Jobs of the future: global & BRICS perspective

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New wave of automation & autonomization challenges the foundations of current (still largely industrial) society.


Existing (industrial) model: 60-70% of jobs directly or indirectly serve systems of mass production

Economy 2035: production & logistics can be up to 95-99% unmanned, and up to 50-70% of jobs in related services can be replaced by AI.
... and it is further enhanced by range of complimentary technological & social innovations

Biotech: biofuel, food, materials etc.

Fintech: cryptocurrencies, smart contracts etc.

3D printing: from organs to houses
Mass extinction of blue & white collar jobs

<table>
<thead>
<tr>
<th>Rank</th>
<th>Job title</th>
<th>Automation Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Telephone salesperson</td>
<td>99.0%</td>
</tr>
<tr>
<td>2</td>
<td>Typist or related keyboard worker</td>
<td>98.5%</td>
</tr>
<tr>
<td>3</td>
<td>Legal secretary</td>
<td>97.6%</td>
</tr>
<tr>
<td>4</td>
<td>Financial accounts manager</td>
<td>97.6%</td>
</tr>
<tr>
<td>5</td>
<td>Weigher, grader or sorter</td>
<td>97.6%</td>
</tr>
<tr>
<td>5</td>
<td>Routine inspector and tester</td>
<td>97.6%</td>
</tr>
<tr>
<td>7</td>
<td>Sales administrator</td>
<td>97.2%</td>
</tr>
<tr>
<td>8</td>
<td>Book-keeper, payroll manager or wages clerk</td>
<td>97.0%</td>
</tr>
<tr>
<td>8</td>
<td>Finance officer</td>
<td>97.0%</td>
</tr>
</tbody>
</table>

Over 2 billion existing jobs may be destroyed by automation around 2030

Source: (Frey, Osborn, 2013)
... accompanied by massive reorganization of industries
Jobs not only destroyed but also created

Future careers in next 20 years: over 180 jobs of tomorrow

Atlas of Emerging Jobs

atlas100.ru/en/
Accelerating changes in industrial & economic practices (driven by technologies, esp. ICT) and growing complexity of global markets

**Challenge of future skills**

Push of global technological, financial & environmental standards – and possible redefinition of global governance structure

**Techno-social transition:**
up to 70% of traditional jobs in manufacturing and services may become obsolete in next 20 years due to application of AI, robotics, automated logistical systems etc. (but many new may be created)

**Future Skills:** skills that will make workers competitive in the future socio-economic & technological environment

Search for **new sources of national competitiveness** in industrialized countries through creation of new & emerging industries
Our work on global skills anticipation

Since 2012: future skills for 25 existing sectors of Russian economy + 9 emerging sectors of National Technology Initiative
Network of learning platforms & STEM clubs for next gen engineers

Ca. 200 jobs of the future (leading carrier guiding tool that stimulated transformation of Russian secondary & tertiary education)

Methodology of skills anticipation co-developed with International Labor Organizations. Pilot applications in Viet Nam, Armenia, Tunis, Tanzania, South Africa, Argentina

Discussion of skills of the future involving industrial & TVET leaders from ca. 50 countries of the world

Planned focus since 2016: study & pilot projects on Industry 4.0
Future of manufacturing sector and skills for it

<table>
<thead>
<tr>
<th>Manufacturing sector</th>
<th>Sector specific skills</th>
<th>Universal skills</th>
</tr>
</thead>
</table>
| **Mass-scale industrial manufacturing** (e.g. energy, natl resources, food, chemistry & new materials, machinery & equipment etc.): *highly autonomous* cyber-physical manufacturing systems | - Cyberphysical manufacturing facility operation & maintenance  
- Skills for Internet of Things: system engineering, M2M lang, dynamic programming, etc.  
- AI development / training of AI  
- Skills for chemistry & new materials dev & production (e.g. for electric materials)  
- Flexible supply chain management  
- Technology ethics | - Information worker skills (search, programming, etc.)  
- Collaboration  
- Working in dynamic / high-uncertainty environment  
- Working in multidisciplinary environments  
- Creativity  
- System engineering  
- ‘Green thinking’  
- Languages: foreign + universal ‘lingua franca’ (based on IT + finance + system engineering?)  
- Ability to unlearn / relearn (supported by mind-stimulation) |
| **Networks of unmanned transport for industrial & consumer logistics** | **Customized end-user manufacturing** (consumer electronics, consumer transport, apparel, furniture etc.): *localized personalized* production based on 3D manufacturing | - Product co-creation with customer  
- Creativity for unique product creation  
- 3D-scan-supported reverse engineering for customization (“same watch, different color”)  
- ‘Beautiful exceptions’ of manual work dominated by artisans |
### Future of service sector and skills for it

**Service sector**

- **Digitalized & machine-assisted massive use services** (e.g. digital health, digital entertainment, unmanned transportation, post-retail distribution, etc.)

