City Resilience Index

A Presentation to

The National Academies of Sciences Engineering Medicine

12th November 2015

Nancy Kete, The Rockefeller Foundation





The primary purpose of this grant is to develop **a comprehensive set of indicators, variables and metrics** – that can be used by cities to baseline and measure their resilience over time; thereby inform urban planning and investment decisions that will enhance their resilience

Purpose Statement, Arup's grant proposal, September 2014

By December 2015, to have designed a **comprehensive, credible, technically robust, and widely accessible tool** that enables cities to measure, assess and monitor their resilience in order to inform urban planning, practice, and investment patterns.

<u>Beyond 2015</u>, to use data from the assessments to **refine the tool, share knowledge**, and **inform best practice globally**

Opportunity Statement, RF/Arup inception meeting, November 2014



Our methodology

	Q4 -2014	Q1 -2015	Q2 -2015	Q3 -2015
Credibility	Literature review (Vol 3)	Reviewed 16 frameworks	Consultation with 64 sectoral experts	
		Analysis of 1,746 data points	Reviewed 32 new references (papers)	
Usability	NOLA 'salon' with 100RC CROs	Consultation with 9 Arup offices world-wide	Pre-pilot in 'data-rich' cities: • Hong Kong, China*	Pilot in 3+ cities:Arusha, TanzaniaConcepcion, Chile
		Bangkok 'salon' with ACCCRN partners	Liverpool, UK*	 Hong Kong, China Liverpool, UK* New Orleans, USA
		NYC 'salon' with US- based practitioners		 Sao Paulo, Brazil* Shimla, India
		Cape Town 'salon' with a city government		



Our starting point



Research Report Volume 3	
1	
Urban Measurement Repor	t

ARUP

May 2014 © Ove Arup & Partners International Limited 2014

- Define a clear **purpose** and audience;
- Establish a '**universe of resilience**' but not all cities will be able or want to measure all of them;
- Aggregate up to indicator level only based on 4-5 sub-indicators, 3-4 variables, ~150 fields (max)
- Include different **types of variables**: leading/lagging, qualitative/quantitative.
- Use **established variables** where possible and identify an 'owner' of each variable
- Local ownership is an opportunity to build capacity and promote change.







What matters: the City Resilience Framework



- 4 Dimensions
- 12 Indicators





What to measure: ~150 variables

E.g.

7.3 Effectively managed protective ecosystems

Protective ecosystems have been identified and the inter-relationships with other ecosystems (within and beyond city boundaries) is understood

Policies and legislation are enforced to protect important ecosystems and natural resources

Active management and/or restoration of important ecosystems

8.1 Diverse and affordable transport networks

Diverse road network with adequate route planning and navigation

Diverse public transport system that is affordable for all

Informal/personal travel options (car sharing, walking paths, cycle routes and associated infrastructure)

Diverse and effective transport links to other cities/regions



How to measure: > 450+ potential metrics

8.1 Diverse and affordable transport networks

Diverse road network with adequate route planning and navigation

Diverse public transport system that is affordable for all

Informal/personal travel options (car sharing, walking paths, cycle routes and associated infrastructure)

Diverse and effective transport links to other cities/regions



E.g.

Average journey time (mins) for commuting catchment by transport mode (road, rail, long-distance bus, air)

Number of other cities to which this city has daily connections by:

- rail
- air
- bus

CRI Part A: qualitative

Prompt question

E.g.

To what extent does the city provide diverse and effective transport links to other cities or regions?

Part A: Qualitative Assessment

Best-case Scenario

The city has identified the commuting catchment and has up-to-date data on commuting time and cost by mode. The city has strong regional transport connectivity through a range of accessible transport modes. The city has undertaken a strategic assessment of.....

Worst-case Scenario

The city has not identified the commuting catchment. The city has poor transport links to other cities or regions. The city has not undertaken a strategic assessment of.....

Score = 4

Assessor makes judgement on where their city lies on the scoring scale



CRI Part B: quantitative

Prompt question

E.g. To what extent does the city provide diverse and effective transport links to other cities or regions?

