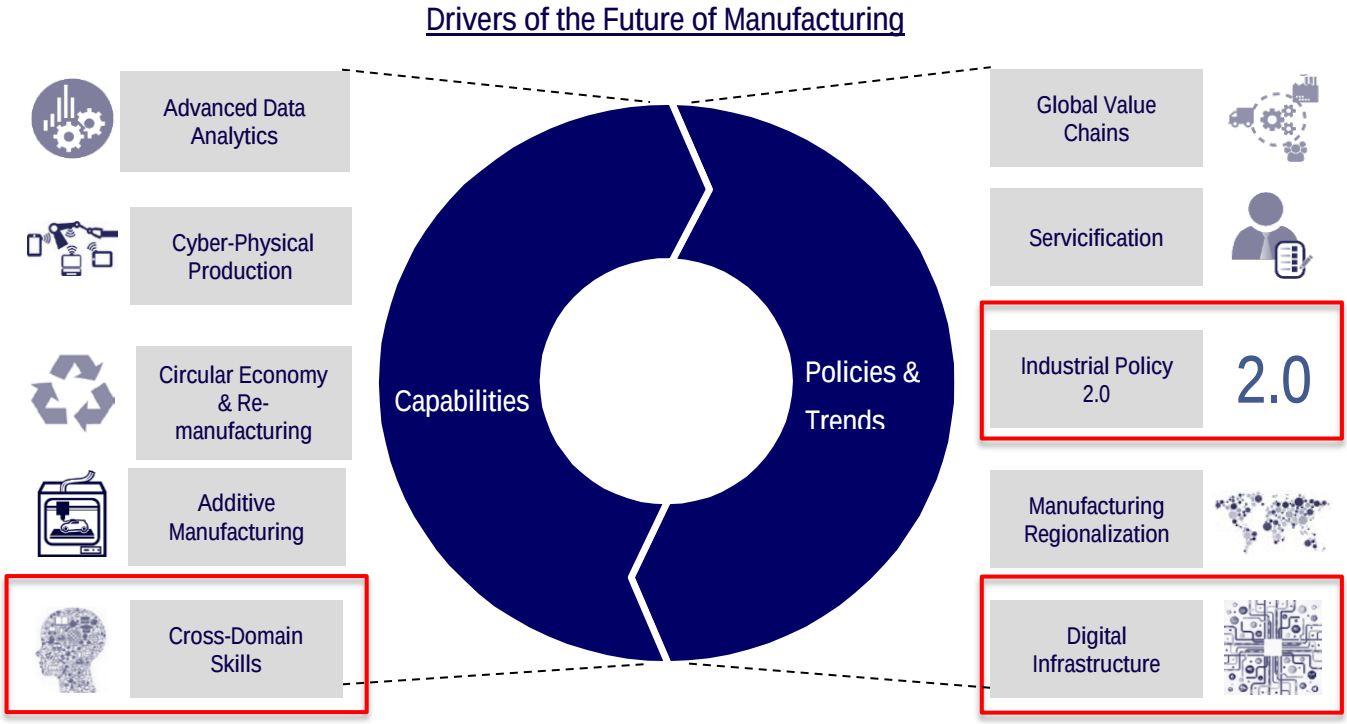
Case 1

# Framing the Future of Manufacturing Policies: A Country Case Study




Source: World Economic Forum Global Agenda Council on the Future of Manufacturing, Whiteshield Partners framing

| Energy-based Economies | Least Developed | Developing Economies | Developed or OECD Countries |
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Covered by Case

# Executive Summary

## 1. Challenge Confronted

The country's government faced the challenge of preparing for the future of manufacturing, assessing the country's performance versus others and developing relevant and innovative public policies. This case study summarizes the work performed, as well as any learnings and potential implications for wider industrial policies. (The name of the country covered has been removed for reasons of confidentiality).