- **Uber-like direct service provider markets**

- **Customized highly-personalized services** (e.g. wellness, psychotherapy, fitness & tourism, hospitality, personalized art & entertainment, etc.)

**Sector specific skills**

- Engineering of socio-technical systems
- Sustainable design (incl. balance between personal & social structures)
- Green design
- New skills for working with ‘smart machines’ (e.g. human-machine psychiatrist)
- Authentic serving (serving others as a personal ‘quest’)
- Psychology skills
- Ethics of service including the principle of “We belong, we care, we serve” (also, principles that serve local communities, e.g. ‘slow food’)
- Storytelling (“every personalized service is a story”)

**Universal skills**

Similar to those for Manufacturing sector plus:

- Concentration / attention management
- Empathy / bonding (“I am a person because of another person”)
Transformation of our civilization towards green / sustainable living is primarily transformation of cities. It will create multiple jobs for multiple aspects of city life, catering to needs of various population groups. Some of these are new skills, while others are existing skills that will increase in importance.

**Jobs that support …**

- Green city living
- Healthy city living
- Connected city living
- Harmonious city living

**Some skills that will be required in this sector**

- Sustainable design
- Smart grid design & maintenance
- Electric transport repairing
- Urban farming
- Environmental law
- Personal wellness advising / healthy habits coaching
- Healthy aging consulting
- Adaptation psychology
- Cyber-security management
- IoT design / maintenance
- Home robotics maintenance
- Re-education for adults
- Smart political design
- Inter-cultural communication
- Cloud police
- Cyber law
Shape of things to come: hypothesis on future job market landscape

Massive shifts of job market structure within less than one generation will require multiple mechanisms to smoothen transformation (including education & training)

Existing (industrial) model

~60% of jobs directly or indirectly serve systems of mass production (incl. design & engineering, finance, marketing etc.)

~5-10% of jobs “feed” us (agriculture)

~10% of jobs: urban-related services & products

~20-25% of jobs are human-to-human services (incl. education, healthcare, wellness, govt etc.)

Emerging model of 2035

Not more than 10-15% of high-skilled jobs (direct + indirect) remain in food, commodity & goods mass production due to automation

25-30% of jobs migrate into personalized manufacturing & urban-related jobs

Various technologies of automation & autonomation (2015-30)

Explosive growth to 50-60% of jobs in human-centered services (incl. new services) as they are least susceptible to automation

Source: GEF estimates
Professional, soft & meta- skills of successful workers

**Key professional skills**
- Multidisciplinary work (T-specialist to m-specialist)
- Multicultural + multi-lingual competencies
- IT competencies
- Working in distributed (IT enhanced) environments

**Soft skills**
- Problem- and *opportunity* oriented thinking
- Entrepreneurial skills: acting in uncertainty & taking responsibility (for VUCA environments)
- Creativity (incl. “right-brain” creativity)
- Collaboration
- Empathy & emotional intelligence
- “Ethics of responsibility” (social + environmental)

**Meta-skills**
- Concentration & attention management
- Flexibility & adaptability
- Self-development + ability to unlearn / relearn throughout life

Source: Skills 2030 Foresight, Global Education Futures
Flexible learning organizations

- (Globally distributed) small teams (2 pizza rule)
- Intrapreneurial
- Flatter hierarchies / holocracy
- Innovation everywhere
- Learning everywhere

IT-enhanced

- Connected workforce
- Cloud-based processes
- AI supported decision making
- New IT based organizational models (UBER, DAO, ...)

Employee / human oriented

- Social good AND profit (profit to prosperity)
- More women in decision-making positions
- Focus on “want” instead of “need”: joy / fun as motivation, gamified environments

Source: Future of Work community
... with new type of managerial skills ...

Collective intelligence

AI-enhanced real-time management

Fluid organizations: removal of artificial barriers (work / learn / play / serve)

Human focus / meaning above process

Gearing up for the Fourth Industrial Revolution!
… and more often within sectors of tomorrow

Unmanned transportation (air, ground, water, ...)

