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BIG DATA TO SMART CITY: RECOMMENDATION TO COR

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It is estimated that every $1 spent on resilience efforts yields $4 in economic benefits, not including the value of the thousands of prevented injuries and hundreds of saved lives

Source: National Academy of Sciences, Engineering, and Medicine

Background

COR brings together the municipality's 30 departments and private suppliers in a single monitoring room. Scope of work includes:

Track real-time conditions in the city

Share real-time information between city staff from various departments

Host a room for journalists, who can access much of the same information

Other cities have similar projects – Madrid has one control room for police, fire and ambulance services – but none are as big or broadly operational as Rio's

SWOT Analysis

strengths

S

- Integrates several departments involved in Rio's routine
- Manages crisis and emergency situations
- Provides and exchanges information with the public through the media, social networks, and the *data.rio* portal

weaknesses

W

- Social media presence is not reaching the masses
- Service delivery and access to services for citizens living in favelas
- Lack of sustainable funding mechanisms for public welfare projects

O

opportunities

- Mobilize academic partners and other research partners to improve service delivery
- Redefine mission and vision statements post-Olympics
- Provision of analytical insights and simulations
- Build upon previous resilience efforts

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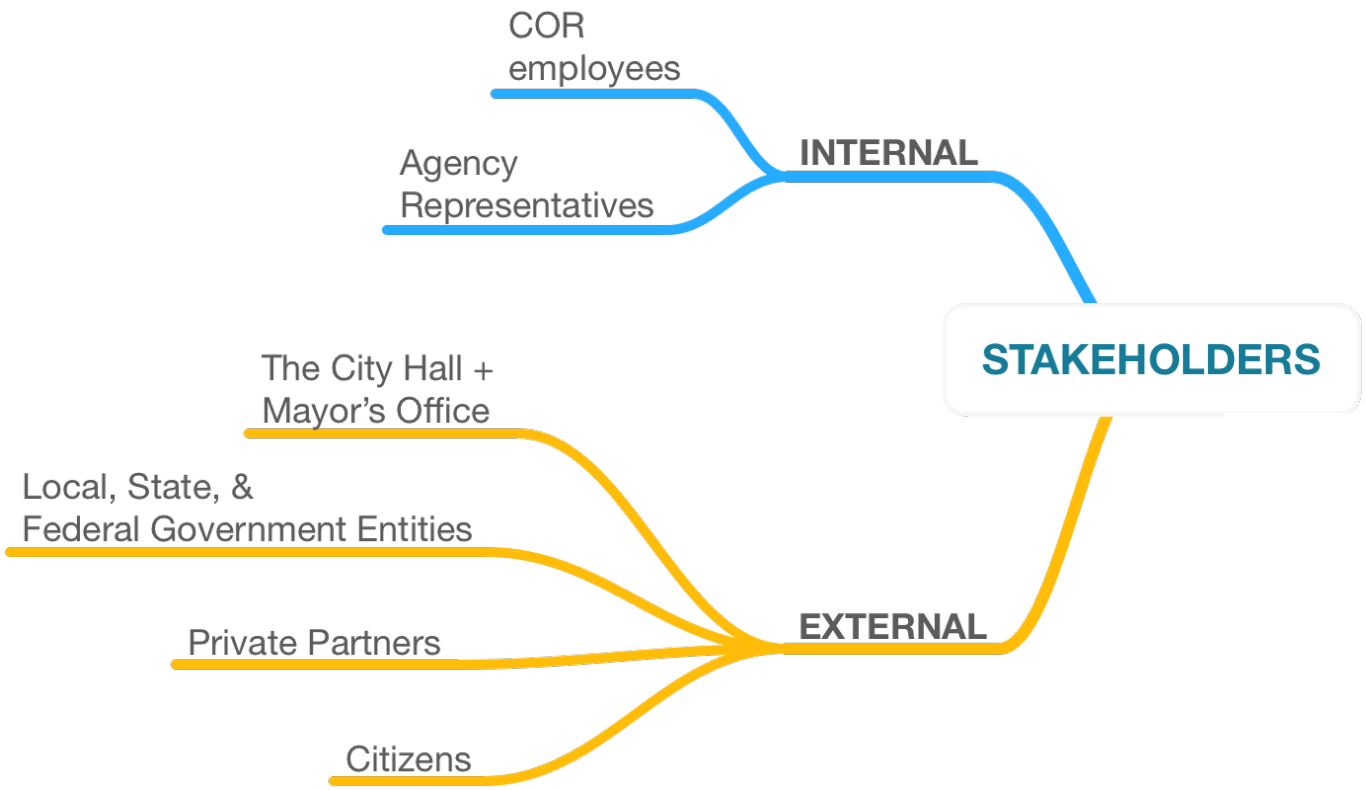
threats

