

Supply Chain Drivers and Location Criteria

Jacob Dencik, IBM - Plant Location International

Seoul, May 2015



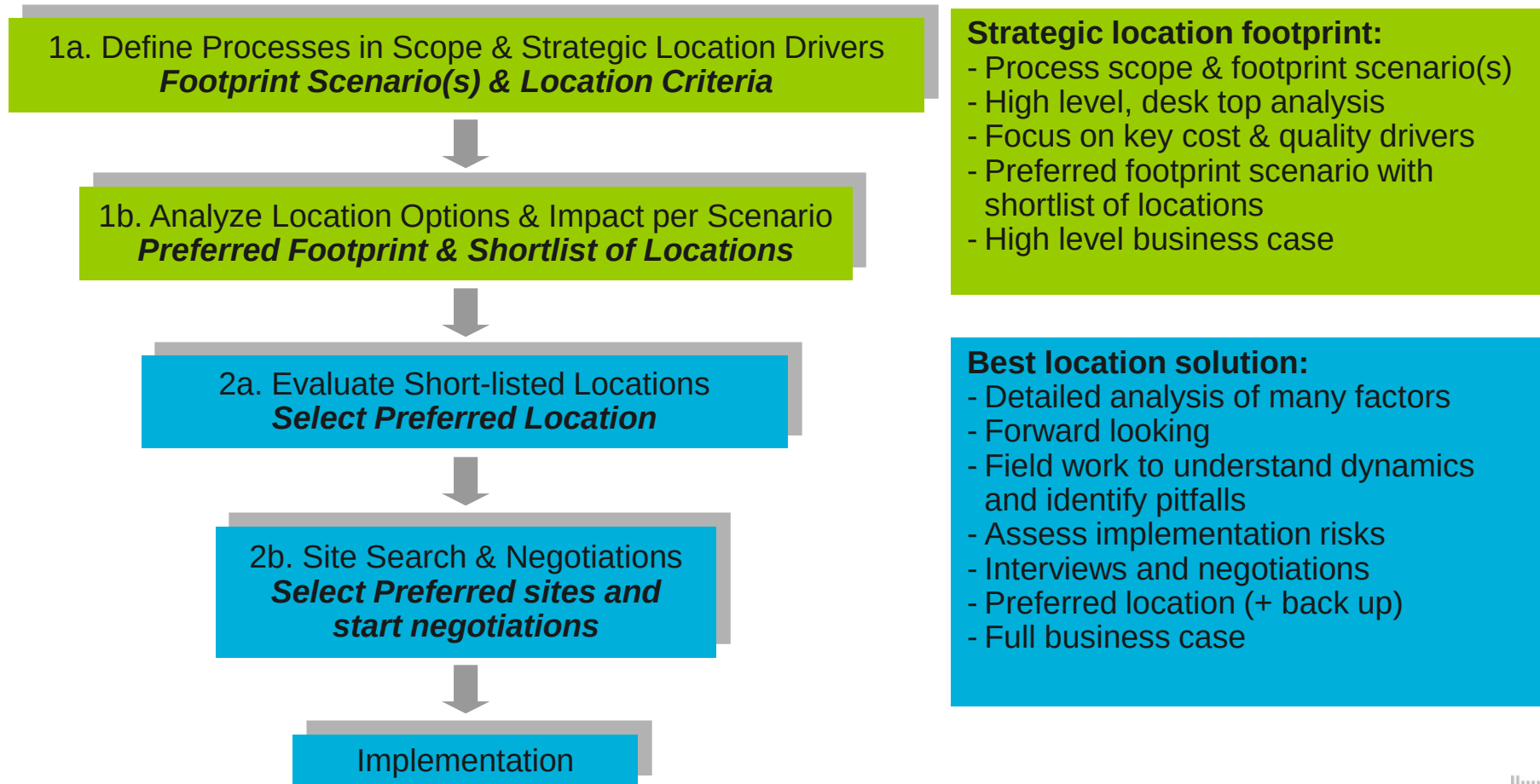
Content

Corporate Location Decision Making

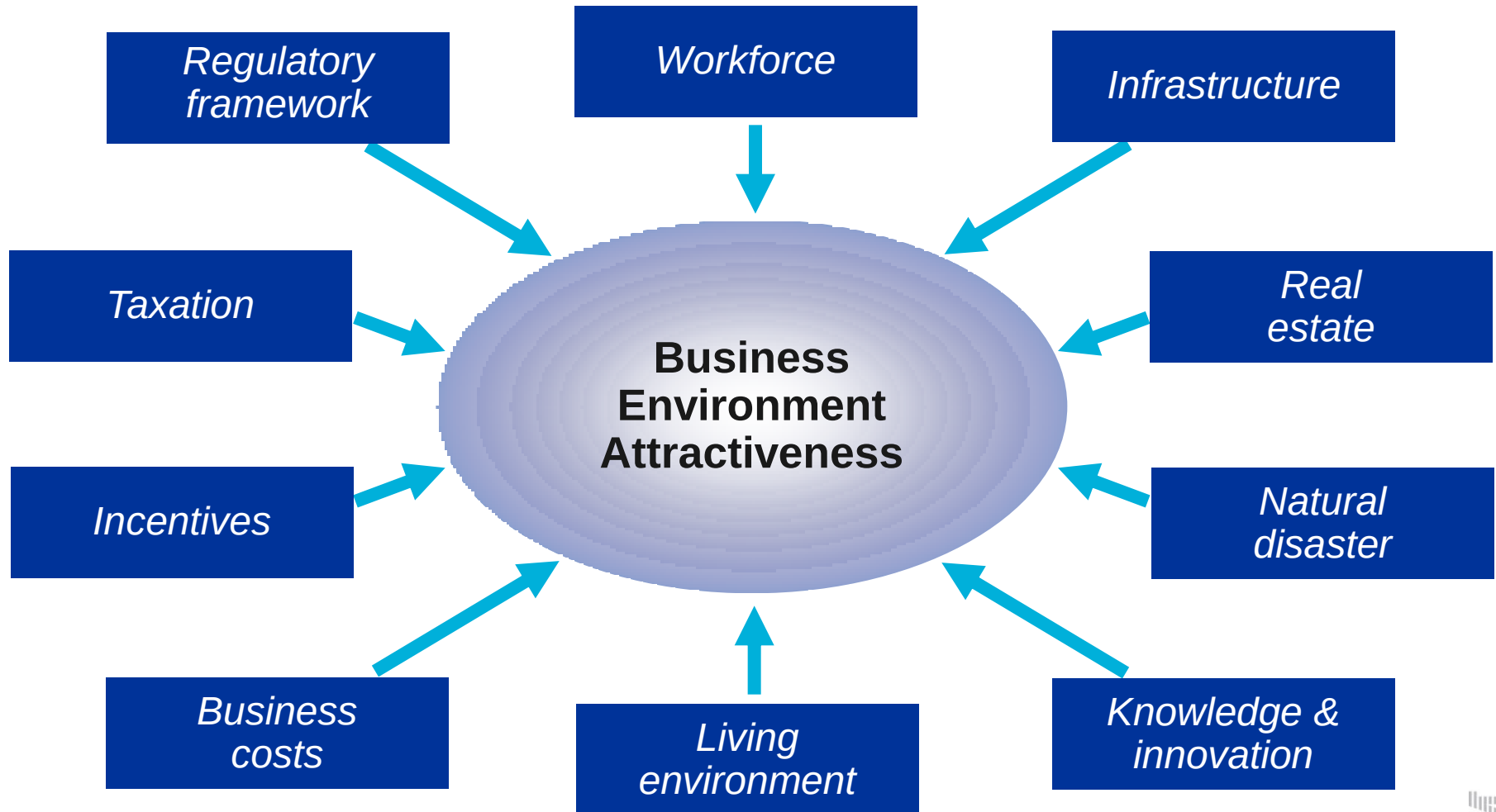
Supply Chains and Location Drivers in Renewable Energy and Clean Tech