Indeed, over the last 230 years, cycles of technological innovation and its diffusion have shaped the manufacturing sector and repeatedly created entirely new processes, production methods and products. These waves of innovation mark three distinct disruptive industrial revolutions, with a fourth wave on its way. The so-called Fourth Industrial Revolution may accelerate change at an unprecedented scale and will be driven and shaped by advances in capabilities, as well as by new policies and trends. Several developments have already significantly changed the nature of manufacturing jobs: faster and leaner operations with changes in methods; cross-domain skills required to cover electronics, robotics, coding and usage of new equipment; but also technological advancements, such as cyber-physical production methods (e.g. Internet of Things), additive manufacturing (e.g. 3D printing) and advanced data analytics (e.g. big data). This raises the questions: Is the country at stake "ready for the next industrial revolution"? And, how can its policy-makers and business leaders adapt to these changes? To address the fundamental drivers behind the future of manufacturing, the country's policy-makers will require more relevant and adapted metrics. The future of manufacturing will see an increased convergence of skills, materials and processes; thus, metrics solely focused on manufacturing will not be sufficient to inform policy-makers. Manufacturing will become much more knowledge-intensive, requiring cross-domain metrics. Therefore, current manufacturing metrics may lead to ill-conceived policy actions.

Capability drives the largest manufacturing countries, whereas smaller manufacturing economies follow a factor or competitiveness-driven model. How can industrial development paths of economies be modeled for the country? How can factor-based economies shift to become capability-driven?

The typical worker-vs-manager job distinction no longer holds. While former white-collar workers have moved up into innovation, former blue-collar workers are required to perform more capability- and cross-domain-based functions in manufacturing, as manual jobs are taken over by machines. In times of disruptive technological change, how can business and government policies be designed to support existing jobs and create new ones in the manufacturing sector?

## 2. Solution Used

For the country at stake, the Future of Manufacturing Barometer was developed as an analytic tool to assess opportunities for the government and business leaders in the context of future radical changes in manufacturing. The barometer helped the country measure gaps between today's manufacturing performance (benchmark using United Nations metrics and the Global Innovation Index [the latter co-published by Cornell University, INSEAD and the World Intellectual Property Organization]) and countries' future potential (economic complexity), and also measure the role of policy effectiveness (the World Economic Forum's Global Competitiveness Index). The barometer covered over 100 countries and was animated in an online world map to spur dialogue with the country's regional partners.

# Framing the Future of Manufacturing Policies: A Country Case Study

Dates: 2015 – present

Keywords: capabilities, industrialization, innovation, metrics, policies, skills, barometer

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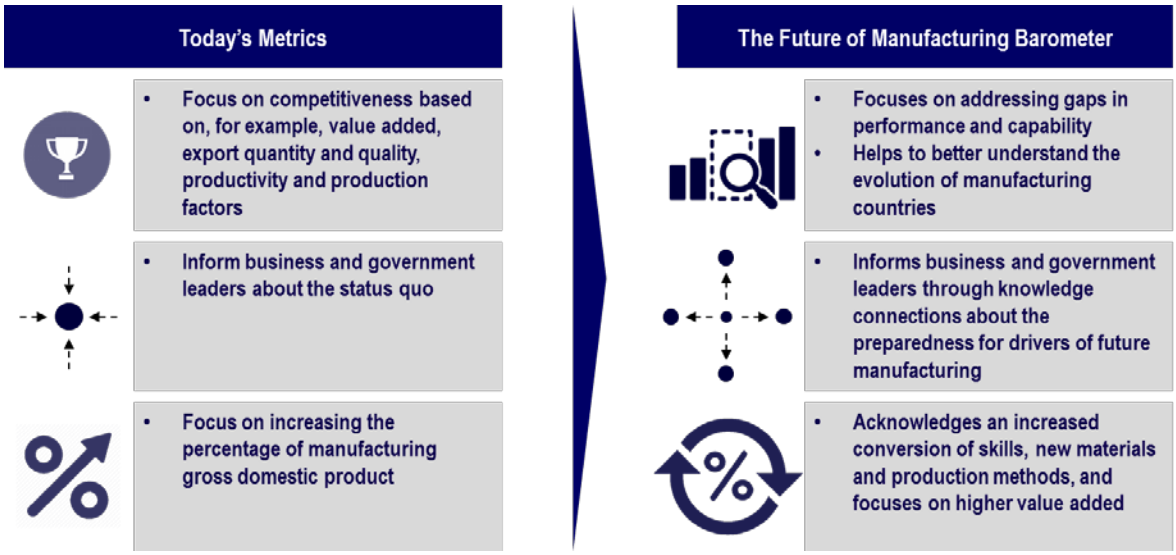
Key facts:

- The country wanted to leapfrog into a better manufacturing position and was looking for relevant policy options.
- However, current manufacturing metrics were not adapted to put effective manufacturing policies in place.
- A new set of measures was needed to have more effective policy and capture future trends.
- The Future of Manufacturing Barometer covered most countries in the world, providing insight for a particular country on the gap between performance and potential, and possible policy issues to address.

## Is the Country Using Relevant Manufacturing Metrics to Measure Performance?

A new approach for measuring manufacturing at both the country and global level is required to address the drivers of the future of manufacturing. A number of indexes already cover manufacturing performance or industry-led competitiveness, yet none have focused on capability, innovation gaps and the convergence of manufacturing drivers. The country needed a novel approach.

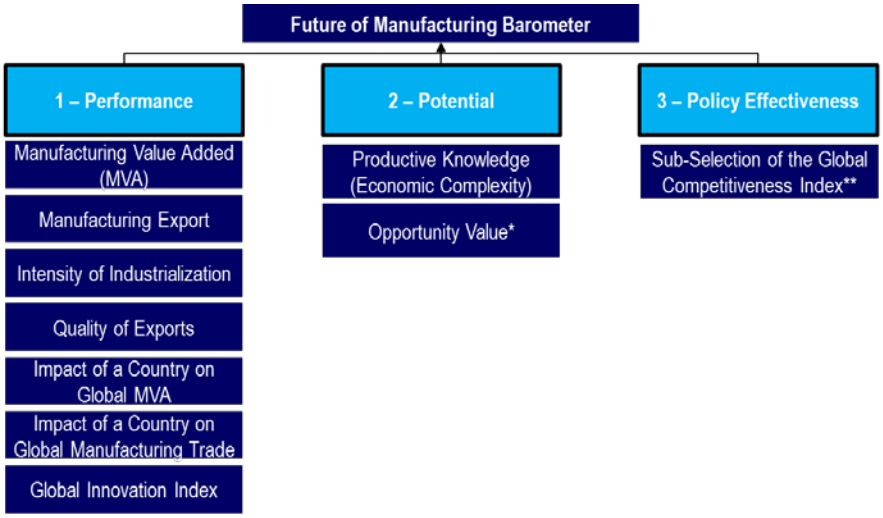
### The Case for New Manufacturing Policy Metrics for the Country




Source: Whiteshield Partners

As developed, the Future of Manufacturing Barometer included three dimensions: (1) current manufacturing and innovation performance, (2) future potential based on knowledge and capabilities, and (3) perceived effectiveness of public policy. These dimensions helped to highlight gaps between countries' manufacturing performance and future potential, as well as policy effectiveness and the benchmark for the country at stake. Unlike the performance sub-index, the potential sub-index includes knowledge networks and a conversion between skills, production methods and materials. Together, the three dimensions help to inform business and government leaders about manufacturing's preparedness for the future and to identify a successful evolution. (The barometer and figures in this case study are the intellectual property of Whiteshield Partners and its clients, when applicable.)

