The industry 4.0 and its impacts on skills development

Paulo Esteves
November 2019
BRICS and Industry 4.0: skills gaps and skills development

The continuous loop connecting the physical and the digital will frame the jobs of the future. Digitalization and automation are the salient dimensions of the process we have been calling the Fourth Industrial Revolution. The phenomenon has no borders and will affect industries all over the globe. Nevertheless, Industry 4.0 impacts each country and each sector in different ways. Highly developed countries are discussing in-depth these changes and their potential impacts. The reality of the emerging economies such as Brazil, Russia, India, China and South Africa, however, is fairly different. Having economies in different positions and diverse political stands, BRICS countries must seek for topics and challenges of common interest aiming at establishing proper and shared platforms, networks and alliances.

The skills that tend to Industry 4.0’s needs are quite different from the ones that have always been valued in traditional industries. In order to gain competitiveness in the future business landscape, each country’s workforce must adapt. It is therefore of utmost importance that the BRICS countries have an adequate understanding of their current skills gap so that appropriate policies for skills development can then be developed. This project identifies and analyzes trends and impacts of the Industry 4.0 upon the labor market in BRICS countries.

The following Fact Sheets provide relevant data about the BRICS countries, allowing for a better understanding and analysis of the industry 4.0 workforce and the challenges of the future. It was developed in partnership with the Brazilian Section of the Skills Development Working Group (SDWG) of the BRICS Business Council (BBC).

Publications

**Russia: Skills Gap and Skills Development**
The document summarizes the Industry 4.0 main impacts upon the workforce in Russia, highlighting future jobs, skills gaps and skills development strategies.

**India: Skills Gap and Skills Development**
The document summarizes the Industry 4.0 main impacts upon the workforce in India, highlighting future jobs, skills gaps and skills development strategies.

**Brazil: Skills Gap and Skills Development**
The document summarizes the Industry 4.0 main impacts upon the workforce in Brazil, emphasizing future jobs and skills development strategies.

**China: Skills Gap and Skills Development**
The document summarizes the Industry 4.0 main impacts upon the workforce in China, emphasizing future jobs, skills gaps and skills development strategies.

**South Africa: Skills Gap and Skills Development**
The document summarizes the Industry 4.0 main impacts upon the workforce in South Africa, emphasizing future jobs, skills gaps and skills development strategies.
Productivity and Technological Intensity: a Lasting Divide?

Source: ECLAC 2019
ADP Technologies

Source: UNIDO, 2019
Production and use of ADP technologies

Source: UNIDO 2019
Impacts on Jobs

13–19% of FTEs may be displaced by automation by 2030 in BRICS countries

Demographics (Average Age):
- China and Russia: 40-45
- Brazil: 35-40
- India and South Africa: 30-35

World Average Impact: 15%

Jobs surplus by 2030

How to manage the transition?