Part B: Quantitative Measurement

1 primary metric (proxy)

E.g. Number of other cities to which this city has daily connections by: rail; air; bus.

Good performance

Poor performance

Cities will be able baseline and benchmark their performance. Scores will <u>not</u> be assigned



Agenda

1. Research and development

2. Key Challenges and Lessons Learned

- 3. Online tool
- 4. What next?



Key Issues: Who is the CRI for?



Perceived benefits

- Identify areas where action is required
- Baseline and demonstrate improvement over time
- Common basis of assessment facilitates peer-to-peer exchange
- Potential to understand relative performance ie. compare cities

Potential challenges

- Multiple stakeholders contributing to assessments;
- Allocation and ownership of input data;
- Conflict between formal city data, and data collected through surveys.
- Managing complexity





- Arup offices that consulted with their cities
- Ongoing pilot (CRI-2 2015)



Key Issues: Operationalizing qualities

idication Manda for the lease of the				Quanties						
000000000000000000000000000000000000		Indicators	Sub-indicators	Integrated	Inclusive	Reflective	Resourceful	Robust	Redundant	Flexible
9 1 Mining human vulnerability 1 Solicity infraction graphy 1 Solicity infraction graphy 1 Mining human vulnerability 1 Solicity infraction graphy 1 Solicity infraction graphy 1 Solicity infraction graphy 2 Solicity infraction graphy 1 Solicity infraction graphy 2 Solicity infraction graphy 2 Solicity infraction graphy 1 Solicity infraction graphy 2 Solicity infraction graphy 2 Solicity infraction graphy 1 Solicity infraction graphy 3 Solicity infraction graphy 2 Solicity infraction graphy 1 Solicity infraction graphy 3 Solicity infraction graphy 2 Solicity infraction graphy 1 Solicity infraction graphy 3 Solicity infraction graphy 2 Solicity infraction graphy 1 Solicity infraction graphy 3 Solicity infraction graphy 2 Solicity infraction graphy 1 Solicity infraction graphy 3 Solicity infraction graphy 2 Solicity infraction graphy 1 Solicity infraction graphy 3 Solicity infraction graphy 2 Solicity infraction graphy 1 Solicity infraction graphy 3 Solicity infraction graphy 3 Solicity infraction graphy 1 Solicity infraction graphy 3 Solicity infraction graphy 3 Solicity infraction graphy 1 Solicity infraction graphy 3 Solicity infraction graphy			1.1 Cale and allordable bouring						1	
9000 1 Minima human vulnerability 1 Social wises the photogrammer in the photogramer in the photogramer in the photogrammer i			1.1 Sale and allordable nodsling						é	-
0 1 Ammin Rule Rule Rule Rule Rule Rule Rule Rule	D)	4 Minimal human and an hilling	1.2 Adequate anordable energy supply		_			_	í.	
000000000000000000000000000000000000	-	i minimai numan vuinerabiity	1.5 Inclusive access to sale drinking water							
0 21 Individue basing projections 22 Obverse livelihood and employment 22 individue basing setuporent allow and innovation 23 Dynamic local business development allow and innovation 24 individue basiness development allow and innovation 23 Dynamic local business development allow and innovation 24 individue basiness development allow and innovation 24 Dynamic local business development allow and innovation 24 individue basiness development allow and innovation 24 Dynamic local business development allow and innovation 24 individue basiness development allow and innovation 24 Dynamic local business development allow and innovation 24 individue basiness development allow and innovation 24 Dynamic local business development allow and innovation 24 individue basiness development allow and innovation 25 Dynamic local business development allow and innovation 24 individue basiness development allow and innovation 24 Dynamic local business development allow and innovation 24 individue basiness development allow and innovation 26 Objective local business development allow and innovation 24 individue basiness development allow and individue basines development allow and indindindividue basine development allow and indiv	õ		1.4 Enecuve sanitation						i	_