### The Barometer's Composite Index Structure



Sources: Whiteshield Partners; data metrics are from the United Nations Industrial Development Organization for "performance", from *The Atlas of Economic Complexity: Mapping Paths to Prosperity* (Hausmann et al., 2011) for "potential", and from the World Economic Forum for "policy effectiveness"

## Is the Country Ready for the Future of Manufacturing?

- The **global state of manufacturing performance improved significantly** between 2007 and 2013. On average, performance increased by 25.5% in this period to 34 on the barometer scale. In particular, improved performance on innovation, as well as stronger export participation of developing countries, contributed to this positive development. Generally, this indicates that countries have been able to capitalize on their comparatively higher potential and perceived policy effectiveness.
- At the same time, **future potential declined** by 2.6% on average. This is **a first indicator of the changing nature of the future of manufacturing**, which requires countries to develop new skills and capabilities.
- Consequently, the gap between **performance and potential narrowed significantly** between 2007 and 2013, **though still leaving a gap of 22** on the barometer scale. However, this means that countries, such as the one studied, were not yet fully capitalizing on their manufacturing potential. Historical analysis revealed that **improving policy effectiveness by 1% could help to close the performance-potential gap by 0.47% over two years.**

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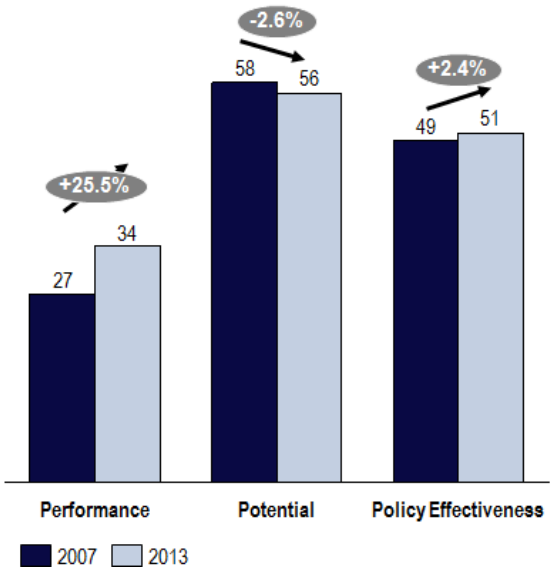
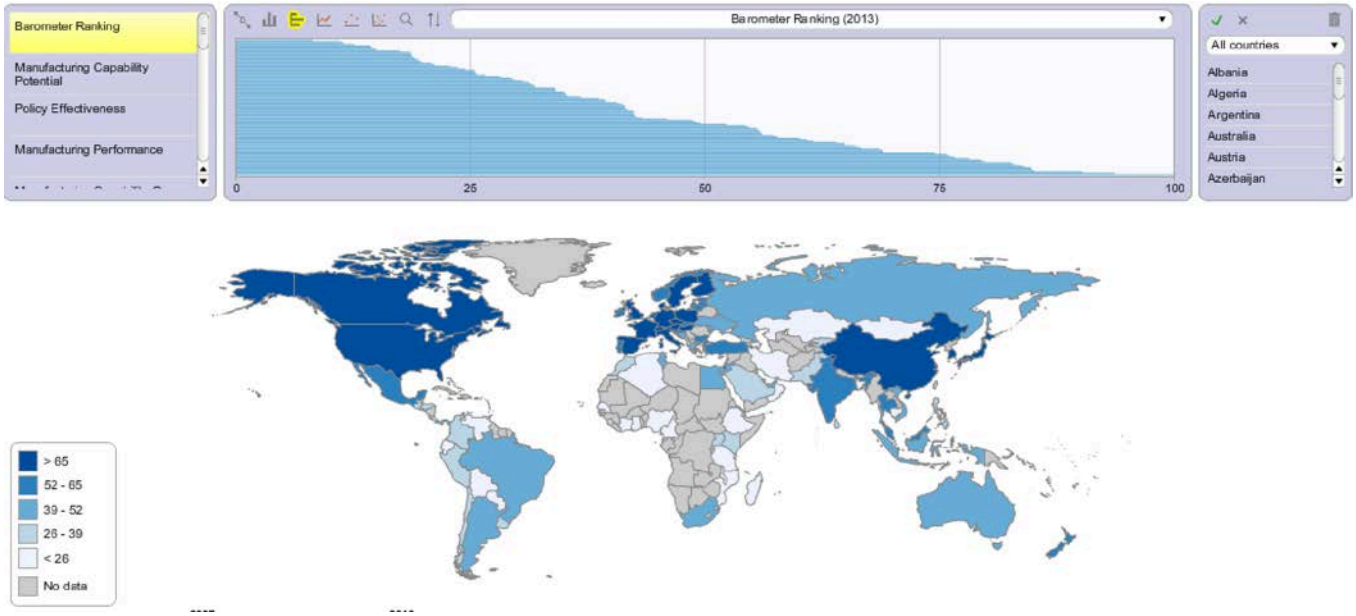