- Small number of employees
- A need to make a case for themselves in a limited funding context
- Credibility issues stemming from blind-side events

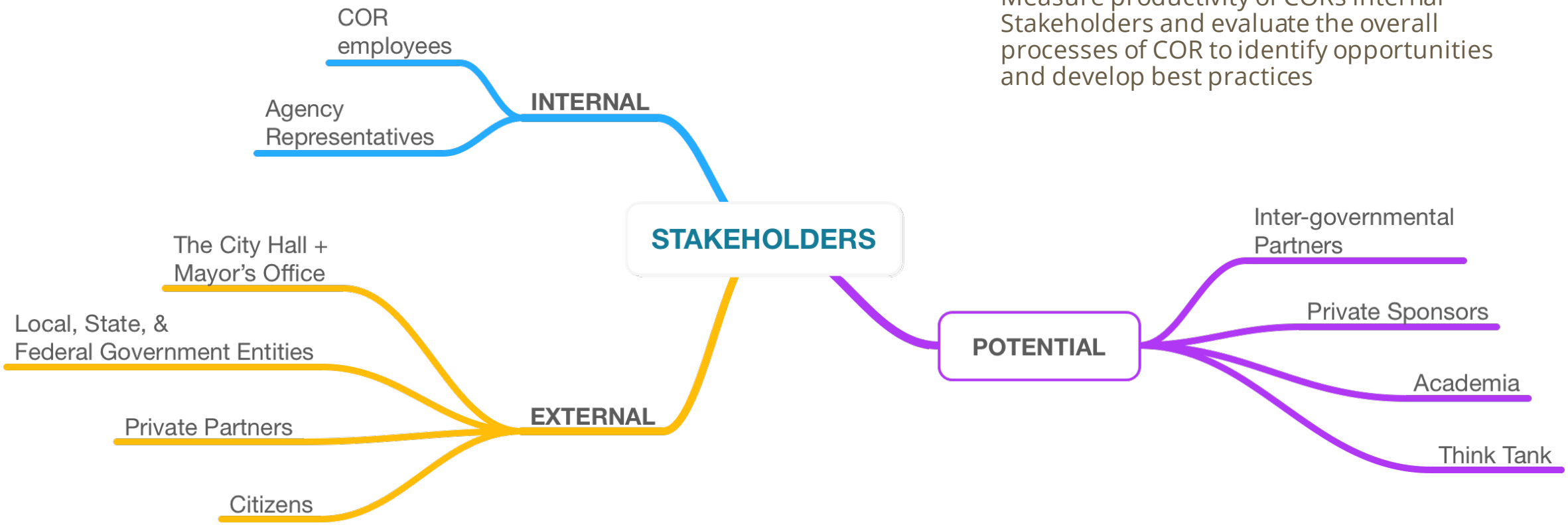
People and Partners



Consistent engagement, communication, and performance measurement of internal and external Stakeholders will help maintain support, advocacy, and mutually beneficial partnerships.