What can IPAs do?

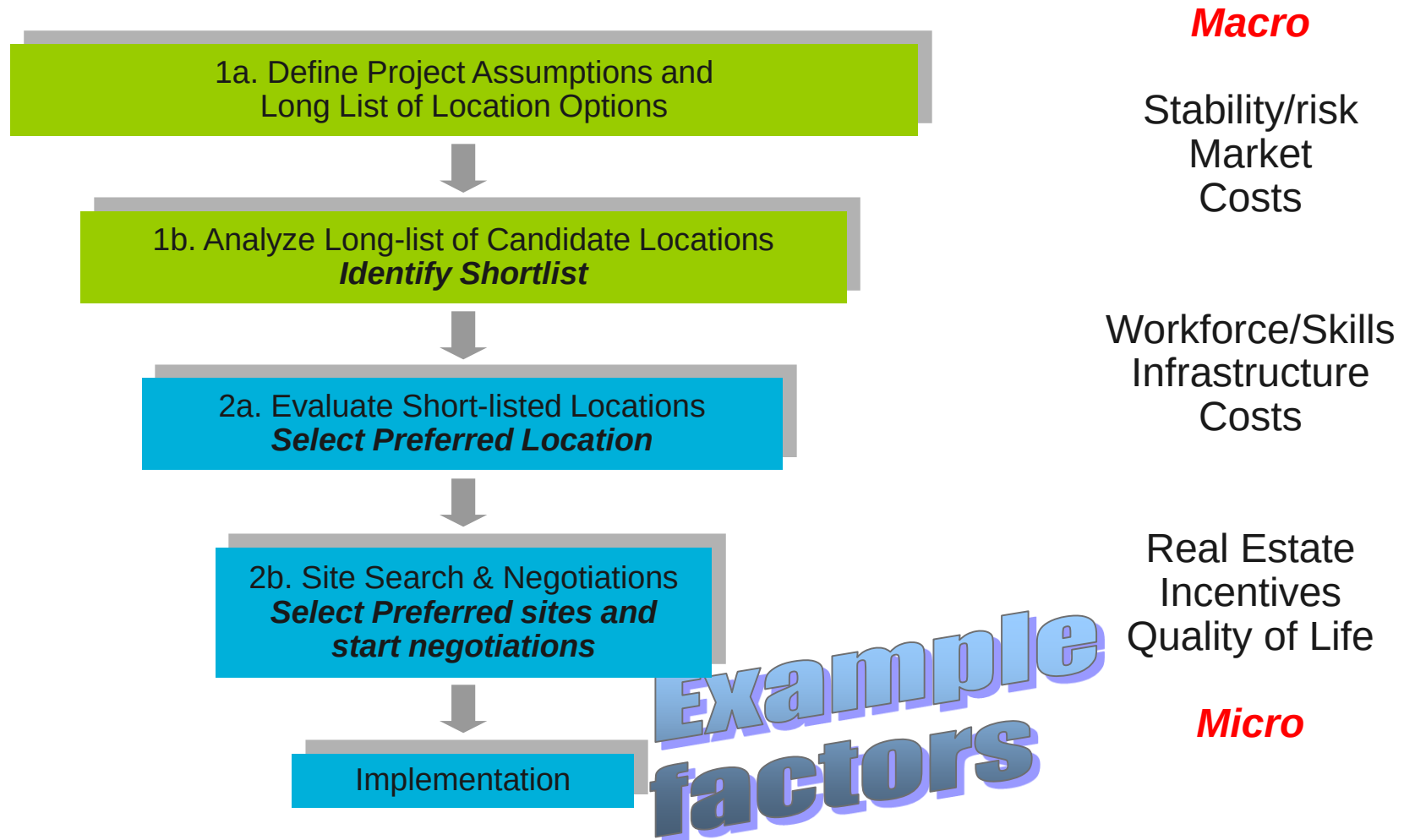
Typical steps in location selection for 'mobile' investment projects