Source: McKinsey Global Institute, 2017
<table>
<thead>
<tr>
<th>Country</th>
<th>Overall Index Score</th>
<th>Education Flexibility</th>
<th>Labour Market Participation</th>
<th>Labour Market Flexibility</th>
<th>Talent Mismatch</th>
<th>Overall Wage Pressure</th>
<th>Wage Pressure in High-Skill Industries</th>
<th>Wage Pressure in High-Skill Occupations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>6.0</td>
<td>4.9</td>
<td>5.7</td>
<td>4.3</td>
<td>6.1</td>
<td>5.9</td>
<td>8.6</td>
<td>6.2</td>
</tr>
<tr>
<td>Austria</td>
<td>5.9</td>
<td>5.2</td>
<td>5.7</td>
<td>4.0</td>
<td>8.8</td>
<td>7.3</td>
<td>6.6</td>
<td>3.6</td>
</tr>
<tr>
<td>Belgium</td>
<td>3.9</td>
<td>5.6</td>
<td>5.6</td>
<td>3.7</td>
<td>1.5</td>
<td>6.2</td>
<td>0.0</td>
<td>4.5</td>
</tr>
<tr>
<td>Brazil</td>
<td>5.3</td>
<td>5.8</td>
<td>5.9</td>
<td>9.2</td>
<td>7.9</td>
<td>3.9</td>
<td>3.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Canada</td>
<td>5.6</td>
<td>5.9</td>
<td>5.0</td>
<td>4.1</td>
<td>6.0</td>
<td>3.9</td>
<td>9.1</td>
<td>5.4</td>
</tr>
<tr>
<td>Chile</td>
<td>5.0</td>
<td>6.4</td>
<td>5.9</td>
<td>6.5</td>
<td>0.0</td>
<td>5.8</td>
<td>4.3</td>
<td>5.8</td>
</tr>
<tr>
<td>China</td>
<td>3.7</td>
<td>0.9</td>
<td>1.2</td>
<td>8.1</td>
<td>4.1</td>
<td>1.9</td>
<td>4.4</td>
<td>5.0</td>
</tr>
<tr>
<td>Colombia</td>
<td>6.3</td>
<td>5.3</td>
<td>9.1</td>
<td>7.8</td>
<td>6.2</td>
<td>6.1</td>
<td>3.1</td>
<td>N/A</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>4.2</td>
<td>7.7</td>
<td>4.6</td>
<td>3.5</td>
<td>4.3</td>
<td>3.6</td>
<td>0.9</td>
<td>5.0</td>
</tr>
<tr>
<td>Denmark</td>
<td>6.5</td>
<td>5.2</td>
<td>4.5</td>
<td>3.5</td>
<td>9.5</td>
<td>8.9</td>
<td>8.7</td>
<td>4.9</td>
</tr>
<tr>
<td>France</td>
<td>6.0</td>
<td>4.5</td>
<td>5.2</td>
<td>8.4</td>
<td>10.0</td>
<td>3.4</td>
<td>6.4</td>
<td>3.8</td>
</tr>
<tr>
<td>Germany</td>
<td>6.5</td>
<td>6.3</td>
<td>5.2</td>
<td>6.9</td>
<td>4.2</td>
<td>5.8</td>
<td>9.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td>4.4</td>
<td>1.9</td>
<td>5.7</td>
<td>2.6</td>
<td>5.7</td>
<td>8.7</td>
<td>6.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Hungary</td>
<td>4.8</td>
<td>8.4</td>
<td>3.7</td>
<td>5.0</td>
<td>6.0</td>
<td>4.8</td>
<td>0.9</td>
<td>4.7</td>
</tr>
<tr>
<td>India</td>
<td>5.4</td>
<td>0.7</td>
<td>4.2</td>
<td>8.7</td>
<td>5.2</td>
<td>7.0</td>
<td>6.8</td>
<td>5.0</td>
</tr>
<tr>
<td>Ireland</td>
<td>5.5</td>
<td>3.1</td>
<td>7.6</td>
<td>3.0</td>
<td>3.0</td>
<td>3.6</td>
<td>5.7</td>
<td>7.8</td>
</tr>
<tr>
<td>Italy</td>
<td>4.8</td>
<td>6.2</td>
<td>3.7</td>
<td>6.6</td>
<td>8.5</td>
<td>3.8</td>
<td>2.4</td>
<td>2.3</td>
</tr>
<tr>
<td>Japan</td>
<td>6.1</td>
<td>3.9</td>
<td>6.3</td>
<td>7.0</td>
<td>9.8</td>
<td>7.0</td>
<td>1.1</td>
<td>7.5</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>6.8</td>
<td>5.9</td>
<td>5.1</td>
<td>3.6</td>
<td>10.0</td>
<td>10.0</td>
<td>8.3</td>
<td>4.4</td>
</tr>
<tr>
<td>Malaysia</td>
<td>4.5</td>
<td>4.1</td>
<td>3.8</td>
<td>5.7</td>
<td>N/A</td>
<td>4.6</td>
<td>5.1</td>
<td>3.9</td>
</tr>
<tr>
<td>Mexico</td>
<td>5.8</td>
<td>4.9</td>
<td>5.7</td>
<td>7.1</td>
<td>5.5</td>
<td>4.9</td>
<td>10.0</td>
<td>2.4</td>
</tr>
<tr>
<td>Netherlands</td>
<td>5.5</td>
<td>4.7</td>
<td>6.3</td>
<td>5.2</td>
<td>6.4</td>
<td>5.4</td>
<td>5.3</td>
<td>5.5</td>
</tr>
<tr>
<td>New Zealand</td>
<td>5.5</td>
<td>4.6</td>
<td>5.6</td>
<td>4.1</td>
<td>5.8</td>
<td>6.1</td>
<td>10.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Poland</td>
<td>4.1</td>
<td>5.1</td>
<td>3.6</td>
<td>6.8</td>
<td>5.9</td>
<td>4.1</td>
<td>3.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Portugal</td>
<td>5.5</td>
<td>5.2</td>
<td>5.1</td>
<td>6.1</td>
<td>8.6</td>
<td>5.1</td>
<td>8.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Romania</td>
<td>4.4</td>
<td>7.4</td>
<td>3.9</td>
<td>7.3</td>
<td>5.0</td>
<td>4.9</td>
<td>0.0</td>
<td>2.6</td>
</tr>
<tr>
<td>Russia</td>
<td>6.1</td>
<td>6.4</td>
<td>5.8</td>
<td>7.6</td>
<td>4.3</td>
<td>5.3</td>
<td>5.9</td>
<td>7.2</td>
</tr>
</tbody>
</table>
Talent Shortage