C 2 Interior shall addressing 2 Interior shall addressing 2 Interior shall addressing 2 Overse livelihood and employment 20 points instances 2 Interior shall addressing 2 Enterior shall address ing mechanisms 2 Interior shall addressing 2 Interior shall addressing 2 Enterior shall address ing mechanisms 2 Interior shall addressing 2 Interior shall addressing 2 Enterior shall address ing mechanisms 2 Interior shall addressing 2 Interior shall addressing 2 Enterior shall address ing mechanisms 2 Interior shall addressing 2 Interior shall addressing 2 Enterior shall address ing mechanisms 2 Interior shall addressing 2 Interior shall addressing 2 Enterior shall address ing mechanisms 2 Interior shall addressing 2 Interior shall addressing 2 Enterior shall address ing mechanisms 2 Interior shall addressing 2 Interior shall addressing 2 Enterior shall address ing mechanisms 2 Interior shall addressing 2 Interior shall addressing 2 Enterior shall address ing mechanisms 2 Interior shall addressing 2 Interior shall addressing 2 Enterior shall address ing mechanisms 2 Interior shall addressing 2 Interior shall addressing 2 Enterior shall address ing mechanisms 2 Interior shall addressing 2 Interior shall addressing 2 Enterior shall addressing mechanisms 2 Interior shall addressing	Ō		1.5 Sumcient anordable tood supply				_			
2 Diverse invalues using approximation and approximation and approximation approximate approximate approximation approximation approximatio	<u> </u>		2.1 inclusive labour policies							
2 Unterla International and employment 2 - 0 perturbation and employment 2 - 0 perturbation and employment 2 Unterla International Internation International International International In		0 Diverse livelihe ad and smaller much	2.2 Relevant skills and training							
9000000000000000000000000000000000000		2 Diverse livelihood and employment	2.3 Dynamic local business development and innovation	-						
Selective safeguards to human health and ife 3 Effective safeguards to chains community support 4 Collective identity & community support 4 Comparison of comparison of the comparison of			2.4 Supportive financing mechanisms							
 Effective safeguards to human health and like			2.5 Diverse protection of livelihoods following a shock						e	
 2 Effective safeguards to human health and life 3 Effective safeguards to human health and life 3 Effective safeguards to human health and life 3 Effective safeguards to human health and life 4 Collective identify & community support 5 Comprehensive security and rule of law 5 Comprehensive basiness continuity planning 6 Sustainable conomy 6 Sustainable conomy 7 Comprehensive basiness continuity planning 7 Comprehensive basiness continuity faioning 8 Effective provision of critical services 9 Paicaber fination for comparison 9 Comprehensive basiness continuity faioning 9 Comprehensive basiness continuity faioning			3.1 Robust public health systems							
		3 Effective safeguards to human health and life	3.2 Adequate access to quality healthcare						1	
			3.3 Emergency medical care	_						
 4 Collective identify & community support 4 Collective identify & community support 4 Collective identify a community support 4 Collective identify a community support 5 Comperiments to deter crime 2 Proster computing in the subset of the subset			3.4 Effective emergency response services							
00 4 Collective identity & community support 42 Consistence minuties 4 Collective identity & community support 42 Consistence minuties 42 Consistence 5 Comprehensive security and rule of law 33 comprehensive sites continuity faming 42 Consistence 42 Consistence 6 Sustainable economy 61 Webmanaged public financis 61 Webmanaged public financis 61 Webmanaged public financis 7 Reduced exposure & fragility 62 Comprehensive security planing 63 Webmanaged public financis 61 Webmanaged public financis 7 Reduced exposure & fragility 73 Comprehensive security and global constraints 61 Webmanaged public financis 61 Webmanaged public financis 7 Reduced exposure & fragility 73 Endowly managed protective constraints 61 Webmanaged protective constraints 61 Webmanaged protective constraints 8 Effective provision of critical services 63 Network material and econcement 61 Webmanaged protective constraints 61 Webmanaged protective constraints 9 Reliable mobility and communications 63 Network material and econcement 61 Webmanaged protective constraints 61 Webmanaged protective constraints 9 Reliable mobility and communications 63 Network material seconce seconce 62 Webmanaged protective constraints 62 Webmanaged protective constraints 10 Effective leaders	C		4.1 Local community support							
	ō	4 Collective identity & community support	4.2 Cohesive communities					-		
S Comprehensive security and rule of law S Comprehensive business continuity planning S Comprehensive business continuity S Comprehensity for continuity planning S S Comprehensity for continuity for continuity planning S S S S S S S S S S S S S S S S S	÷=		4.3 Strong city-wide identity and culture						1	
9 Comprehensive security and rule of law 5 Comprehensive security and rule of rule of law	g		4.4 Actively engaged citizens							
5 Comprehensive security and rule of law 52 Phother corruption prevention 53 Comprehensive policing 54 Comprehensive policing 55 Comprehensive policing	.02		5.1 Effective systems to deter crime						1	
