations
- Innovation/cooperation-hostile state procurement pricing
- Lack of competition with foreign companies – even in domestic markets
- Lack of competitive exports
Some suggested solutions ripe for implementation

- Develop competitive components market: integrators, foreign investors, component manufacturers as separate BUs
- Long-term cooperation of big businesses and suppliers: LT contracts, IP access, testing facilities and certification access
- Certification expenses refunds

Option plans, carried interest in CVCs
- CEO talent pools
- Local R&D as market entry condition
- CVC co-financing
- Workforce training programs
- Partial privatization of SOEs

Harmonization/differentiation of industrial standards with rest of world
- Introduction of advanced standards / quality stamps
- Industrial R&D coordination
- Targeted high-tech export support
- Simplified R&D state support procedure

Reform of pricing in state defense procurement: long-term contracts, abandonment of 20%+1% rule
- Development of clear guidelines for life-cycle contracts in SOEs
Manage critical: we suggest 10 KPI for the “critical paths” of the innovation system

<table>
<thead>
<tr>
<th>Key focus areas</th>
<th>Key focus area KPIs</th>
<th>Controllable</th>
<th>Measurable</th>
<th>Manipulation-proof</th>
</tr>
</thead>
<tbody>
<tr>
<td>INNOVATIVE EXPORTS</td>
<td>Exports of Russian high-tech products, USD</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>INNOVATIVE PRODUCTION</td>
<td>Percentage of innovative products, operations and services in total volume shipped,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>operations and services performed, %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NUMBER OF INNO-VATIVE COMPANIES</td>
<td>Percentage of innovative organizations, %</td>
<td></td>
<td></td>
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<tr>
<td>SIZE OF VC INVESTMENTS</td>
<td>Total volume of venture investments, RUB</td>
<td></td>
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<tr>
<td>DEMAND FOR READY-MADE TECHNOLOGY</td>
<td>Investments in intangible assets to GDP ratio, %</td>
<td></td>
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<td>NUMBER OF PATENTS</td>
<td>Number of patents received abroad via PCT</td>
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<td>Number of patent applications via PCT</td>
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<tr>
<td>QUALITY OF RESEARCH</td>
<td>Number of citations per publication by Russian researchers in science magazines</td>
<td></td>
<td></td>
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<td></td>
<td>indexed by the Web of Science database</td>
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<tr>
<td></td>
<td>the Web of Science database, %</td>
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Каскадирование: отраслевые ФОИВы/ГК отвечают за достижение целевых показателей по отрасли в долгосрочной перспективе

**EXAMPLE: HIGH-TECH EXPORTS**

**CASCADING LEVEL**

**ECONOMY**

**INDUSTRY**

**COMPANY**

**KPI RESPONSIBILITY**

**GOVERNMENT**

Government owns:
- correct goal setting
- resource and tools provision

**INDUSTRIAL DEVELOPMENT & TRADE MINISTRY**

Industrial ministries/SOEs own:
- long-term KPIs
- short-term industrial pans

**Rosatom**

**Roskosmos**

**MANUFACTURING**

**ATOMIC**

**SPACE**

Industrial ministries/SOEs/Innovation institutes own:
- KPIs (for subordinated organizations)
- Industrial plans (for rest of industry)
Project management office is a way to set and achieve measurable targets without radical management system changes.

**Incremental improvements**
- Collective KPI responsibility
- Personalized penalties for goal non-achievement

**Strong industrial ministry**
- Industrial ministry
  - Ministry of Petroleum & Energy

**Special-purpose ministry**
- New structure
  - Oil & Gas Authority
  - Dept for Business, Energy & Industrial Strategy

**Responsibility**
- Responsible ministry
  - KeTTHA²
  - Ministry of Higher Education

**KPI**
- Ave oil recovery index growth 46% to 68%
- Prospected reserves growth up to 5 bln barrels by 2015
- Reduction of ave p/b OPEX by 30% by 2019
- Oil production growth by 250 mln bbl by 2021

**Key Tool**
- Coordination platforms for participating ministries
- Management of SOEs through BoD / supervisory board
- Concentration of state regulation tools required for completing the task

**Applicability to Russia**
- No individual responsibility for (non)achievement of collective goals
- Hierarchy changes required: bigger minister “weight”, including authority to appoint SOEs’ CEOs
- Hard to separate Innovation ministry and industrial ministries’ mandates
- No critical barriers

**Project Management Office**
- FDI in oil field services, six JVs to be created by 2014
- Project management office reporting to PM
  - Roadmaps to KPIs
  - Control implementation
  - Impact on ministers’ careers
To be successful, PMO needs political support, resources and competent team able to build effective mechanism

<table>
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<th>SUCCESS FACTORS FOR PMO</th>
<th>EXAMPLE: 2014 OLYMPICS ORGANIZING COMMITTEE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POLITICAL WILL</strong></td>
<td>• Absolute support by President of Russia</td>
</tr>
<tr>
<td>PMO’s tasks on the</td>
<td>• Determination to implement the project</td>
</tr>
<tr>
<td>agenda of key decision</td>
<td>despite 2008-10 crisis</td>
</tr>
<tr>
<td>makers</td>
<td></td>
</tr>
<tr>
<td><strong>COMPETENT TEAM</strong></td>
<td>• Key team members experienced in similar-</td>
</tr>
<tr>
<td>Seasoned professionals</td>
<td>sized projects (A. Zhukov, D. Chernyshenko)</td>
</tr>
<tr>
<td>– no need for training</td>
<td></td>
</tr>
<tr>
<td>/ team building</td>
<td></td>
</tr>
<tr>
<td><strong>ADEQUATE RESOURCES</strong></td>
<td>• Unprecedented public (~ 1/3) and private</td>
</tr>
<tr>
<td>Ability to use financial</td>
<td>(~ 2/3) funding</td>
</tr>
<tr>
<td>and administrative</td>
<td>• Immediate access to top officials when</td>
</tr>
<tr>
<td>levers</td>
<td>escalation needed</td>
</tr>
<tr>
<td><strong>GOVERNANCE SYSTEM</strong></td>
<td>• Three-tier project mgmt system:</td>
</tr>
<tr>
<td>Responsibilities,</td>
<td>Steering Committee, Central PMO and unit</td>
</tr>
<tr>
<td>authorities and</td>
<td>functional PMOs</td>
</tr>
<tr>
<td>resources clearly</td>
<td>• Clear functional allocation of tasks</td>
</tr>
<tr>
<td>distributed</td>
<td></td>
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<tr>
<td><strong>EFFICIENT PROCESSES</strong></td>
<td>• Unified planning and reporting system</td>
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<tr>
<td>AND TOOLS</td>
<td>• Real-time tracking of milestones and</td>
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<tr>
<td></td>
<td>objectives</td>
</tr>
<tr>
<td></td>
<td>• KPI dashboard implementation</td>
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</table>
What's next: seven suggestions

1. Continue with annual National Innovation Reports
2. Focus innovation policies on large enterprises – without compromising on existing directions
3. Implement solutions according to Four-S approach
   - **SIZEABLE BUSINESSES**: create long-term motivation schemes for top management
   - **SALES**: improve state procurement systems, implement life-cycle contracts
   - **STATE SUPPORT**: implement advanced standards / quality stamps, simplify state support
   - **SUPPLIERS**: develop component markets, refund certification costs, stimulate long-term cooperation
4. Use 10 KPI suggested for implementation management
5. Distinguish between short- and long-term horizons when cascading responsibilities
6. Cascade long-term KPIs on industrial ministries and SOEs
7. Implement project management office to administer programme

Looking forward to innovations in 2017 report!