People and Partners

- Increase number of external Stakeholders by fostering meaningful partnerships and collaborative efforts
- Measure productivity of CORs internal Stakeholders and evaluate the overall processes of COR to identify opportunities and develop best practices



Vision of Strategic Recommendations

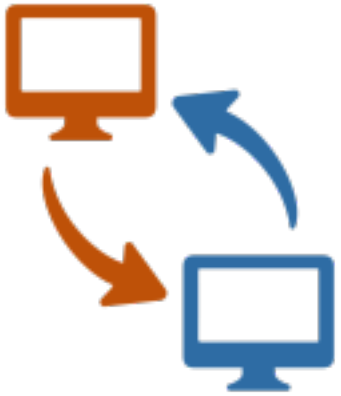
To identify and strategically focus how city management in Rio de Janeiro, specifically Centro de Operações Rio (COR), can use big data to promote resilience and smarter city growth consistent with COR's mission.

Roadmap


Smart Data and Open Source
Indicators
Communication
Implementation

Smart Data and Open Source

Recommendations



- Require partners to collect more variables related to the same data points
  - Ex. Populations in the same area who experience a shock differently because they live at different points in elevation.
- Facilitate partnerships with universities to create guideline for data sharing
- Recommend partnerships with data science startups to help organize, store, visualize data
- Create PENSA 2.0 within COR to facilitate data flows and analysis. The team will continue to include: 1) Strategic planning 2) Data analysis 3) Research 4) Public policy development forecasting
- Advice data.rio to release frequent output of reports to highlight value of COR and sustain conversation and funding

Value

- Coordination and communication between P3s
- COR will obtain disaggregated data that captures equity information
- Meaningful data for better forecasting, mitigation, and resource allocation
- Relationship, trust and collaboration with diverse neighborhoods
- Increase funding for sustainable scaling

Data Equity

Standardize data to reflect neighborhood analytics rather than city aggregated analytics

Collect evaluation data to collect before and after costs of projects and response to system failures

Case Study: Mexico

- Establishment of a damage assessment committee (DAC) before the declaration of natural disaster is formally issued
- The DAC is comprised of sectorial subcommittees composed of members of both federal and local institutions.
- Each subcommittee has a maximum of 20 working days to complete fieldwork, to itemize reconstruction needs and the related costs
- While the full damage assessment is being completed, federal and local agencies have 7 days to request funding for the emergency phase.

Data Scope for Data.Rio

Facilitate a model for larger data sets over longer time horizons per agency

Recommend agency for better organizing and streaming multi-agency data

Recommend more data visualization methods through partnerships with universities

Case Study: Singapore

- In Singapore, 100 apps have been developed through integration of government data.
- Private sector application developers have utilized data from the Land Transport Authority to create apps that inform motorists about car park availability and road pricing.
- Community groups have created apps for topics that add value to the public by informing citizens of options and warning them of potential encounters (e.g. clean public toilet locations and street cats)
- Collaboration between People's Association and Civil defense force that alerts first responders to perform CPR before the ambulance arrives

Indicators

Recommendations

Work with academic specialists to develop three indices:

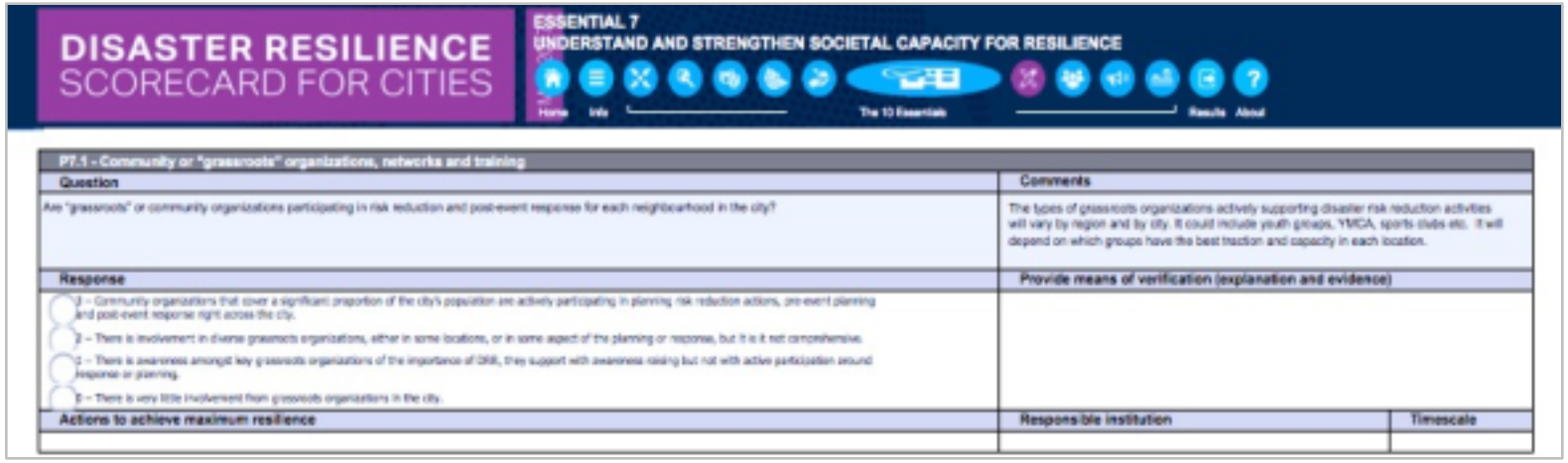
- Hazard Vulnerability Index
- Resilience Index
- Smart City Index

Value

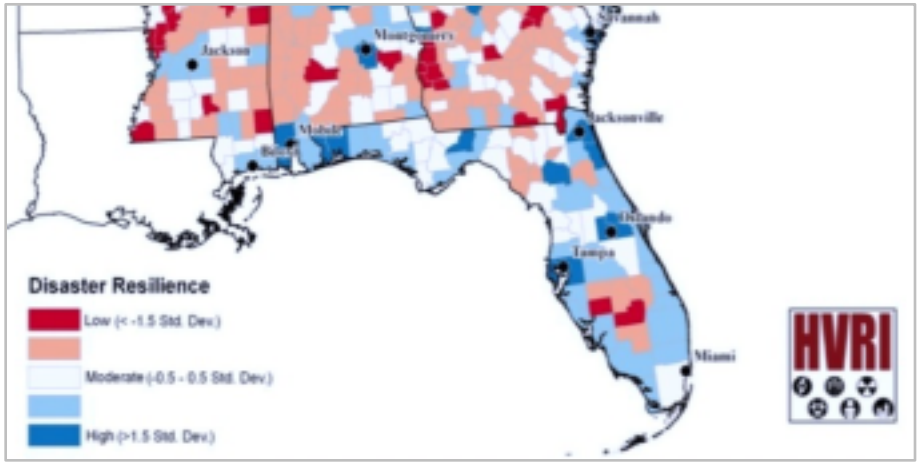
- Quantify COR's value for external constituents
- Indices capitalize on COR's comparative advantage of aggregating data
- Provide internal performance evaluation and alignment with COR mission
- Move forward with the RioResiliente Strategy
- Suggest actions, next steps, and priorities for the City of Rio de Janeiro
- Provides measurements to address equality in access to and delivery of citizen services

Building an Indicator

Source: Scorecard - UNISDR 2017



Source: HVRI Map on Disaster Resilience - Cutter et al. 2010



Process

- Research measurement models based on COR-identified needs, RioResiliente Goals, and IDB Case Study
- Create suggestions based on academic literature, other cities, and site visits