0 Competine security and use of saw 3 Competine policing 3 Competine policing 6 Sustainable economy 6 Sustainable economy 6 Sustainable economic base		5. Comprehensive security and rule of law	5.2 Proactive corruption prevention						1	
6 Sustainable economy 61 Weitmanged public finances	¹⁰	5 Comprehensive security and rule of law	5.3 Competent policing							
 Sustainable economy 6. Sustainable economy 8. Solverine economic base continuity planning 8. Solverine economic base economics 8. Solverine economics 8. Solve	2		5.4 Accessible criminal and civil justice							
 B 2 Comprehensive business continuity planning Comprehensive business continuity planning Comprehensive business environment: Comprehensive hazard and exposure mapping Comprehensive services Comprehensive and exposure services Comprehensive hazard and exposure mapping Comprehensive and exposure services Comprehensive hazard and exposure mapping Comprehensive hazard materioris and exposure memping Comprehensive faus	0		6.1 Well-managed public finances							
6 Sustainable economy 6 Subtainable economic base 6 Sustainable economic base 6 Sustainable economic base 6 Sustainable economic base 7 Reduced exposure & fragility 8 Effective provision of critical services 8 Reliable mobility and communications 8 Reliable mobility and communications 9 Reliable mobility and communications technology retrotive expostment 10 Effective leadership and management 10 Effective leadership and management 11 Empowered stakeholders 11 Empowered stakeholders 12 Integrated development planning 13 Reduce transmities to erage with government 14 Secure technology revorts 12 Integrated development planning 12 Integrated development planning process 13 Reduce transmities to erage with government 14 Reduce transmities to erage with government 14 Reduce transmities to erage with government 15 Reduce transmities to erage with government 16 Reliable mobility and communities to erage with government 16 Reliable mobility and co	-		6.2 Comprehensive business continuity planning							
 A Altacke busines environment S Strong inlegation with regional and global economies T Comprehensive hazard and exposure mapping T Effective provision of critical services T Effective provision of critical services T Effective provision of critical services T Effective information tempore and continuity T Effective information tempore and exposure for an information technology networks T Effective information technology networks		6 Sustainable economy	6.3 Diverse economic base							
0 0.5 Strong integration with regional and pobule economies 0 0 0 0 7 Reduced exposure & fragility 72 Appropriate codes, standards and enforcement 0			6.4 Attractive business environment							
Produced exposure & fragility 7 Reduced exposure & fragility 8 Effective provision of critical services 8 Effective provision of critical services 8 Reliable mobility and communications 9 Reliable mobility and communications for longer exposed expo			6.5 Strong integration with regional and global economies							
7 Reduced exposure & tragility 8 Effective provision of critical services 8 Effective provision of critical services 9 Reliable mobility and communications 9 Reliable mobility and communications tempore and another tempore tempore tempore and another tempore tempore and another tempore tempore and another tempore tempore tempore and another tempore tempore another tempore temp			7.1 Comprehensive hazard and exposure mapping						1	
7 Reduced exposure & traginity 7 3 Effective managed protective cosystems 7 4 Reduced exposure & traginity 8 11 Effective provision of critical services 8 3 Retained spate capacity 8 4 Reduced exposure expos			7.2 Appropriate codes, standards and enforcement				1			
A Robust protective infrastructure 8 Effective provision of critical services 8 Effective provision of critical services 9 Reliable mobility and communications 10 Decreta and dividual transport networks 10 Decreta and transport operation tetworks 11 Decreta transport operation tetworks 11 Decreta transport operation tetworks 12 Integrat		7 Reduced exposure & fragility	7.3 Effectively managed protective ecosystems							
8 Effective provision of critical services 81 Effective services			7.4 Robust protective infrastructure							