Smart energy & utilities

Cyberphysical manufacturing systems

Digital health

Next gen internet based on BCI
BRICS situation: some of the largest economies of the world

### State of BRICS nations

<table>
<thead>
<tr>
<th>Category</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>201,046,886</td>
<td>143,451,702</td>
<td>1,354,040,000</td>
<td>1,270,193,422</td>
<td>1,371,371,000</td>
</tr>
<tr>
<td>GDP (nominal) (bn)</td>
<td>1,266.3</td>
<td>2,695.9</td>
<td>1,835.3</td>
<td>1,827.0</td>
<td>2031.0</td>
</tr>
<tr>
<td>Household Consumer Spending</td>
<td>101.2</td>
<td>517,468</td>
<td>737.9</td>
<td>173.8</td>
<td>95.3</td>
</tr>
<tr>
<td>Government Spending</td>
<td>238.8</td>
<td>2,021.9</td>
<td>846.6</td>
<td>846.6</td>
<td>13,623</td>
</tr>
<tr>
<td>GDP per capita (PPP)</td>
<td>205.0</td>
<td>8,234.8</td>
<td>1,835.3</td>
<td>1,827.0</td>
<td>2031.0</td>
</tr>
<tr>
<td>Exports (bn)</td>
<td>236.0</td>
<td>542.5</td>
<td>2021.0</td>
<td>100.3</td>
<td>106.8</td>
</tr>
<tr>
<td>Imports (bn)</td>
<td>358.1</td>
<td>500.3</td>
<td>737.9</td>
<td>173.8</td>
<td>95.3</td>
</tr>
<tr>
<td>Literacy Rate (%)</td>
<td>93.50</td>
<td>99.60</td>
<td>92.20</td>
<td>74.04</td>
<td>0.730</td>
</tr>
<tr>
<td>Life Expectancy (avg yrs)</td>
<td>74.6</td>
<td>69.7</td>
<td>72.7</td>
<td>86.40</td>
<td>51.2</td>
</tr>
<tr>
<td>Human Development Index</td>
<td>0.730</td>
<td>0.788</td>
<td>0.524</td>
<td>0.570</td>
<td>0.629</td>
</tr>
</tbody>
</table>
BRICS situation: shifting from resource-based to knowledge based economies

**BRAZIL 2025?**
- Developed infrastructure for the country and South America
- Emerging actor in knowledge economy around new manufacturing sectors
- Shifting towards “green” economy, incl. renewable resources & sustainable agriculture

**RUSSIA 2025?**
- Development of infrastructure for economic transformation:
- Growth through new hi-tech sectors (National Technological Initiative etc.),
- Cultural innovations & growth of creative industries

**INDIA 2025?**
Generation of jobs (12 mln jobs annually) with high economic growth
- Manufacturing+ green economy;
- Infrastructure development;
- Energy security + renewable energy (esp. solar),
- ICT sector development

**CHINA 2025?**
- From manufacturing to full scale knowledge-based economy
- New centers of economic activity
- Sustainable energy & infrastructure

**SOUTH AFRICA 2025?**
- Nation building + social equality
- Infrastructure development for the country & macro-region of Africa
- Growth through new sectors

Sources: working group discussion results, for China: China State Council 10-year plan
BRICS situation: looking for breakthroughs in Industry 4.0 and emerging sectors
Enabling new sector creation in Russia through skills development: some cases

Clusters with skill dev component: Innopolis Hi-Tech City

Innopolis is a new Russian city, located in the Republic of Tatarstan. The city’s economy is based on high-tech industries. In Innopolis, a unique environment has been created that combines a modern residential infrastructure in harmony with the nature, safe environment, and broad opportunities for education and professional development. Innopolis University is a Russian higher education institution focused on education and research in the field of IT and Robotics.

Next gen technical universities: Moscow Polytech University

Founded in 2016 on the base of the Engineering University & Moscow State University of Printing Arts One of the largest technical universities in Russia. The mission of the University is to train engineers and managers for enterprises of the real sector of the economy, including the military-industrial complex, and engineering elite, who would have competences of project work. Partnership with SAP on skills of Industry 4.0

STEM Clubs for Youth: “Super-Engineers of the future”

Program targets children & youth between 10 & 18. Search for talents in new sectors (robotics, IoT etc.), primarily in large cities covered by Quantorium Youth Technoparks program. Partnership with top Russian IT companies (ABBYY, Kaspersky, Yandex, ...) and leading MNCs (IBM, Microsoft etc.)

Competitions focused on tech talent: WorldSkills HiTech & JuniorSkills

Competitions based on WorldSkills methodology that are centered on talents necessary for Industry 4.0 skills and advanced manufacturing skills. New types of competitions: life cycle management, competition of experts. “Laboratory” for new skills (e.g. “neuropiloting”) and new training methodologies (e.g. biofeedback-enhanced hard skill training)
Russia’s National Technological Initiative: integrated development of talent for sectors of tomorrow

- **DIRECT SEARCH**
  - 12-16
  - STEM: school & extra
  - NTI Competitions

- **VIRTUAL COMMUNITIES**
  - FUTURE TALENT
  - COMMUNITY LEARNING MOVEMENT
  - MAKER MOVEMENT
  - STUDENTS

- **REFERENCES**
  - 25 +
  - Lifelong Learning NTI companies

- **TEAM COMPETITIONS**
  - NTI educational program
  - Student’s projects, startups

- **TALENT OLYMPIADS**
  - 16-25