Source: Whiteshield Partners

### The Future of Manufacturing Barometer World Map



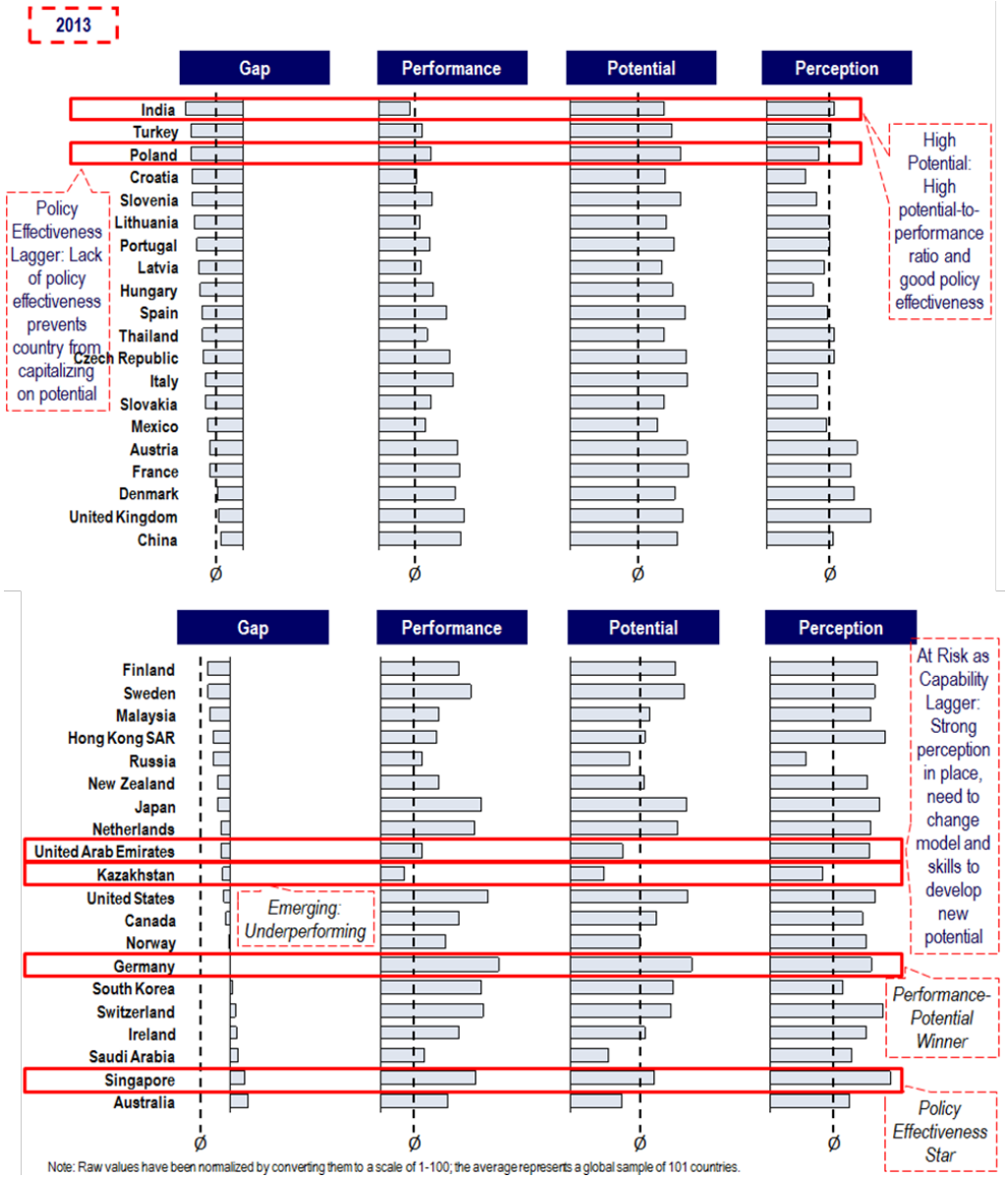

Source: Whiteshield Partners

Whiteshield Partners' animated World Map of the Future of Manufacturing helped analyse the evolution of over 100 economies and benchmark the country studied with a new perspective.