8 Effective provision of critical services 8 Effective provision of critical services 9 Reliable mobility and communications 9 Reliable mobility and communications 10 Effective transport operation & maintenance 11 Effective transport operation & maintenance 12 Effective transport operation & maintenance 12 Effective transport operation & maintenance 13 Effective transport operation & maintenance 14 Secure technology networks 13 Effective transport operation & maintenance 14 Secure technology networks 13 Effective transport operation & maintenance 13 Effective transport operation with other operation maintenance 14 Secure technology networks 13 Effective transport operation with other operation maintenance 14 Secure technology networks 13 Effective transport operative multi-statematication with other operative multi-statematication with other operative multi-statematication with other operative multi-statematication 13 Effective transport operative multi-statematication operative multi-statemative multi-state			8.1 Effective stewardship of ecosystems				E			
8 Effective provision of critical services 8.3 Retained sparts capacity 8.0 Retained sparts c	<u>0</u>		8.2 Flexible infrastructure services							1
9 Reliable mobility and communications 84 Diigent maintenance and continuity for critical services 84 Diigent maintenance and continuity for critical services 86 Adequate continitical services 86 Adequate continuity	S	8 Effective provision of critical services	8.3. Retained spare capacity			i				
B 5 Adequate continuity for critical assess and services B 7 Adequate continuity for critical assess and services B 7 Reliable mobility and communications B 7 Reliable mobility and motions B 7 Reliable mobility and communications B 7 Reliable B			8.4 Diligent maintenance and continuity							
9 Reliable mobility and communications 9.1 Diverse and addredule transport operations & maintenance 9.2 Effective transport operations & maintenance 9.3 Reliable communications technology 9.4 Secure technology networks 9.4 Secure technology necos </th <th><u>u</u></th> <th></th> <th>8.5 Adequate continuity for critical assets and services</th> <th></th> <th></th> <th></th> <th>i se se</th> <th></th> <th></th> <th></th>	<u>u</u>		8.5 Adequate continuity for critical assets and services				i se			
9 Reliable mobility and communications 9 2 Effective transport operations maintenance 9 2 Effective transport operations 9 2 Effective transpo			9.1 Diverse and affordable transport networks					-		
			9.2 Effective transport operation & maintenance			1				
94 Secure technology retrots 104 Secure technology retrots 104 Secure technology retrots 104 Secure technology retrots 102 Effective leadership and management 102 Effective cordination with other government bodies 104 Secure technology retrots 105 Secure technology retrots 102 Effective leadership and management 102 Effective cordination with other government bodies 104 Secure technology retrots 105 Secure technology retrots 111 Empowered stakeholders 112 Wideprada community awarneets		9 Reliable mobility and communications	9.3 Reliable communications technology							
10 Effective leadership and management 10 1 Appropriate government decision-making Image: Construction with other government bodies 10 Effective leadership and management 10 2 Effective condination with other government bodies Image: Construction of the second s			9.4 Secure technology networks				(i i i i i i i i i i i i i i i i i i i			
10 Effective leadership and management 10.2 Effective conditiation with check powerment bodies Image: Conditiation with check powerment bodies Image: Conditiation with check powerment bodies 00 Effective leadership and management 10.2 Effective conditiation with check powerment bodies Image: Conditiation with check powerment bodies 11 Empowered stakeholders 11.2 Wideprad community awarness and preparedness Image: Conditiation with check powerment Image: Conditiation with check powerment 12 Wideprad community awarness and preparedness 12.1 Comprehensive city monitoring and data management Image: Conditiation with check powerment Image: Conditiation with check powerment 12 Wideprad community awarness and preparedness 12.1 Comprehensive city monitoring and data management Image: Conditiation with check powerment Image: Conditiation with check powerment 12 Wideprad community awarness and preparedness 12.1 Comprehensive city monitoring and data management Image: Conditiation with check powerment Image: Conditiation with check powerment 12 Nontering and use and zoning 12.3 Appropriati process Image: Conditiation with check powerment Image: Conditiation with check powerment 12 About planning porces Image: Conditiation with check powerment Image: Conditiation with check powerment Image: Conditiation with check powerment 12 About planning porces Image: Conditiation with check powerment Image: Condititiation Image: Conditiatitiatiation </th <th></th> <th></th> <th>10 1 Appropriate government decision-making</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>1</th> <th></th>			10 1 Appropriate government decision-making						1	