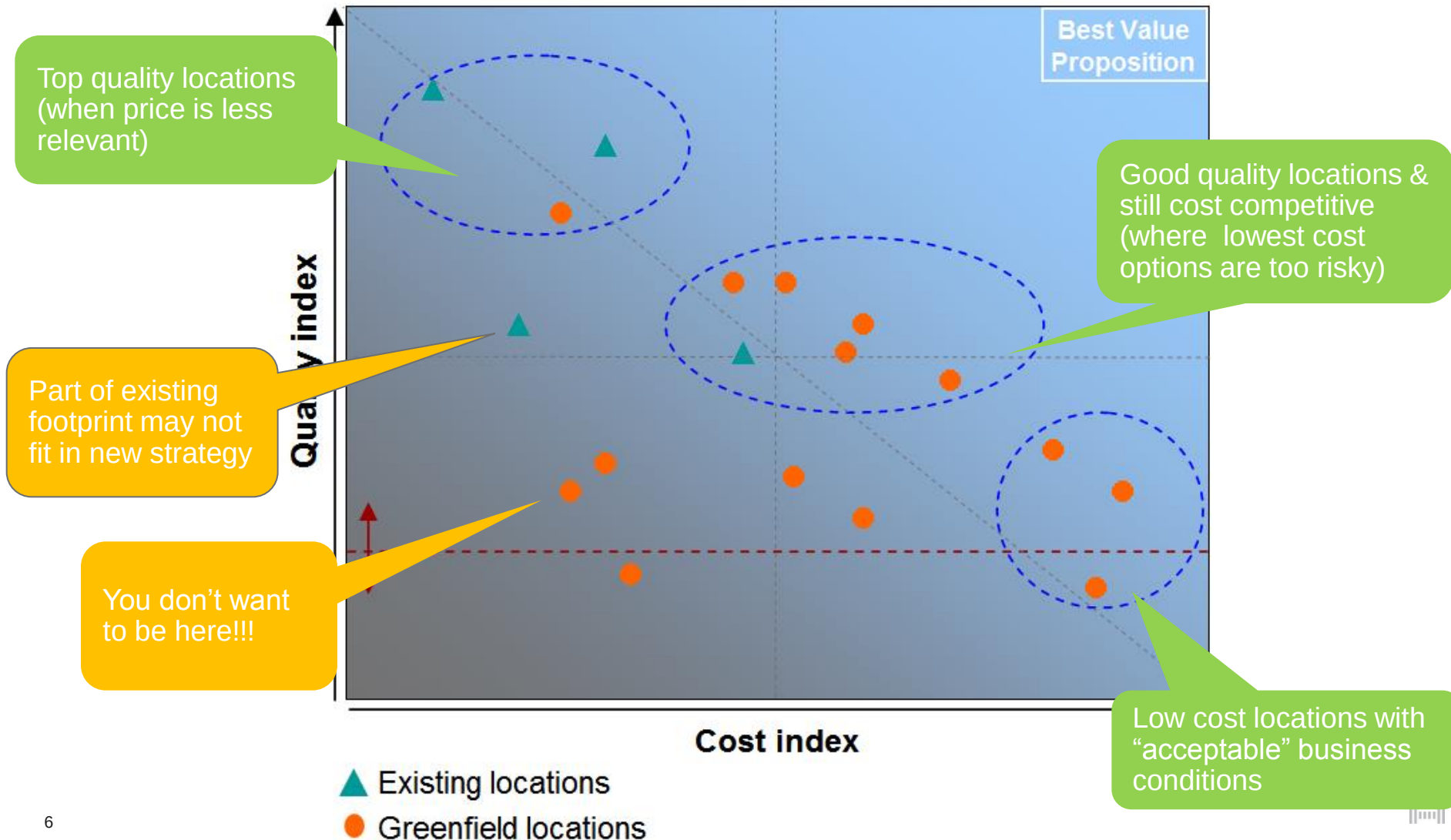
Location selection is a multi-dimensional process. Many factors are involved, which vary by industry, business function, company, ...



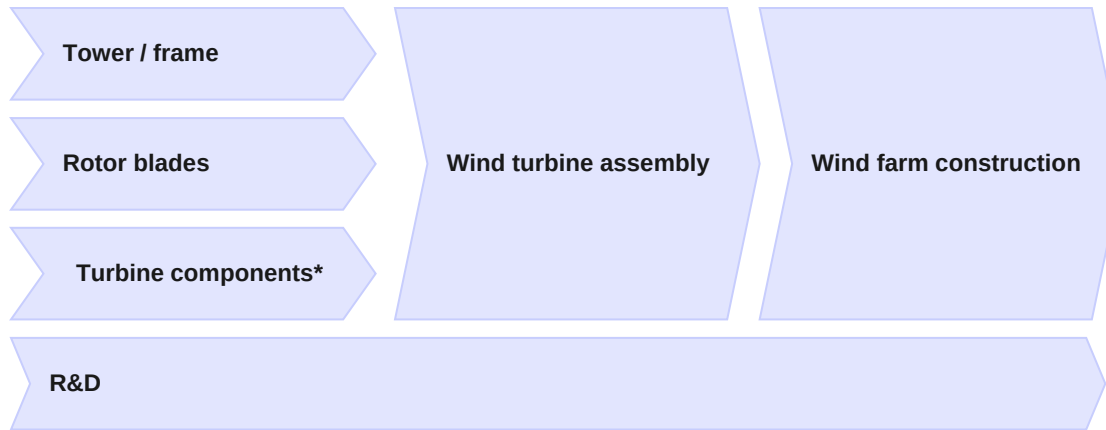
... but the factors considered by companies, also change throughout the location selection process.



When screening location options, companies identify different solutions and eliminate locations that don't offer the right proposition.



The wind energy sector and supply chain

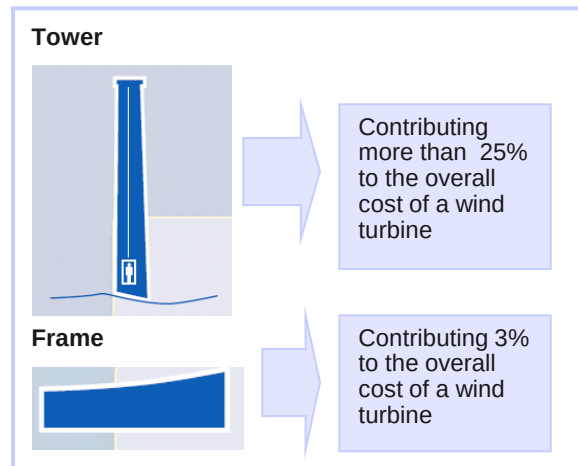


- Sector determined by:
 - Price developments for traditional sources of energy
 - Government regulations and financial support, e.g. tax credits or feed-in tariffs
 - Access to finance
 - Wind conditions
- Investment projects driven by
 - Costs (labor, material, utilities) and incentives
 - Access to market (in particular for tower, frame and blade production)
 - Quality and availability of specialized staff
 - Quality of local infrastructure
 - Access to key input materials

