Industrial Policy in an hyper-connected world

Mario Cimoli, Deputy Executive Secretary, UN-ECLAC
Outline

Waves of Industrial Policy strategies

A globalized and hyper-connected world

Global structural changes: GVCs and production strategies

Technological revolution: a new world for industries

Is manufacturing still manufacturing?

Industrial Policy today: promoting technology-ecosystems

Learning from emerging trends: which industrial policy for LACs?
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</thead>
<tbody>
<tr>
<td><strong>Rational for Policy</strong></td>
<td>Economic development through industrialization</td>
<td>Liberalization and poverty reduction key to economic development</td>
<td>ITC and Knowledge as key factors for development</td>
<td>Digital economy and innovation in production systems</td>
</tr>
<tr>
<td><strong>Policy level</strong></td>
<td>Create new markets. Structural changes and diversification</td>
<td>The best industrial policy is no industrial policy.</td>
<td>Targeted strategies to increase productivity. Enabling institutional environment</td>
<td>Technological and industrial ecosystems development. Competences and capabilities strategic assets</td>
</tr>
<tr>
<td><strong>Instruments</strong></td>
<td>Vertical Industrial Policy. Focus on sectors. Gradual open to international competition. Import substitutions</td>
<td>No productive policies. Opening to international competition. Focus on human capital development.</td>
<td>Horizontal policies (entrepreneurship) and selective policies (strategic sectors). National competitiveness agendas.</td>
<td>Smart industrial policies (vertical but focused on technology trajectories and local opportunities). Public-private setting of national missions</td>
</tr>
<tr>
<td></td>
<td>Capital movement management. Export-oriented productive policies.</td>
<td>FDI attraction as a strategy to national specialization. Modernization of the state</td>
<td>Management of FDI flows. Focus on national competitiveness.</td>
<td>Strategic management of FDI (assets protection). Strategic management of international trade (USA)</td>
</tr>
</tbody>
</table>
A globalized hyper-connected world

Source: ECLAC based on data from Klasing and Milionis (2014), Penn World Table 9, World Bank (2017)
Properties of globalization

<table>
<thead>
<tr>
<th><strong>Agglomeration-fragmentation</strong></th>
<th>The internationalization of competition requires more and more scale to compete in the global arena. This generates agglomeration-fragmentation dynamics that affect productive and technological opportunities, the accumulation of capabilities and the structure of the labour market</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multi-polarity and Complexity</strong></td>
<td>Shift of economic and political power and new emerging actors, especially China. Interconnected economies deeply dependent and responsive to each other.</td>
</tr>
<tr>
<td><strong>Interrelated Issues</strong></td>
<td>Problems and challenges are increasing borderless and tackling them usually requires coordinated actions.</td>
</tr>
<tr>
<td><strong>Growing Imbalances</strong></td>
<td>Persistent trade and current accounts imbalances. Growing asymmetries in development and income distribution, between and within countries.</td>
</tr>
<tr>
<td><strong>Crisis-prone context</strong></td>
<td>The world economy is much more vulnerable and subject to systemic shocks. Shocks’ propagation scale has increased.</td>
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</table>
Reverting trends in production integration

Domestic value added share of total exports (Global average)

- 2011
- 2008
- 2005
- 2000
- 1990

68 70 72 74 76 78 80
Global Structural Changes

Export structure by technology level, world regions (1990,2016)
Global Structural Changes

• Global Value Chains domaniates international production networks
• Countries participate to GVCs according to their national production network
• The importance of national and regional industrialization strategies
• Specialization in specific segments of international production might cause lock in-effects
• Value captured by major companies in critical stages of the value chain (consequence: concentration of value in tech-intensive sectors)
• One question to think about: is this kind of development strategy working?
Technological Revolution is reshaping global production models

**Zero marginal cost economy**
- New internet-based business models of production and distribution of digital goods and services.
- Very low marginal cost of distribution and replication.
- Production by businesses complemented with production by consumers.
- Re-skilling and up-skilling of capabilities in the fields of software development and data analytics.