10 Effective leadership and management 13 2 Produk multi skakholder collaboration 10 Comprehensive jours of multi skakholder collaboration 11 Comprehensive jours of multi skakholder collaboration 11 Empowered stakholders 12 Integrated development planning 12 Consultative planning process 12 Appropriate land use and zoning			10.2 Effective co.ordination with other government hodies				` 			
Concerner readers in a uninegement 10 Concerner and search of a Concerner and monitoring and risk assessment 10 Comprehensive government memory management 10 Comprehensive government memory management 11 Comprehensive government memory management 12 Wideprad community awarness and preparedness 12 Comprehensive government memory 12 Integrated development planning 12 Comprehensive government 12 Comprehen		10 Effective leadership and management	10.3 Proadive multi stakeholder collaboration	_	_	_				
11 Empowered stakeholders 12 Integrated development planning 12 Consultative matad monitories and preparedness 12 Consultative matadmonities on engage with government 12 Consultative planning process 12 Appropriate land use and zoning 12 Appropriate land u	0	To Elective leadership and management	10.5 Produive indid-stakeholder conaboration	_				_		
11 Empowered stakeholders 10 S Competensive government mergency management 11 Addeguate education for all 11 Addeguate education for all 12 Widespread community awareness and preparedeness 13 Elective mechanisms for communities to engage with government 12 (Competensive City monitoring and data management	B		10.4 Comprehensive nazard monitoring and risk assessment		_	_				
11 Empowered stakeholders 11.2 Modulate electration for all 12 Integrated development planning 12.2 Consultative planning process 12 Integrated development planning 12.2 Consultative planning process 12 Adobut planning process 12.3 Appropriate land use and zoning 12 Adobut planning process 12.3 Appropriate land use and zoning 12 Adobut planning process 12.3 Appropriate land use and zoning 12 Adobut planning process 12.3 Appropriate land use and zoning 12 Adobut planning process 12.3 Appropriate land use and zoning 12 Adobut planning process 12.3 Appropriate land use and zoning 12 Adobut planning process 12.3 Appropriate land use and zoning 12 Adobut planning process 12.3 Appropriate land zoning 12 Adobut planning process 12.3 Appropriate land zoning 12 Adobut planning process 12.3 Appropriate land zoning 12 Adobut planning process 13.3 Appropriate land zoning 13 Adobut planning process 13.3 Appropriate land zoning 14 Adobut planning process	S		10.5 Comprehensive government emergency management	_					(
11 Empowered stakenoiders 11.2 Woesprad community awareness and preparedness 01 13.3 Effective mechanisms for communities to engage with government 12.1 Comprehensive city monitoring and data management 12.1 Comprehensive city monitoring and data management 12.1 Consultative planning process 12.2 Consultative planning process 12.4 Robust planning approval process 12.4 Robust planning approval process	Ŭ	44 Emperated stakeholders	11.1 Abequate education for all							
1.3 Emechanisms for communication engage with government 1.2 Consultative planning 12 Integrated development planning 12.3 Opportialle land use and zoning 12.4 Apportialle land use and zoning 12.4 Apportial participation process	2	The Empowered stakeholders	11.2 widespread community awareness and preparedness	_						
12 Integrated development planning 12.1 Comprehensive city monitoring and data management 12.1 Comprehensive city monitoring and data management 12 Integrated development planning 12.2 Consultative planning process 12.1 Comprehensive city monitoring and data management 12.1 Comprehensive city monitoring and data management 12.2 Consultative planning process 12.1 Comprehensive city monitoring and data management 12.1 Comprehensive city monitoring and data management 12.2 Consultative planning process 12.1 Comprehensive city monitoring and data management 12.1 Comprehensive city monitoring and data management 12.2 Consultative planning process 12.1 Comprehensive city monitoring and data management 12.2 Consultative planning approval process 12.1 Comprehensive city monitoring approval process 12.1 Comprehensive city monitoring approval process	2		11.3 Effective mechanisms for communities to engage with government							
12 Integrated development planning 122 Consultateve planning process 12 Robust planning approval process 124 Robust planning approval process	č		12.1 Comprehensive city monitoring and data management							
12.3 Appropriate land use and zoning 12.4 Robust planning approval process	$\overline{\mathbf{v}}$	12 Integrated development planning	12.2 Consultative planning process		_					
12.4 Robust planning approval process	_		12.3 Appropriate land use and zoning				4			
			12.4 Robust planning approval process			-	1		i i	