Several industry sectors – metals, industrial machineries, electrical, among others - are involved in the supply chain for wind turbines production

Industry sectors involved in the Supply Chain, Wind

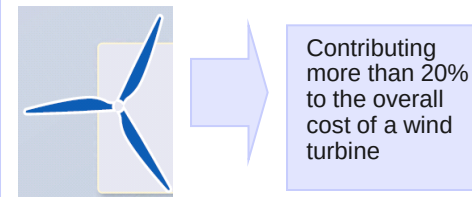
INDUSTRY: METALS (steel)



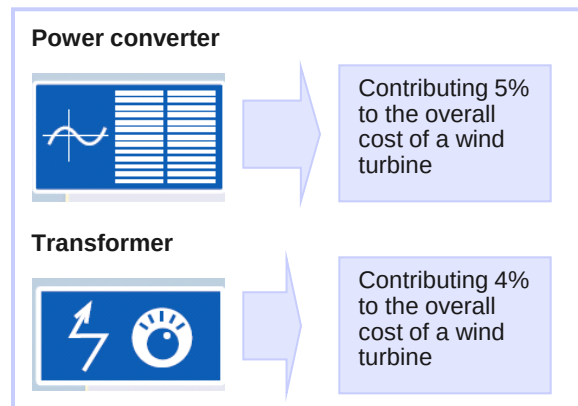
INDUSTRIES:

- METALS** (aluminum) for small size turbine);
- MINERALS** (glass fiber) and
- CHEMICALS** (resins) for more technologically advanced and large turbines

Rotor blades



INDUSTRY: ELECTRICAL EQUIPMENT



INDUSTRY: INDUSTRIAL MACHINERY & EQUIPMENT (wind turbine assembly is also part of this industry sector)

Gearbox



Generator



8 Among the turbine components, only the ones contributing by more than 3% to the total costs of a turbine have been taken into account. Source: IBM analysis based on BTM Consult data on costs



Drivers and requirements

Wind towers and frames manufacturing

Wind towers and frames manufacturing	
Qualitative location categories	Weight
1. Stability & Risk	5
2. Talent	25
3. Market & Industry	25
4. Regulatory framework	15
5. Living environment	5
6. Infrastructure & Real Estate	25
	100

The presence of an adequate infrastructure (notably port), market access and talent are key drivers for manufacturing investment

Key cost drivers:

- Labor costs
- Transport costs
- Utility costs

Qualitative location factors	Weight	Overall weight
1. Stability & Risk		
Economic & financial stability	30	2%
Political & government stability	30	2%
Business operations risk	40	2%
	100	5%
2. Talent		
Overall size of labor pool	10	3%
Presence of non-experienced staff	15	4%
Presence of experienced staff	35	9%
Presence of manufacturing skills	20	5%
Productivity	10	3%
Competition for skills	10	3%
	100	25%
3. Market & Industry		
Local market size	50	13%
Presence of supplier / customer base	30	8%
Presence of cluster	20	5%
	100	25%
4. Regulatory framework		
Supportive renewable energy regulations and incentives	70	11%
Labor regulations	10	2%
Business permitting	10	2%
Corporate taxation	10	2%
	100	15%
5. Living environment		
Cost of living	50	3%
Quality of life	30	2%
Personal safety	20	1%
	100	5%
6. Infrastructure & Real Estate		
Air access	5	1%
Road access	10	3%
Train access	10	3%
Waterways & seaports	45	11%
IT infrastructure	10	3%
Reliability of power supply	10	3%
Availability of manufacturing space	10	3%
	100	25%
		100%

Drivers and requirements

Wind energy R&D

Wind R&D	
Qualitative location categories	Weight
1. Stability & Risk	5
2. Regulations	5
3. Taxation & Incentives	5
4. Market	8
5. Sector specialization	20
6. Talent	35
7. Infrastructure	10
8. Real estate	5
9. Living environment	7
	100