**Industrial Internet**
- New industrial models and production processes using:
  - Machines and sensors connected through the internet.
  - Robots and machine learning.
  - Cyber-physical systems.
  - Cognitive abilities, complex problem solving and data analytics, social skills, critical thinking, literacy and active learning.

**Gig economy /sharing**
- Business models in which temporary positions are common and organizations contract with independent workers for short-term engagements.
- Basic digital skills.
Is manufacturing still manufacturing?

• Manufacturing goes **beyond the traditional industry definition and national borders**
  
  • Manufacturing involves activities across different sectors
  
  • Modern manufacturing has a global scale with local ecosystem contributing with components and materials at different production levels
  
  • Vertical analysis is not enough to understand manufacturing complex systems
“A proper understanding of the “portentously rapid” rate of technological innovation which accompanied American industrialization [...] requires that we focus attention on a particular aspect of the changing nature of manufacturing. For this purpose, it is necessary to discard the familiar Marshallian approach, involving as it does the definition of an industry as a collection of firms producing a homogenous product- or at least products involving some sufficiently high cross-elasticity of demand. For many analytical purposes it is necessary to group firms together on the basis of some features of the commodity as a final product; but we cannot properly appraise important aspects of technological developments in the nineteenth century until we give up the Marshallian concept of an industry as the focal point of our attention and analysis. These developments may be understood more effectively in terms of certain functional processes which cut entirely across industrial lines in the Marshallian sense.”

(Rosenberg, 1963

“Technological change in the machine tools industry 1840-1910”)
Is manufacturing still manufacturing?

Supply of Industrial Robots

Estimated annual supply of industrial robots by industries worldwide
('000 of units)

- Automotive Industry
- Electrical/electronics
- Metal
- Chemical, rubber and plastics
- Food
- Others
- Unspecified

Source: IFR World Robotics 2017
Is manufacturing still manufacturing?
Supply of Industrial Robots

Estimated worldwide annual supply of industrial robots - 2016 ('000 of units)

Source: IFR World Robotics 2017
A new world for industries

- Technological revolution has redefined the locus of value creation
- Value is created by a recombination of complex technology ecosystems
- Diffused production technology and capabilities are key
- High degree of cross-sectoral spill-overs
A new world for workers

Jobs Creation Dynamics (2015)

- Office and Administrative: -4759, 492
- Manufacturing and Production: -1609, 416
- Construction and Extraction: -497, 405
- Art, Design, Entertainment, Sports and Media: -151, 339
- Legal: -109, 303
- Installation and Maintenance: -40, 66

Source: WEF (2016)
Evidence of a paradigm shift

• Tendency to start the reshoring of some industries
  • Automation reduces the importance of labor cost
  • On-demand production
  • Transportation costs and logistics more and more important
  • Design and production proximity crucial to R&D

• Manufacturing is (and will be) the focus
  • Dominates trade balances
  • Foster technological development
  • Positive externalities for growth in other sectors
  • Determines *innovative advantages*

Which policies are then necessary to support a new competitive manufacturing sector?
New Industrial Policy