Source: Talent Shortage Survey 2018
Talent Shortage

Impact of Labor shortage on different sectors in 2030 (in USD billions)

Source: KORN FERRY, "Future of Work: The Global Talent Crunch", 2018
Skills Development

Source: WEF Future of Jobs 2018 Report, 2018
Skills Development

Projected Use of Training Providers

Source: WEF Future of Jobs 2018 Report, 2018
Skills Development

Skilling Initiatives

- Analysis of reskilling and upskilling demands
- Design of a corporate workforce skills plan
- Individual assessment
- Match Jobs and Existing Skills
- Implement reskilling and upskilling activities
- No reskilling or upskilling initiatives

Source: BBC – SDWG Survey 2019
SG / SD - Brazil

Skills-Sets Availability
- Resource Management Skills
- Systems Skills
- Basic Skills (Content)
- Complex Problem Solving Skills
- Technical Skills
- Basic Skills (Process)
- Social Skills

Knowledge Areas - Availability
- Business and Management
- Engineering and Technology
- Communications
- Arts and Humanities
- Mathematics and Science
- Education and Training
- Law and Public Safety
- Manufacturing and Production
- Health Services

Abilities - Availability
- Quantitative Abilities
- Verbal Abilities
- Memory
- Reasoning Abilities
- Perceptual Abilities
- Auditory and Speech Abilities
- Reaction Time and Speed Abilities
- Visual Abilities
- Spatial Abilities
- Attentiveness
- Flexibility, Balance and Coordination
- Control Movement Abilities
- Endurance
- Physical Strength
- Fine Manipulative Abilities

Source: OECD, 2019
## New Jobs (2023)

<table>
<thead>
<tr>
<th>Job Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics Designers</td>
<td>12%</td>
</tr>
<tr>
<td>Natural and hard sciences researchers</td>
<td>12%</td>
</tr>
<tr>
<td>Mechanical technicians</td>
<td>13%</td>
</tr>
<tr>
<td>Electromechanical Maintenance Supervisors</td>
<td>13%</td>
</tr>
<tr>
<td>Mechanical machining Operators</td>
<td>13%</td>
</tr>
<tr>
<td>IT Services Directors</td>
<td>13%</td>
</tr>
<tr>
<td>Electromechanical Technicians</td>
<td>14%</td>
</tr>
<tr>
<td>Automation and mechatronic engineers</td>
<td>14%</td>
</tr>
<tr>
<td>Electrical line installers and repairers</td>
<td>15%</td>
</tr>
<tr>
<td>Food and related engineers</td>
<td>15%</td>
</tr>
<tr>
<td>Logistics Managers</td>
<td>15%</td>
</tr>
<tr>
<td>Cartographers engineers</td>
<td>15%</td>
</tr>
<tr>
<td>Aircraft system and structure assemblers</td>
<td>15%</td>
</tr>
<tr>
<td>Logistics planning technicians</td>
<td>17%</td>
</tr>
<tr>
<td>Engineering and technology researchers</td>
<td>18%</td>
</tr>
<tr>
<td>Environmental engineers</td>
<td>19%</td>
</tr>
<tr>
<td>Vehicle mechanics technicians</td>
<td>20%</td>
</tr>
<tr>
<td>Robotic Processes</td>
<td>22%</td>
</tr>
</tbody>
</table>