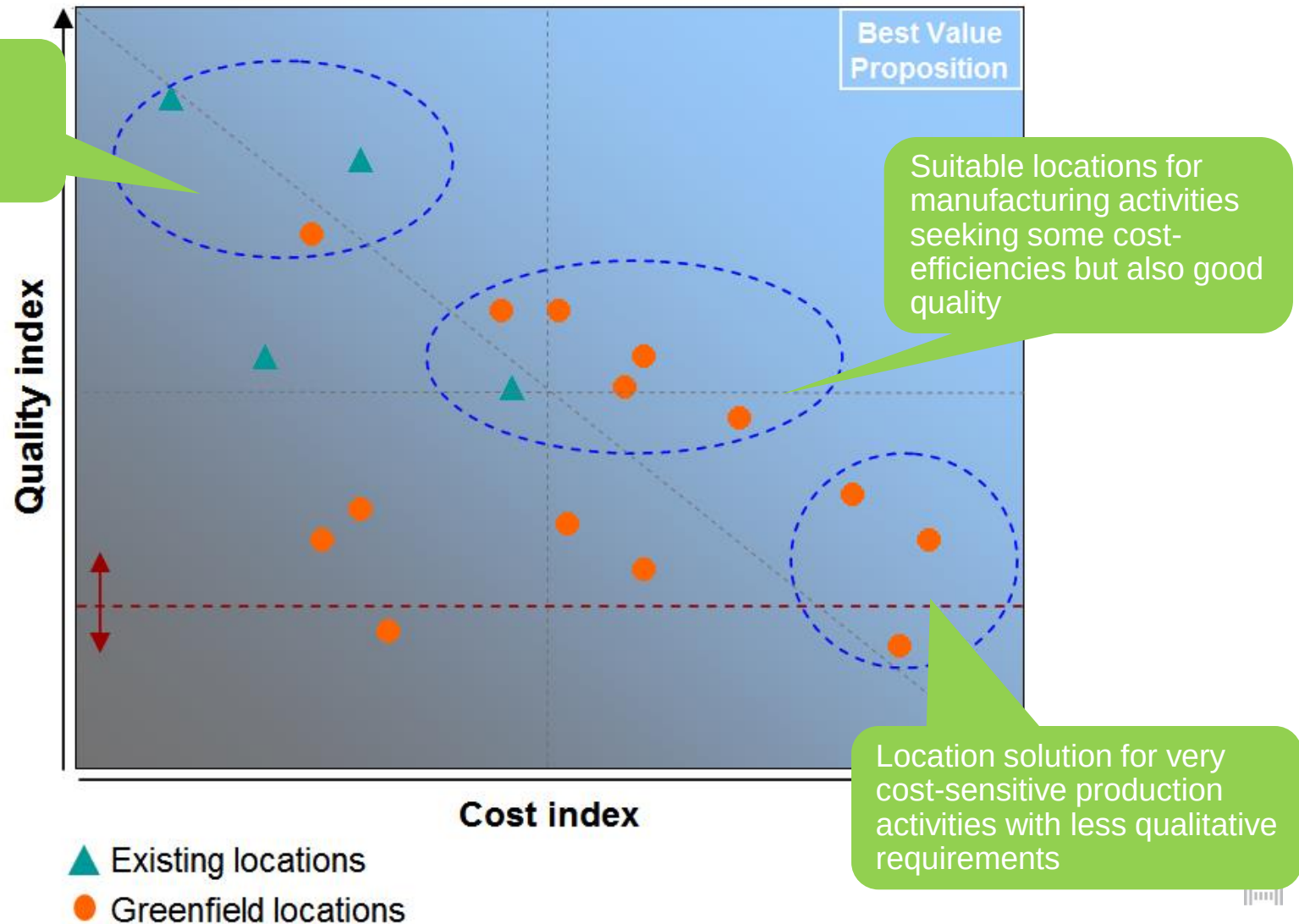
The presence of talent and sector competences are key drivers for R&D investment

Key cost drivers:

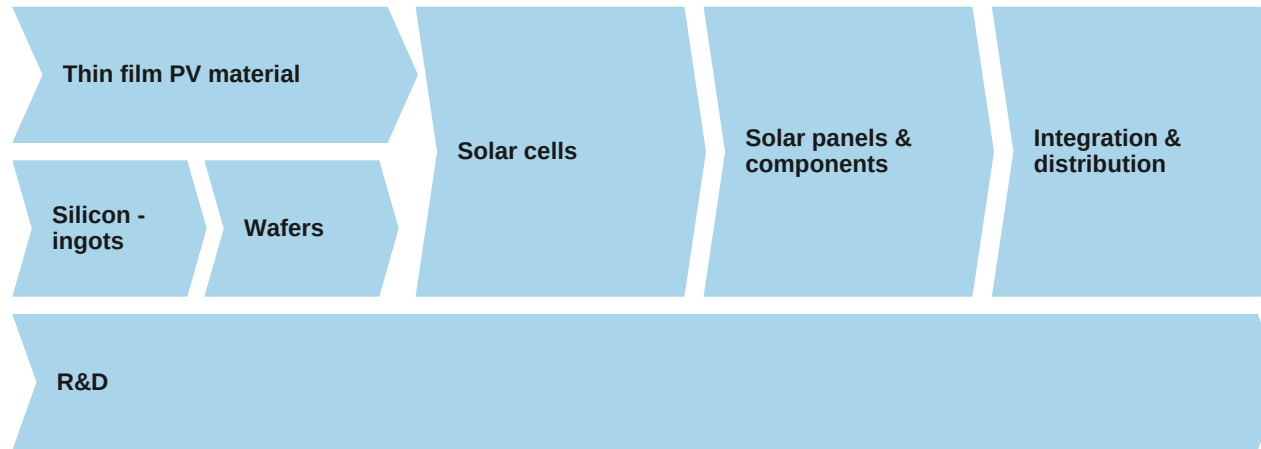
- Labor costs

Qualitative location factors	weight	overall weight
1. Stability & Risk		
Economic and financial stability	40	2%
Political and government stability	40	2%
Business security risks	20	1%
	100	5%
2. Regulations		
Data protection and IP rights	30	2%
Investor protection	20	1%
Contract enforcement	15	1%
Hiring flexibility	5	0%
Firing flexibility	5	0%
Working time regulations	5	0%
Business permitting	20	1%
	100	5%
3. Taxation and incentives		
Corporate taxation	50	3%
Investment incentives	50	3%
	100	5%
4. Market		
Supportive environmental regulatory environment	25	2%
Availability of cleantech end-user financial incentives	25	2%
Access to finance (PE/VC)	50	4%
	100	8%
5. Sector specialization		
Presence and size of sector cluster	40	8%
Presence of specialized R&D base	60	12%
	100	20%
6. Talent		
Overall size of labor market	5	2%
Presence of industry-specific experienced staff	40	14%
Presence of relevant student population	25	9%
IT proficiency	15	5%
Mastery of English (as corporate language)	10	4%
Overall tightness in labor market (unemployment)	5	2%
	100	35%
7. Infrastructure		
Air access	20	2%
Road access	25	3%
Train access	10	1%
Public transport	10	1%
Waterways and seaports	5	1%
IT infrastructure	25	3%
Reliability of power supply	5	1%
	100	10%
8. Real estate		
Availability of office space	100	5%
	100	5%
9. Living environment		
Cost of living	30	2%
Quality of life	40	3%
International schools	10	1%
Safety	20	1%
	100	7%

Cost and quality are balanced differently for different activities.