Products

- Sub-indices which can be aggregated
- Possibility for scorecards

Limitation

- Data availability
- Overlapping measures
- Proper aggregation methodology

Creating an Index

A basic example of a Disaster Resilience Index from Cutter et al. 2010:

a. Reflect on the scale at which you want to measure

- Chose one U.S. Federal Emergency Management Agency regions comprised of eight states

b. Develop or apply a theoretical model

- DROP: Disaster Resilience of Place model (Cutter et al. 2008)

c. Select variables based on existing literature and data availability/quality

- Excluded natural systems data due to inconsistency and diverse ecological areas
- Included measures of social cohesion

d. Clean the data and address missing values

- Transformed raw data into comparable scales using percentages, per capita, and density functions
- Removed one of any pair of highly correlated indicators
- Checked reliability using Chronbach's Alpha Reliability/Item analysis
- Used Min-Max rescaling to create indicators on a similar measurement scale

e. Decide on the weight of each component

- Decided to equally weigh each component

f. Create the index score

- Averaged sub-index scores
- Added the sub-index scores to create final aggregated resilience score

Source: Cutter et al. 2010

	Resilience Type					
	Social	Economic	Institu-tional	Infra-structure	Community Capital	Resilience Score
Gulfport-Biloxi MSA						**2.271**
Hancock County, MS	0.498	0.409	0.499	0.203	0.499	2.108
Harrison County, MS	0.527	0.552	0.579	0.504	0.660	2.821
Stone County, MS	0.440	0.324	0.324	0.258	0.537	1.883
Charleston-North Charleston MSA						**2.583**
Berkeley County, SC	0.657	0.495	0.554	0.073	0.446	2.216
Charleston County, SC	0.500	0.648	0.702	0.519	0.722	3.091
Dorchester County, SC	0.743	0.549	0.423	0.141	0.586	2.442
Memphis MSA						**2.330**
DeSoto County, MS	0.913	0.557	0.456	0.328	0.501	2.754
Marshall County, MS	0.356	0.537	0.325	0.185	0.351	1.753
Tate County, MS	0.573	0.471	0.287	0.197	0.502	2.031
Tunica County, MS	0.252	0.400	0.401	0.167	0.308	1.528
Fayette, County TN	0.622	0.469	0.429	0.289	0.618	2.427
Shelby County, TN	0.582	0.716	0.499	0.845	0.534	3.175
Tipton County, TN	0.750	0.536	0.527	0.300	0.532	2.646

Hazard Vulnerability Index

	Intense Rain	Strong Winds	Heat Susceptibility
Sea Level Rise	Epidemics and Pandemics	Droughts	Saturation of Road Infrastructure
Accidents with Urban Infrastructure	Agglomeration of People with Impact in Normalcy	Criminal Acts in Urban Spaces	Sanitation

Intense Rain

Variable	How Measured	Expected Effect on Resilience	Recommended Unit of Analysis
Landslide Vulnerability	Percentage of area in landslide susceptibility map high risk zone	Negative	Neighborhood
Flood Vulnerability	Percent of the land-area in the 100-year storm flood plain	Negative	Neighborhood
Impervious Surfaces	Percent impervious surface	Negative	Neighborhood
Precipitation	Cm	Negative	Block
Humidity	Percentage	Negative	Block
Temperature	Celsius	Negative	Block
Atmospheric Pressure	hPa	Negative	Block
Wind Direction	Degrees	Negative	Block
Wind Speed	Km/h	Negative	Block
River Levels	Cm	Negative	Neighborhood
Geological Studies	Availability of geological risk assessment maps	Positive	Neighborhood
Floodplain population	Number of people living in flood plain (Pop./sq km)	Negative	Neighborhood
Landslide zone population	Number of people living in landslide zone (Pop./sqkm)	Negative	Neighborhood
Flood Frequency	Number of flood incidents per year	Negative	Neighborhood
Community Perception	Percentage of community residents who identify "intense rains" as an important issue	Positive	Neighborhood

Resilience Index

	Mobility	Hazard Vulnerability	Community
Social	Institutional	Infrastructure	Economic