- **Canada**
  - Smart Manufacturing
- **USA**
  - Manufacturing USA (America First)
- **UK**
  - Catapult-High Value Manufacturing
- **Belgium**
  - Made Different
- **Netherlands**
  - Smart Industry
- **Spain**
  - Industria Conectada
- **Portugal**
  - PRODUTECH
- **France**
  - Industrie du Futur
- **Italy**
  - Italia 4.0
- **Germany**
  - Industrie 4.0
- **Sweden**
  - Produktion 2030
- **South Korea**
  - Manufacturing Innovation
- **China**
  - Made in China 2025
- **Japan**
  - Industrial Value Chain
- **India**
  - Make in India
- **Australia**
  - Next wave of manufacturing
- **Sweden**
  - Produktion 2030
- **UK**
  - Catapult-High Value Manufacturing
<table>
<thead>
<tr>
<th><strong>Rational for Policy</strong></th>
<th>Manufacturing Offshoring of production and R&amp;D centres undermines competitiveness.</th>
<th>The historical trade surplus in High-Tech products has been converted in a deficit since 2001. Significant Job losses.</th>
<th>Changes in production processes and the emergence of technological ecosystem put US manufacturing under pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Policy strategy</strong></td>
<td>Promote US-based manufacturing competitiveness</td>
<td>Create a business-friendly environment and improve international conditions</td>
<td>Boost advanced manufacturing R&amp;D and innovation</td>
</tr>
<tr>
<td><strong>Policy level</strong></td>
<td>Cross-cutting technologies initiatives (Robotics, Bio manufacturing, Etc.)</td>
<td>Sectoral Policies at the State level. Initiatives to boost international trade</td>
<td>Development of technology infrastructure</td>
</tr>
<tr>
<td><strong>Instruments</strong></td>
<td>Incentives to SMEs, Manufacturing tax credit, reduction in energy costs</td>
<td>High-tech mission oriented initiatives.</td>
<td>Network of manufacturing innovation, Robotics initiatives and other high-tech initiatives</td>
</tr>
<tr>
<td><strong>Complementary Policies</strong></td>
<td>Tax benefits as a mean do incentivize US-based production</td>
<td>Input-technology strategies: skills, education and energy Renegotiation of FTA</td>
<td>High risk investments to help the development of new technologies. Federal investments (mainly defence)</td>
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Concrete Initiatives in the US

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Goal</th>
<th>Implemented by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Internet Consortium (IIC)</td>
<td>Input on standardization; new business models</td>
<td>Business Sector</td>
</tr>
<tr>
<td>Smart Manufacturing Leadership Coalition (SMLC)</td>
<td>Joint pre-competitive research on an open platform</td>
<td>Business Sector</td>
</tr>
<tr>
<td>AllSeen Alliance</td>
<td>Consumer electronics</td>
<td>Business Sector</td>
</tr>
<tr>
<td>Open Connectivity Foundation (OCF)</td>
<td>Inter-system communication</td>
<td>Business Sector</td>
</tr>
<tr>
<td>National Network for Manufacturing Innovation (NNMI)</td>
<td>Innovation centre, not specifically focused on Industrie 4.0 (DMDI)</td>
<td>Government</td>
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### Made in China 2025

<table>
<thead>
<tr>
<th>Rational for Policy</th>
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<tbody>
<tr>
<td><strong>China</strong> aims to be the <strong>manufacturing superpower</strong> in the world by 2025</td>
<td>Increase quality of Chinese manufacturing and <strong>reducing dependence on international trade for high-tech</strong></td>
<td><strong>Broad-scale</strong> <strong>industrial upgrading as a strategy to escape income-trap</strong></td>
<td></td>
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<table>
<thead>
<tr>
<th>Policy strategy</th>
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<tbody>
<tr>
<td>Increase <strong>import-substitution</strong> in high tech</td>
<td>Develop national technological ecosystem</td>
<td><strong>Local government strategies to upgrade the industrial system all over the country</strong></td>
<td></td>
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<tr>
<th>Policy level</th>
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<tr>
<td><strong>Top-down approach</strong>: the government sets objectives and time horizon</td>
<td><strong>Huge investments in technology and industrial development</strong>, specifically targeted to development of more competitive technologies (automotive and energy)</td>
<td><strong>Subsidies to indigenous IP development and localization.</strong> Public fund to R&amp;D and innovation in strategic industries (semiconductors, robots, batteries)</td>
<td></td>
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<table>
<thead>
<tr>
<th>Instruments</th>
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<tbody>
<tr>
<td>Financial Policies, Technological and Sectoral funds and business subsidies</td>
<td><strong>Preferential access to capital to domestic companies to enhance their capacity to acquire technology</strong> and promote their indigenous R&amp;D capabilities</td>
<td><strong>Investment libraries</strong> to promote investments in MCI2025 sectors and technology</td>
<td></td>
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<table>
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<tr>
<th>Complementary Policies</th>
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<tbody>
<tr>
<td><strong>International FDI strategy</strong>, targeting high-tech enterprises all over the world to acquire technological capabilities</td>
<td><strong>Pre-establishment restriction</strong> to protect MIC2025 sectors from foreign competition</td>
<td><strong>Diffusion of State Owned Enterprises</strong> in high tech all over the country – technological network</td>
<td></td>
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</table>
Concrete Initiatives in China