The solar energy sector and supply chain



- Sector determined by:
 - Local incentive policies, such as tax incentives, feed-in tariffs, cash grants
 - Local net solar radiation
 - Cost of solar energy installations
- Investment projects driven by
 - Costs (labor, material, utilities) and incentives
 - Quality and availability of specialized staff
 - Quality of local infrastructure
 - Presence of industry cluster
 - Access to key input materials
 - Size of local market

With different types of investment projects along the supply chain



Profile	Capital intensive Energy intensive Space consuming Long construction		Labor intensive Market sensitive	Very Labor intensive Very Market sensitive
Investment	VERY HIGH 1,000-1,500 MM	HIGH 500-750 MM	HIGH 500-750 MM	'NORMAL' 200-300 MM
Implementation	36 months	24 months	18 months	15 months

Each part of the chain has different requirements

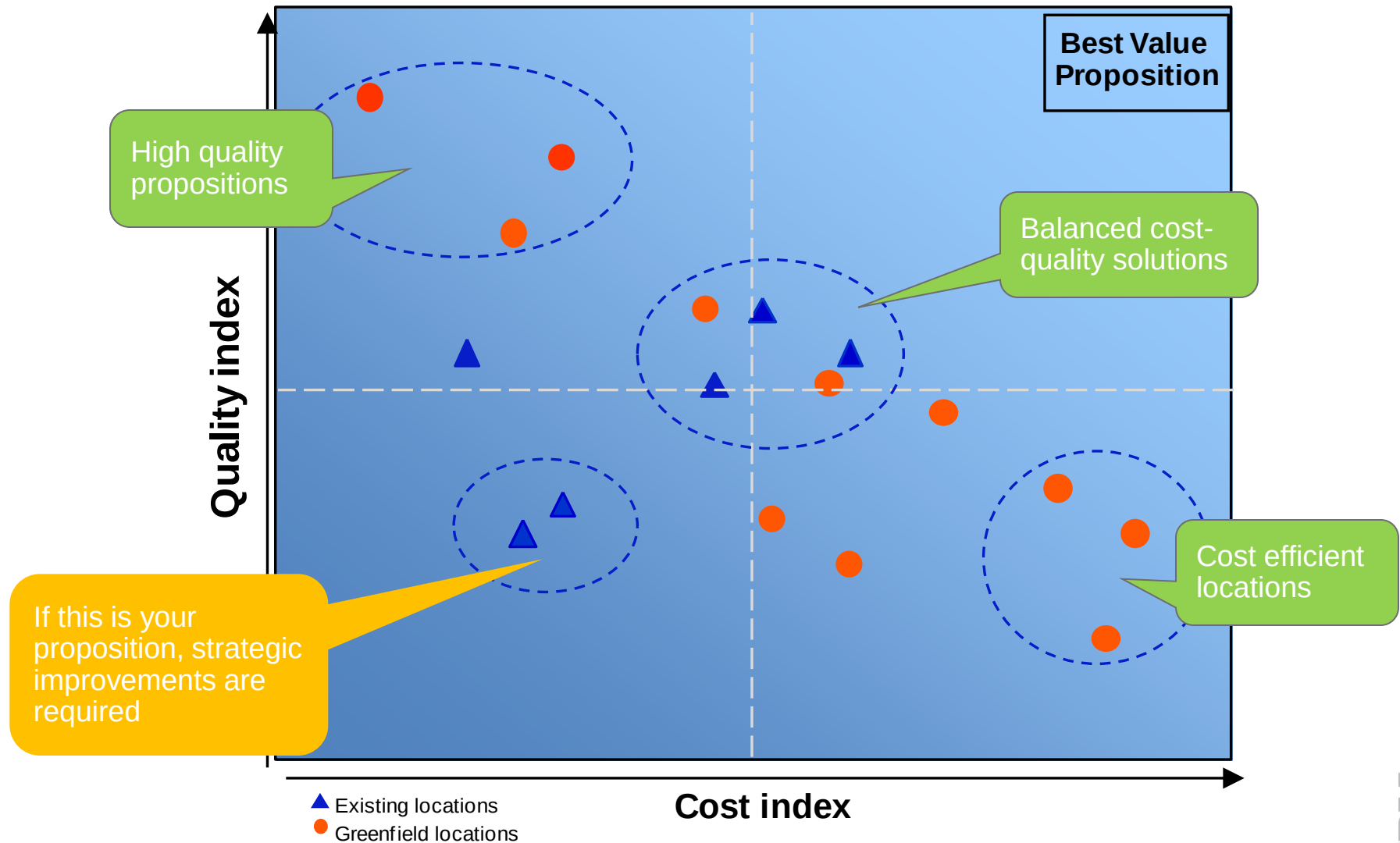
CRITICAL LOCATION FACTORS or 'MUST HAVES'



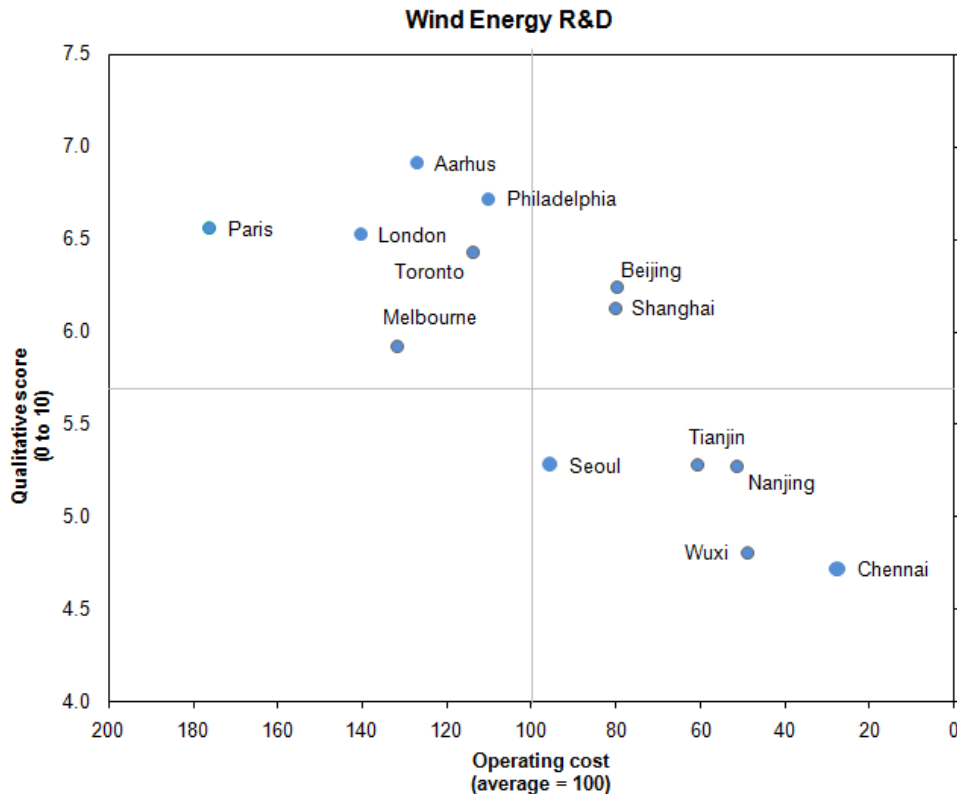
Utilities	Power-water-heat Reliability & cost	Power reliability Water discharge	Power reliability Water discharge	
Human Resources	Skills availability	Skills availability	Skills availability & cost	Skills availability & cost
Logistics	Access to raw materials			Access to market

What can IPAs do to attract Renewable Energy investment?