lities

E.g. *robust* and *inclusive* housing is better understood as *safe* and *affordable* housing.

Useful intellectual construct, used as 'scaffold' to develop the sub-indicators.



Key issues: Managing complexity

A balance needs to be struck between the **breadth of issues** contributing to resilience and the **depth of analysis**. Our research and feedback from consultation suggested that ~150 data points was appropriate.

Breadth of assessment is set – all 12 indicators and 58 sub-indicators are important



ROCKEFELLER **ARUP**

Key issues: Quantitative and qualitative indicators

Both are necessary to develop a comprehensive basis of assessment. But, cannot readily be combined.

	Functions	Quantitative measurement	Qualitative assessment
	Proxy for current performance (can act as 'red flags')	\checkmark	×
	Track year-on-year change	\checkmark	×
t,	Determine if the right processes are in place for building resilience long-term (track long-term trajectories)	×	\checkmark
	Succinctly capture the complexity associated with each sub-indicator	×	\checkmark
	Indicate if qualities of resilient systems are in place	×	\checkmark
	Indicate actual resilience to shocks	×	\checkmark



Key Issues: Data Availability

> 'What matters' implies new things that cities don't currently measure.



Hong Kong

Indicator		Sub-indicator	Data Measurability
		1.1 Safe and accessible housing	67%
		1.2 Adequate affordable energy supply	33%
I: Minimal human	38%	1.3 Inclusive access to safe drinking water	100%
vulnerability		1.4 Effective Sanitation	50%
		1.5 Sufficient affordable food supply	67%
		2.1 Inclusive labour policies	50%
II: Diverse		2.2 Relevant skills and training	50%
livelihoods and	54%	2.3 Dynamic local business development and innovation	75%
employment		2.4 Supportive financing mechanisms	0%
		2.5 Diverse protection of livelihoods following a shock	33%
III: Effective		3.1 Robust public health systems	100%
safeguards to		3.2 Adequate access to guality healthcare	75%
human health and	29%	3.3 Emergency medical care	50%
life		3.4 Effective emergency response services	60%
IV: Collective		4.1 Local Community Support	33%
identity &		4.2 Cohesive communities	67%
community of	45%	4.3 Strong city-wide identity and culture	50%
support		4.44 strong city-while identity and currane	100%
Juppon	-	5.1 Effective systems to datas srima	100%
V: Comprehensive	40%	5.1 Effective systems to deter crime	100%
security and rule of		5.2 Proactive conception prevention	30%
law		5.5 Competent policing	100%
	-	5.4 Accessible criminal and civil justice	0%
	40%	6.1 Well-managed public finances	67%
VI: Sustainable economy		6.2 Comprehensive business continuity planning	33%
		6.3 Diverse economic base	100%
		6.4 Attractive business environment	67%
		6.5 Strong integration with regional and global economies	50%
VII: Reduced	36%	7.1 Comprehensive hazard and exposure mapping	50%
exposure &		7.2 Appropriate codes, standards and enforcement	67%
fragility		7.3 Effectively managed protective ecosystems	100%
		7.4 Robust protective infrastructure	33%
		8.1 Effective stewardship of ecosystems	100%
VIII: Effective		8.2 Flexible infrastructure	86%
provision of critical	42%	8.3. Retained spare capacity	100%
services		8.4 Diligent maintenance and continuity	25%
		8.5 Adequate continuity for critical assets and services	0%
IX: Poliable		9.1 Diverse and affordable transport networks	75%
na kellable	E.49/	9.2 Effective transport operation & maintenance	33%
communications	54%	9.3 Reliable communications technology	67%
communications		9.4 Secure technology networks	0%
	71%	10.1 Appropriate government decision-making	0%
X: Effective		10.2 Effective co-ordination with other government bodies	0%
leadership and		10.3 Proactive multi-stakeholder collaboration	0%
management		10.4 Comprehensive hazard monitoring and risk assessment	33%
-		10.5 Comprehensive government emergency management	60%
	50%	11.1 Adequate education for all	100%
XI: Empowered		11.2 Widespread community awareness and preparedness	33%
stakeholders		11.3 Effective mechanisms for communities to engage with	
		government	100%
		12.1 Comprehensive city monitoring and data management	67%
XII: Integrated		12.2 Consultative planning process	33%
development	50%	12.3 Appropriate land use and zoning	50%
planning		12.4 Robust planning approval process	50%