Source: SENAI, Labour Map. 2019
SG / SD - Russia

SG / SD - Russia

Source: Высшая школа экономики, Москва, 2016

Facing reskilling needs (share of companies surveyed)

- Strategic redundancies of staff who lack the skills to use new technologies
- Hire freelancers with skills relevant to new technologies
- Outsource some business functions to external contractors
- Retrain existing employees
- Expect existing employees to pick up skills on the job
- Hire new temporary staff with skills relevant to new technologies
- Look to automate the work
- Hire new permanent staff with skills relevant to new technologies

Source: World Economic Forum, 2018
SG / SD - India

Workforce Inadequacy

- Qualification Mismatch
- Talent Deficit
- Skills Obsolescence

Source: BBC – SDWG Survey 2019
Source: BBC – SDWG Survey 2019
SG / SD - India

Source: BBC – SDWG Survey 2019
SG / SD - India

Abilities - Relevance

Abilities - Availability

Source: BBC – SDWG Survey 2019
SG / SD - India

Impacts on Jobs

Source: FICCI
SG / SD - India

Skilling Initiatives

- Analysis of reskilling and upskilling demands: 10.0%
- Design of a corporate workforce skills plan: 15.0%
- Match Jobs and Existing Skills: 30.0%
- Implement reskilling and upskilling activities: 40.0%
- No reskilling or upskilling initiatives: 5.0%

Skilling Approaches

- Blended Training: 35.0%
- Coaching: 5.0%
- Detail: 10.0%
- Mentoring: 15.0%
- On the Job Training: 30.0%
- Rotational Assignment: 5.0%
- Shadowing Assignment: 0.0%

Source: BBC – SDWG Survey 2019
SG / SD - China

Source: JP MORGAN CHASE, Skills Shortages in the Chinese Labor Market, October 2016
SG / SD - China

Job-task measures of skill use at work
(STEP - 2014 - %)

Source: World Indicators of Skills for Employment
SG / SD - China

Talent Availability

- International management talent
- Strategic design talent
- Capital operation talent
- Technology research development talent
- Senior technical worker
- Internet talent
- Management talent
- Marketing talent
- Financial management talent

Source: JP MORGAN CHASE, Skills Shortages in the Chinese Labor Market, October 2016
Labour demand and 4IR mid-point adoption, 2030 (Million net jobs)

Source: McKinsey Global Institute, 2017
SG / SD – South Africa

Workforce Inadequacy

Source: BBC – SDWG Survey 2019
SG / SD – South Africa

Source: BBC – SDWG Survey 2019
SG / SD – South Africa

Knowledge Areas - Relevance

Knowledge Areas - Availability

Source: BBC – SDWG Survey 2019
SG / SD – South Africa

Source: BBC – SDWG Survey 2019
SG / SD – South Africa

Labour demand and 4iD mid-point adoption, 2030 (’000 net jobs)

-400  -200   0    200   400   600

Health and Social Assistance
Construction
Other Services
Scientific and Technical Services
Educational Services
Arts and Recreation
Accommodation and Food Services
Wholesale Trade
Finance and Insurance
Utilities
Information
Real Estate
Agriculture, Fishing and Hunting
Mining
Transportation and Storage
Manufacturing
Government
Retail Trade

McKinsey Global Institute, 2017
SG / SD – South Africa

Source: BBC – SDWG Survey 2019
THANK YOU!

esteves.pauloluiz@gmail.com
esteves_paulo@puc-rio.br