Make sure you understand your competitiveness per target segment



Example: Competitiveness of Shanghai for Wind Energy R&D



Location benchmarking
from investor's perspective:

- Validates competitiveness for the sector
- Identifies true location value proposition
- Reveals different location solutions that you may have within country/region
- Identifies key competitor locations and their offer
- In this example, Shanghai has an attractive cost-quality trade-off globally, and a strong qualitative proposition in an Asian context.

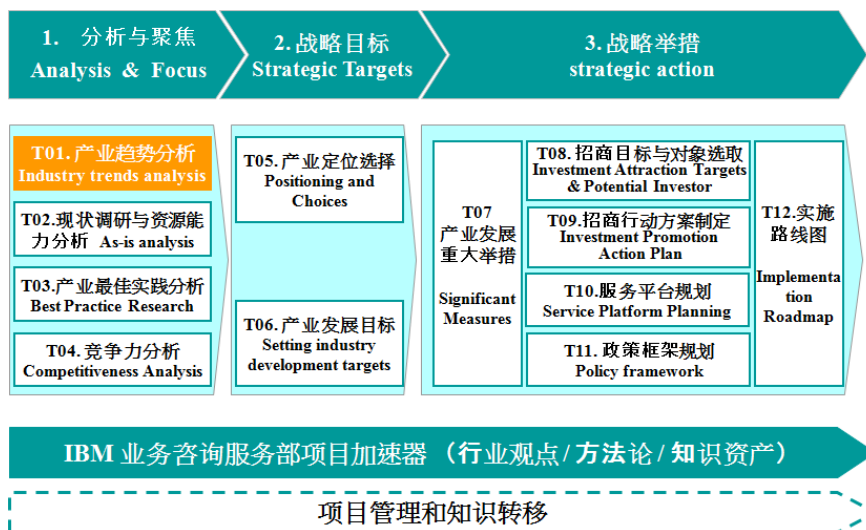
Identify key competitive weaknesses and make targeted improvements

	Melbourne	Toronto	Shanghai	Nanjing	Beijing	Tianjin	Wuxi	Aarhus	Paris	Chennai	Seoul	London	Philadelphia
Political & Government stability	8.6	8.7	4.4	4.4	4.4	4.4	4.4	8.7	7.8	3.7	5.7	8.0	8.5
Economic & Financial stability	8.2	7.6	7.3	7.3	7.3	7.3	7.3	8.0	6.4	3.8	7.0	5.5	6.5
Business security risks	8.8	9.0	7.3	7.4	7.7	7.7	7.5	8.5	8.2	4.6	8.1	8.1	8.0
Data protection and Intellectual Property rights	9.0	8.8	4.8	4.8	4.8	4.8	4.8	9.0	9.0	4.3	5.2	9.0	9.0
Investor protection	7.5	8.8	2.0	2.0	2.0	2.0	2.0	7.9	5.7	3.7	6.3	9.0	9.0
Contract enforcement	5.5	3.1	6.1	7.1	5.1	5.1	5.1	3.9	6.4	3.5	7.8	4.5	6.6
Flexibility of staff	9.0	9.0	5.7	5.7	5.7	5.7	5.7	9.0	2.0	9.0	8.6	7.1	8.6
Working time regulations	9.0	9.0	5.2	5.2	5.2	5.2	5.2	7.1	2.0	7.1	4.3	7.1	9.0
Hiring flexibility	9.0	8.6	8.6	8.6	8.6	8.6	8.6	9.0	2.4	9.0	4.3	8.6	9.0
Firing flexibility	9.0	9.0	2.9	2.9	2.9	2.9	2.9	9.0	5.7	2.0	5.7	9.0	9.0
Ease of business permitting	7.3	8.0	3.3	3.3	3.3	3.3	3.3	7.4	5.3	3.4	3.2	6.1	7.6
Industrial relations	8.1	9.0	7.1	7.1	7.1	7.1	7.1	9.0	2.4	8.1	2.0	9.0	9.0
Work permits	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.1	7.1	7.1	7.1
Corporate taxation	5.0	6.5	6.5	6.5	6.5	6.5	6.5	5.8	3.5	3.5	7.0	5.5	3.0
Investment incentives	4.0	4.5	4.0	4.0	4.0	4.0	4.0	5.0	9.0	6.0	4.5	3.5	3.0
Supportive environmental regulatory environment	6.0	6.5	5.0	5.5	5.0	5.0	5.0	7.0	9.0	4.5	4.5	7.5	4.2
Availability of cleantech end-user financial incentives	5.5	7.0	5.5	5.5	6.0	5.5	5.5	6.0	7.0	4.0	6.0	6.0	4.5
Access to finance (PE/VC)	6.2	7.3	5.7	4.4	6.3	4.3	3.9	5.8	6.9	4.3	4.7	7.6	7.6
Presence and size of sector cluster	3.8	5.1	7.3	6.7	7.1	7.7	6.3	8.0	4.4	5.7	2.2	4.7	5.7
Presence of specialized R&D base	3.8	3.5	4.8	3.8	5.5	3.0	3.5	7.3	7.7	1.5	5.7	5.9	8.0
Labor pool	8.0	9.0	9.0	8.8	9.0	9.0	5.8	2.0	8.0	9.0	9.0	9.0	6.0
Presence of experienced industry-specific employees	4.9	4.7	7.4	4.0	7.5	5.6	4.5	7.3	4.5	4.9	2.0	5.0	5.3
Presence of non-experienced employees (student population)	4.5	6.0	6.6	7.5	7.5	5.5	5.0	5.5	6.7	7.0	6.5	6.5	6.4
Hours worked	7.1	8.1	9.0	9.0	9.0	9.0	9.0	7.1	5.7	9.0	9.0	8.1	9.0
IT proficiency	7.7	8.4	4.4	4.4	4.4	4.4	4.4	9.0	7.6	4.1	7.0	7.9	8.2
Mastery of English (as corporate language)	10.0	10.0	3.0	2.0	3.0	3.0	2.0	8.0	5.0	8.0	5.0	10.0	10.0
Cost of living	6.4	6.9	6.4	7.0	6.0	7.3	7.0	5.0	4.5	7.0	4.0	4.0	5.5
International schools	7.5	6.5	5.5	4.0	5.5	4.5	3.5	6.0	6.5	5.1	4.1	7.7	6.0
Personal security	7.7	9.1	6.0	6.0	5.0	6.0	5.0	8.0	6.0	2.7	7.7	6.0	8.0
Quality of life	9.0	9.0	5.0	5.5	4.5	3.5	3.5	9.0	9.0	2.0	6.4	8.1	8.0
Air access	7.0	7.9	7.8	3.4	8.0	3.0	3.0	6.3	9.0	3.9	7.9	8.9	8.0
Road access	6.6	7.1	6.7	5.7	6.7	5.0	5.2	8.0	8.0	4.4	5.9	6.1	7.1
Train access	5.6	6.8	5.0	5.5	5.0	5.0	5.5	9.0	8.8	5.5	7.4	7.4	7.3
Public transport	8.5	7.1	9.0	5.0	8.5	4.5	3.5	6.0	9.0	2.5	9.0	9.0	7.0
Waterways and seaports	9.0	6.4	7.7	5.0	4.4	6.5	6.0	8.5	6.2	6.0	6.0	7.4	6.4
IT infrastructure	8.0	8.6	4.3	2.8	3.5	3.5	2.8	9.0	8.5	1.0	7.2	9.0	8.4
Reliability of power supply	5.8	7.4	6.0	5.0	5.2	5.0	5.0	8.0	6.8	2.6	6.4	5.9	6.5
Availability of office/lab space	5.7	6.9	6.3	5.9	6.0	6.0	5.6	4.3	7.1	6.0	4.9	7.0	6.0