Key Issues: Summary



- Who is the CRI for?
- Global applicability
- Operationalizing qualities
- Managing complexity
- Combining qualitative and quantitative indicators
- Data availability



On-line Platform

The CRI provides a comprehensive set of city scale indicators, variables and metrics.

The **on-line platform** facilitates **data collection** and provides high quality auditable **outputs**.





Key requirements

Key Features

- Accessible to as wide range of stakeholder
- Promotes an inclusive and rigorous process
- Flexible to adapt to different types of cities/organisations

Value

- Education/ knowledge
- Assessment & measurement
- Cross analysis of data

Multiple cities

- Cross analysis individual cities
- Normalisation of scoring
- Data

City users

- Understand relevance
- Assessment
- Clear data input role
- Baselining and monitoring

Individual users

- Education
- Potential city user

CRI Admin and Moderator

- IT support
- Update index & resources
- Support cities
- · Cross analysis

Key functions



Meta-analysis and optimisation



User-centric design





Nicholas

Patrick (Public User)

Student/ Researcher

...wants to know how cities resilience can be measured and also if it is something he wants to pursue in his career

General Manager, Transportation Agency

(CRI Team Member)

...wants to complete the CRI assessment as efficiently as possible. He is keen to involve junior members of his team to support him with this task.



Freya (CRI Team Leader)

Mayor / CRO

.. wants to understand where her city performs against resilience indicators. Wants to motivate her team/city to think about resilience



Belinda (Arup/RF Admin)

Consultant/ developer

...wants to support cities, view the responses of cities and to keep the CRI assessment tool current



User-centric design





Uses city language

CRI language (Outcomes)

Comprehensive business continuity planning Appropriate codes, standards and enforcement Dynamic local business development and innovation Supportive financing mechanisms Attractive business environment

City language (Who? What? How?) Budget Buildings Business & Finance Citizen participation and awareness City data City planning Community support



Data input by topic

Crime and Policing Culture Disaster Management **Drainage & Sanitation Employment & Labour Education & Training** Energy Environment Food Housing Health Legal & justice Support & welfare Transport **Urban planning** Water Supply





Visual Outputs

The CRI provides a holistic qualitative **visual assessment** based on an aggregation of best/worst case scenarios.

The CRI will also provide a quantitative assessment based on proxy indicators, **benchmarked** against predetermined thresholds of acceptability.





Reporting complex data

Cities will be able to download **further detail** in order to identify specific strengths, weaknesses or where data is not available.



By December 2015

Communication



Knowledge





Vol 2

RECEIPTILLER ARUP

Research Report Volume 3 Criterian Measurement Report

Vol 3

ARUP	Index Development	Index Pilots
	Vol 4	Vol 5

Case Studies

Perspectives on City Resilience New Orlans, USA Several	Prispectives on City Resilience for Cape Town, South Africa	Perspectives on City Resilience Perspectives on City Resilience	
New Orleans	Cape Town	Concepcion	Others

Tool v1.0

PECKIPILLIR



How we can help your cit

Beyond 2015, to use data from assessments to refine the tool, share knowledge, and inform best practice globally.

Opportunity Statement, RF/Arup inception meeting, November 2014