A detailed ranking for 2013 highlighted the following:

- Poland as "Policy Effectiveness Lagger": where a lack of policy effectiveness prevents capitalizing on future potential
- India as "High Potential": where a high potential-to-performance ratio, combined with good policy effectiveness, can accelerate improvement in manufacturing performance
- United Arab Emirates (UAE) as "At Risk as Capability Lagger": where despite strong policy effectiveness being in place, a low potential-to-performance ratio indicates limited future opportunities without improvements in capability
- Kazakhstan as "Emerging": where performance, future potential and policy effectiveness lags the global average
- Singapore as "Policy Effectiveness Star": where public policies are continuously best in class
- Germany as "Performance-Potential Winner": where, compared to other economies, a small gap exists

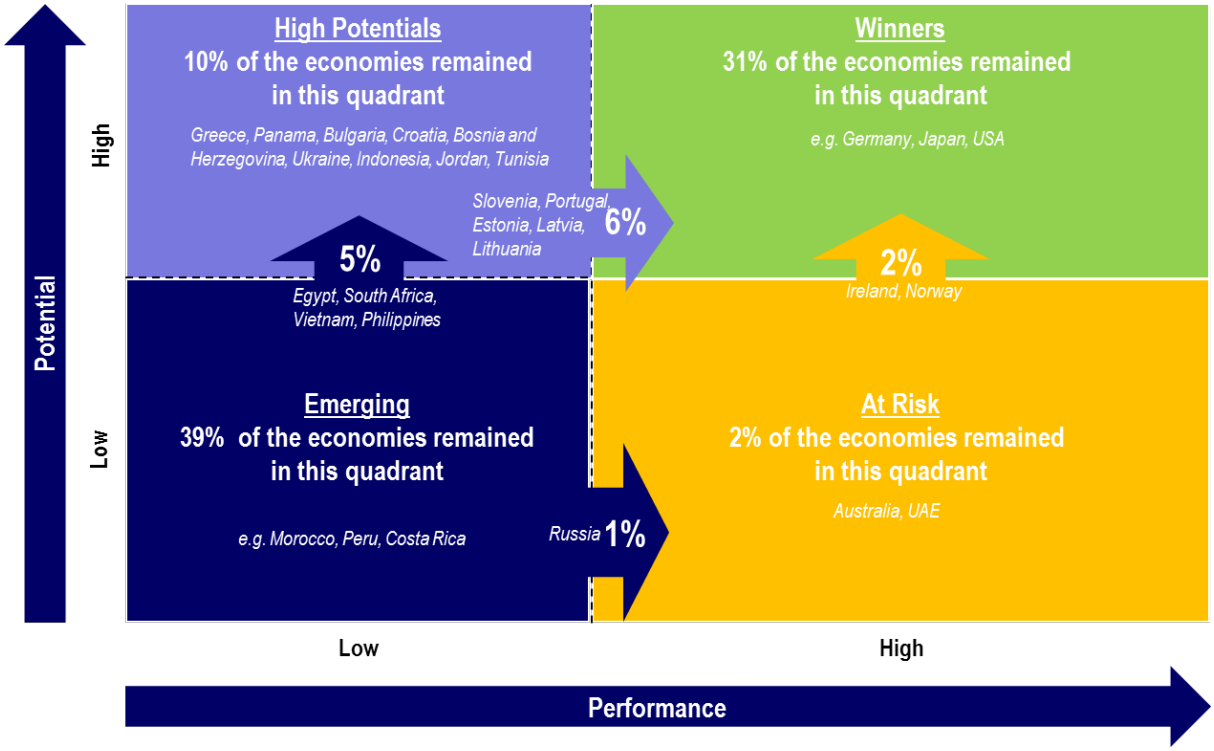
## Country Ranking of 40 Selected Economies