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Goal</th>
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<tbody>
<tr>
<td>Internet of Things Center Shanghai</td>
<td>ITC Development</td>
<td>Government</td>
</tr>
<tr>
<td>Internet Plus</td>
<td>Industrial Internet</td>
<td>Government</td>
</tr>
<tr>
<td>Digital Infrastructure</td>
<td>Enabling system transformation</td>
<td>Government</td>
</tr>
<tr>
<td>Smart Factory 1.0 Initiative</td>
<td>Industrial ecosystem transformation</td>
<td>Business Sector</td>
</tr>
<tr>
<td>Rational for Policy</td>
<td>Maintaining <strong>Germany</strong> unconditional <strong>strong position in manufacturing</strong></td>
<td>Development of <strong>foreign market</strong></td>
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</tr>
<tr>
<td>Policy strategy</td>
<td>Increase excellence and high-tech in German manufacturing industry</td>
<td>Develop <strong>national technological ecosystem</strong> – industry networks</td>
</tr>
<tr>
<td>Policy level</td>
<td><strong>Multi-level approach:</strong> Government guidelines and sectorial initiatives</td>
<td>Large scale <strong>bilateral programs with other countries:</strong> EU, Japan, USA, South Korea</td>
</tr>
<tr>
<td>Instruments</td>
<td>R&amp;D technology oriented and <strong>R&amp;D and innovation institutions networks</strong></td>
<td><strong>Institutional networks</strong> to increase access to R&amp;D founding and bear initial R&amp;D costs</td>
</tr>
<tr>
<td>Complementary Policies</td>
<td>Education and skills programmes</td>
<td>Policies to ensure the increase in private investment and the commitment of the private sector</td>
</tr>
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Concrete Initiatives in Germany

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Sector</th>
<th>Implemented by</th>
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</thead>
<tbody>
<tr>
<td>Plattform Industrie 4.0</td>
<td>General framework coordinated by government</td>
<td>Government</td>
</tr>
<tr>
<td>BDEW</td>
<td>Industrial Internet</td>
<td>Industrial Association</td>
</tr>
<tr>
<td>BDI</td>
<td>Cross-sectorial manufacturing initiatives</td>
<td>Industrial Association</td>
</tr>
<tr>
<td>Bitkom</td>
<td>ITC</td>
<td>Industrial Association</td>
</tr>
<tr>
<td>VDA</td>
<td>Automotive Industry</td>
<td>Industrial Association</td>
</tr>
<tr>
<td>ZVEI, VDMA, et al.</td>
<td>Sectorial engineering industry</td>
<td>Industrial Association</td>
</tr>
<tr>
<td></td>
<td>Target</td>
<td>Technology/Sector</td>
</tr>
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</tr>
<tr>
<td><strong>France</strong></td>
<td>Industry &amp; production base, SMEs &amp; mid-caps</td>
<td>Transport, IoT, artificial intelligence, Big data, HPC, Digital trust, healthcare, smart cities</td>
</tr>
<tr>
<td><strong>Italy</strong></td>
<td>Large companies, SMEs, universities, research centres</td>
<td>Generic R&amp;D promotion with focus on digital and AM industrial transformation</td>
</tr>
<tr>
<td><strong>Spain</strong></td>
<td>Industry: focus on SMEs &amp; micro-enterprises</td>
<td>Digital platforms, Big data, Collaborative applications</td>
</tr>
<tr>
<td><strong>Uk</strong></td>
<td>Business, industry &amp; research organisations</td>
<td>Aerospace, Automotive, Chemicals, Nuclear, Pharma, Electronics</td>
</tr>
<tr>
<td><strong>Czech republic</strong></td>
<td>Industry &amp; service sector companies, trade unions</td>
<td>No specific focus</td>
</tr>
<tr>
<td><strong>Sweden</strong></td>
<td>Research, academia &amp; industrial &amp; service SMEs</td>
<td>No specific focus</td>
</tr>
<tr>
<td><strong>Netherlands</strong></td>
<td>General Business Community</td>
<td>No specific focus</td>
</tr>
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Application Public-Private Partnerships  
ICT Innovation Manufacturing for SMEs  
Digital Sector Partnerships  
Vanguard Program (Regional Excellence in Manufacturing)
New Industrial Policy:
Promoting technology ecosystems