Regulatory and policy weaknesses that can be improved

Example – Shanghai Pudong New Energy Project

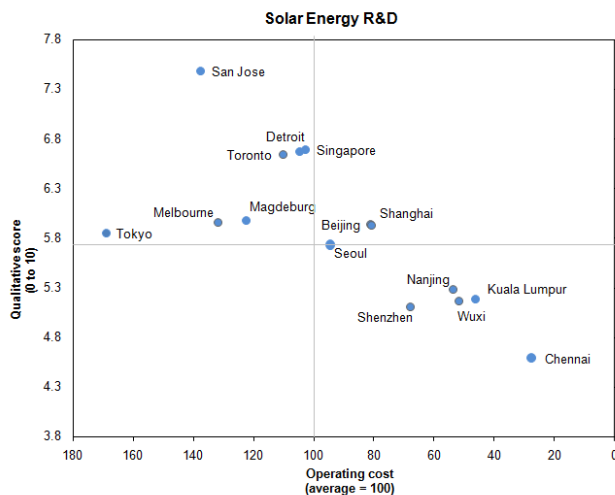
1. Approach



2. Sector prioritization

Activity	Priority
Advanced automotive components manufacturing	3.7
Hybrid/electric car manufacturing	3.5
Advanced automotive components R&D	3.5
Turbine components manufacturing	3.2
Energy efficiency devices manufacturing	3.2
Solar cell production	3.2
Energy Management R&D	3.0
Solar panel & components manufacturing	3.0
Solar energy R&D	3.0
Biofuel R&D	2.9
Wind energy R&D	2.8
Wind turbine assembly	2.8
Carbon Capture & Storage/Clean Coal	2.8
PV material/wafer production	2.8
Blade & rotor manufacturing	2.6
Energy efficiency materials manufacturing	2.6
Tower & frame manufacturing	2.4
Biofuel Production	2.3
Nuclear power plant components manufacturing	2.1
Hydro power R&D	1.8
Consulting & engineering service activities	1.7
Hydroelectric components manufacturing	1.6

3. Competitive Positioning Analysis



4. Set priorities for investment promotion

Target group	Sub-sector	Common number of jobs	Priority Target geographies	Example of target project
Solar	R&D facility	20 - 30	United States, India, Germany, Japan, United Kingdom, Norway	Applied Materials Technology centre in Xi'an
	High end manufacturing	50 - 200		Amerisolar facility in Ningbo
Wind	R&D facility	20 - 50	Denmark, Germany, Spain, United States, India	Vestas Technology R&D Centre in Beijing
	High end manufacturing	100 - 250		Suzlon Energy facility in Tianjin
Smart grid	R&D facility	15 - 30	United States, Germany, France, Japan, South Korea	Mahindra Satyam smart grid research and innovation center in Waterloo (Canada)
	High end manufacturing	25 - 100		Ilron smart meter manufacturing facility in West Union (US)
NE services	Consulting & engineering services	20 - 40	United States, United Kingdom, France, Switzerland, Japan	AECOM Shanghai office

What can IPAs do to attract Renewable Energy investment?

Summary

- Understand the Renewable Energy cluster and its requirements
 - Variation in requirements per sub-cluster and per stage in supply chain
 - Note that requirements are different throughout location selection process
- Understand your location's offer and competitiveness
 - Identify the strengths and weaknesses that investors perceive
 - Develop improvement plans where required and possible
 - Develop your sales proposition based on investor requirements
- Develop industry expertise!
 - Traditional IPAs are offering little value to the investors of today
 - Make sure you have access to industry know how; work with existing network



Plant Location International (PLI)

Global Location Strategies

A service of IBM Global Business Services

Web-site: www.ibm.com/gbs/pli

Jacob DENCİK

Senior Manager

+32 473 23 09 23

Jacob.Dencik@be.ibm.com