Source: Whiteshield Partners

Based on the different levels of performance and potential, **four clusters of countries** were identified – "Winners", "High Potentials", "Emerging" and "At Risk" – and the country studied was placed in the relevant cluster to help inform policy-makers. The clustering also helped to spur regional dialogue.

## Performance and Potential Development, 2007-2013

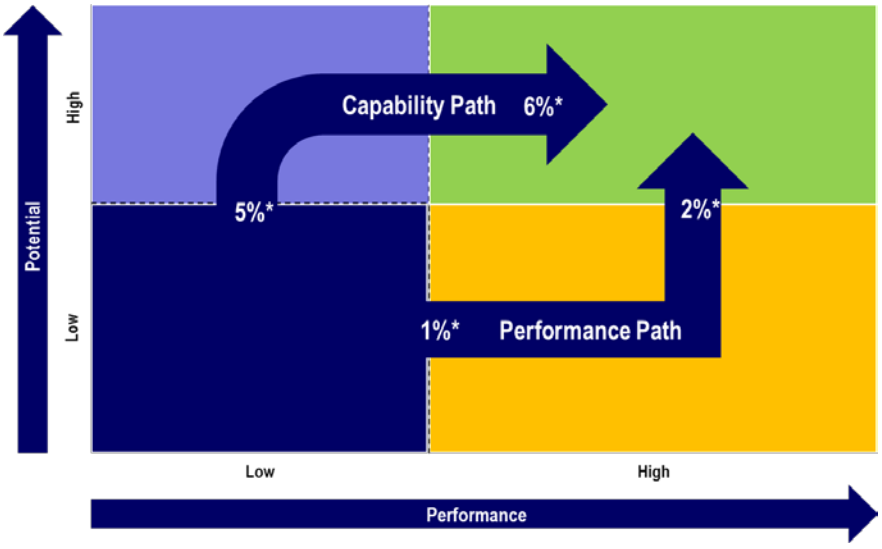



Source: Whiteshield Partners analysis

## Policy Implication for the Country: Two Paths to Industrialization

By modelling the barometer over time (2007-2013), **two paths to industrialization emerged for the country**: one resembles a fully charged car, the other a car whose battery is draining. The charged car represents the capability path, and the draining car stands for the performance path.

### Capability vs Performance Path, 2007-2013




Source: Whiteshield Partners analysis

Capability Path: Countries build diverse capabilities before capitalizing on this path. Subsequently, productive knowledge is transformed into manufacturing performance. From 2007 to 2013, 11% of countries took this path. Generally, higher levels of potential enable countries to improve more in performance over time. For a 10-point increase on the potential barometer scale, future performance growth (in 5 years) is associated with a 1% higher rate.