• **Explicit policies**: Renewed interest in manufacturing policies; the main approach is *cross-sectoral* and is aimed at promoting technology ecosystem

• **Major focus on**: advanced manufacturing, IoT, platforms development and the development of enabling technologies

• Increasing awareness that *geographically concentrated manufacturing systems* (all along the smiling curve) *can be a competitive advantage* in the technological revolution

• Skills and infrastructure development have a key role in all the political packages

• **Main challenge**: transition from traditional manufacturing oriented policies to long-run policies for technology-ecosystem development
New Industrial Policy: a multi-level approach

- Market Failures
  - Imperfect Information
  - Imperfect Competition
  - Externalities

- Structural Problems
  - Undiversified production structure
  - Lock-in
  - Lack of capabilities

- Systemic Failures
  - Transfer failures
  - Public good provision
  - Institutional failures

- Transition Problems
  - Middle income trap
  - Technological gap
  - Knowledge gap
Is LAC ready?

BNDES recurre a blockchain para aportar transparencia tras los casos de corrupción

¿Una nación blockchain? Esto es lo que el gobierno mexicano tiene entre manos

El BCRA, las fintech y los bancos se unen para innovar

La tecnología 5G empezará a desplegarse en América Latina a mediados de 2020

El Ministerio de Tecnologías de la Información de Colombia anuncia el borrador de su política de Ciudades Inteligentes

Los sectores financiero, gobierno y salud serán los primeros en hacer la transición y rentabilizar sus beneficios.
Low productivity persists...

LATIN AMERICA: RELATIVE LABOUR PRODUCTIVITY WITH RESPECT TO THE UNITED STATES AND UNITED STATES' LABOR PRODUCTIVITY INDEX, 1980-2016

Source: ECLAC on CEPALSTAT and ILO
As does the old undiversified productive structure

A. Value Added

B. Employment

Source: ECLAC on CEPALSTAT and ILO
With little innovation and technological progress

**Source:** ECLAC, on the basis of UNESCO and WPO
Gap in adoption of new technologies

NUMBER OF ACTIVE SENSOR, per capita (2014, 2019P)

- **North America**
  - 2014: 6.1
  - 2019: 11.6

- **West Europe**
  - 2014: 4.4
  - 2019: 8.2

- **East Europe**
  - 2014: 2.4
  - 2019: 4.3

- **Latin America**
  - 2014: 2.0
  - 2019: 2.9

- **Africa and Middle East**
  - 2014: 1.0
  - 2019: 1.4

- **Asia-Pacific-Area**
  - 2014: 1.6
  - 2019: 2.5

Source: CISCO, 2015
Industrial Policy are necessary for regional catching-up

**INSTALLED IOT SOFTWARES (BILLIONS)**

- Asia/Pacific
- Latin America
- North America
- Western Europe

**ROBOTS IN MANUFACTURING, 2016 (per 10000 of employees)**

- Brazil
- Argentina
- Mexico
- China
- United Kingdom
- France
- Italy
- United States
- Germany
- Japan
- Korea

Learning from emerging trends: which industrial policy for LACs?

• Horizontal policies are not sufficient
• Selective policies are designed to rebuild the foundation of industrial commons (innovative capacity)
• Focus on new technologies: knowledge and data key assets
• Technical-scientific know-how (knowledge generation)
• Specialized human capital (skills formation)
• Approach similar to vertical policies but focused on skills development
• No dichotomy between market and State
Industrial Policy effectiveness

• Industrial Policy do not work alone
• Capabilities and technological infrastructure matters
• **Regional Scale can offer a competitive advantage**
• Institutional features are key to long run coordination