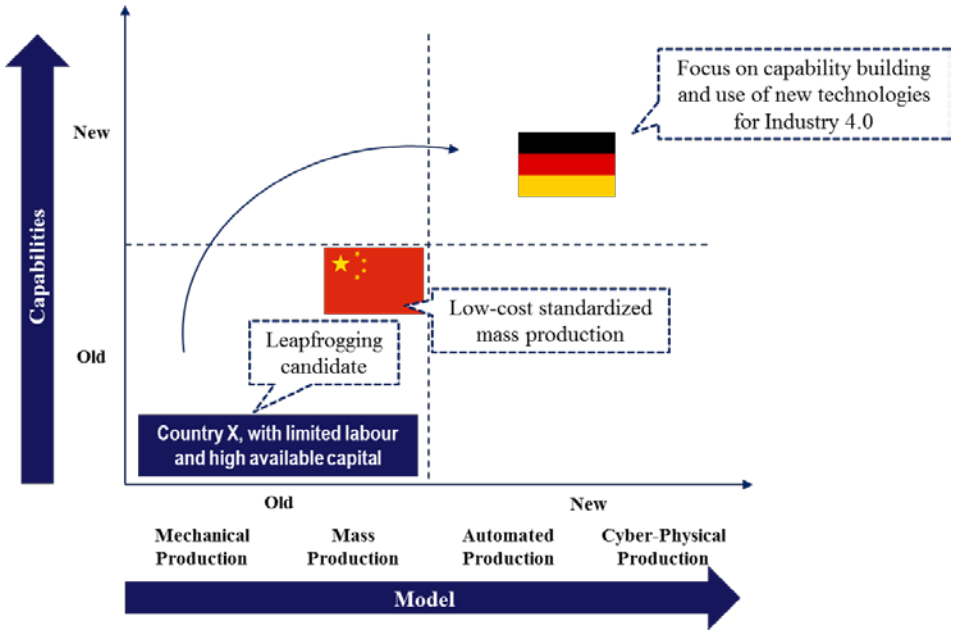
Performance Path: Countries stretch their existing resources to enhance their performance. Subsequently, they build knowledge in their specialization to improve their performance. This logic also applied to the country studied. Only 3% of countries took this path from 2007 to 2013.

The government of the country studied opted for the capability path, thus "leap-frogging" in industrial development.

## Industrial Policy 2.0: Promote Capabilities and New Industrial Models for the Country

The future of manufacturing needs new industrial policies, with private entrepreneurship in the lead supported by a strategic and coordinative government (OECD, 2013a). This means moving from old to new capabilities, and from old to new production models. In terms of policy action, the country studied could either leapfrog into the upper right corner or follow a gradual model. It chose to leapfrog.

New and Old Manufacturing Models and Opportunities for Countries Studied




Source: Whiteshield Partners

Develop talent and cross-domain skills through the entire education cycle: The development of talent and new cross-domain skill sets will be the most critical factor of production in the future (Aghion, 2012; Schwab, 2015). School curricula (e.g. science, technology, engineering and mathematics), vocational educational training, apprenticeship programmes and research programmes need to be aligned with the drivers of the future of manufacturing in order to close capability gaps. From a corporate perspective, training on the job, upgrading skills (Rüßmann et al., 2015) and developing recruiting strategies from a broader pool of backgrounds gain in importance.

Develop a regulatory framework for new industrial standards and requirements: The future of manufacturing, with the Internet of Things and cyber-physical production, is based on seamless integration of machines, products, sensors and people across the value chain. Therefore, new global industrial standards will emerge that regulate and facilitate the interaction of stakeholders in the digital factories of the future. From a policy perspective, failing to actively shape the agenda on standardization can lead to severe competitive disadvantages for national manufacturing companies in the global market. Furthermore, regulatory frameworks

need to be harmonized to ensure a level playing field for manufacturing companies. From a corporate perspective, participating in standard-setting bodies, as well as complying with new industrial standards, will be critical to ensuring access to markets.

Upgrade technology and digital infrastructure: Infrastructure, such as transportation networks, energy and telecommunications, serves as an important input for economic growth, has endurance in the long run, complements other investments and, hence, increases their respective profitability (LSE, 2013). In the future, upgrading technology and building digital infrastructure become indispensable for the manufacturing sector. From a policy perspective, investments in infrastructure (e.g. fixed- and mobile-broadband services), as well as research and development (R&D), are quintessential to increasing overall economic competitiveness (Vasile, & Vulturescu, 2012) and, specifically, manufacturers' future potential. From a corporate perspective, private engagements in R&D investments improve the incorporation of new technologies, and the adjustment of strategies and production processes (LSE, 2013). Beyond that, manufacturers need to embrace new technologies and leverage them in production processes (Rüßmann et al., 2015).

Improve linkages and convergence between the public and private sectors: The future of manufacturing requires an industrial policy that facilitates the convergence of stakeholders and improves matches between employees and employers, as well as linkages between companies (e.g. small to medium-sized suppliers).