Mobility

Variable	How Measured	Expected Effect on Resilience	Recommended Unit of Analysis
Infrastructure Quality	Quality level of roads, stops, walkways, cycle-paths, etc.)	Positive	Neighborhood
Informability	People's awareness and easiness to get information necessary for the journey, number of information boards and apps, updating frequency of information channels	Positive	Neighborhood
Reliability	Punctuality rate of stations/stops/routes	Positive	Neighborhood
Reachability	time required to get to the destination, in real time or, time as perceived by user, waiting time, number of transfer	Negative	Neighborhood
Availability	Variety of transportation modes to allow enough alternatives	Positive	Neighborhood
Transport usage	Number of trips and/or kilometrage per inhabitant per time period, number of people transported per trip or in a certain amount of time	Positive	Neighborhood
Modal Split (Public Transport)	Proportion of use of public transport on a total trip number / kilometrage/within a certain period of time	Positive	City
Intermodal Integration	Number and capacity of intermodal connectors	Positive	City
Security	Fatalies and injury rate in traffic accidents, economic loss caused by traffic accidents	Negative	Neighborhood
Congestion	Number and length of bottlenecks, average speed of road vehicles	Negative	Neighborhood
Delay	Total daily/monthly/yearly delay time, delay time = actual trip time - planning trip time	Negative	Neighborhood
Traffic Volume	Number of vehicles across all modes	Positive	Neighborhood
Public Transport Accessibility	Number of public transport vehicles, length and density of public transport networks and stations, area/population coverage per station	positive	Neighborhood
Infrastructure Quality	Quality level of roads, stops, walkways, cycle-paths, etc.)	Positive	Neighborhood
Informability	People's awareness and easiness to get information necessary for the journey, number of information boards and apps, updating frequency of information channels	Positive	Neighborhood

Smart City Index

	Technology Innovation	Technology Infrastructure	Governance
Safety & Security	User Capacity	Public Convenience & Comfort	Social Media

Safety & Security

Variable	How Measured	Expected Effect on Resilience	Recommended Unit of Analysis
City Video Surveillance Penetration	Number of video cameras in overall population Video camera per capita	Positive	Neighborhood
Accident Ratio (Victim, Damaged Project, etc...)	Ratio of all kinds of accidents predicted by ICT measures in a period of time	Positive	City
ICT Penetration for Disaster Prevention	Number of sensing terminals in disaster-prone areas in overall population	Positive	Neighborhood
Disaster Alert Publication Rate	The publication rate (how fast) timely alerts for natural disasters (Storms, flooding, etc...)	Positive	City
Decrease in Evacuation Time	Decrease in Evacuation Time (minutes, hours, etc...) Time saved with using COR (minutes, hours, etc...)	Positive	Neighborhood
Information Distribution Post-disaster	Preventable incidents of network congestion (via satellite phones or Wi-Fi network antennae) Post-disaster Incidents communicated via email/internet vs. phone call to public	Positive	City

Communication

Recommendations

- Identify the different levels of user access to facilitate data cleaning
- Target potential start ups to develop APIs
- Solidify social media outreach and measure success through social media indicators
- Use social media platforms to analyze citizen priorities and match scorecard perceptions

Value

- Time saving by consolidation of practices
- Usage of low cost social media methods for citizen outreach
- Increase citizen participation and government trust
- Facilitate data dispersion during times of crisis
- Social Media contributions to the data pool
- Improve data through citizen feedback

Targeted Audience

Administrators & Developers

Data cleaning

- Understanding who receives data
- Amount of data cleaning tied to resources management

APIs

- Build partnerships with small start ups
- Develop APIs that can be used by partners for future mobile application creation and user data collection.

Citizens

Social Media Campaign

- Develop campaign to increase social media following and public reach
  - Promoting social media sites via television and radio outlets

User Friendly Information

- Prevent information overload
- Build upon the popularity of WhatsApp

Social Media Indicators

Breadth

Community Size
Community Growth

Depth

Conversion
Viewing

Engagement

Volume
Responsiveness

Loyalty

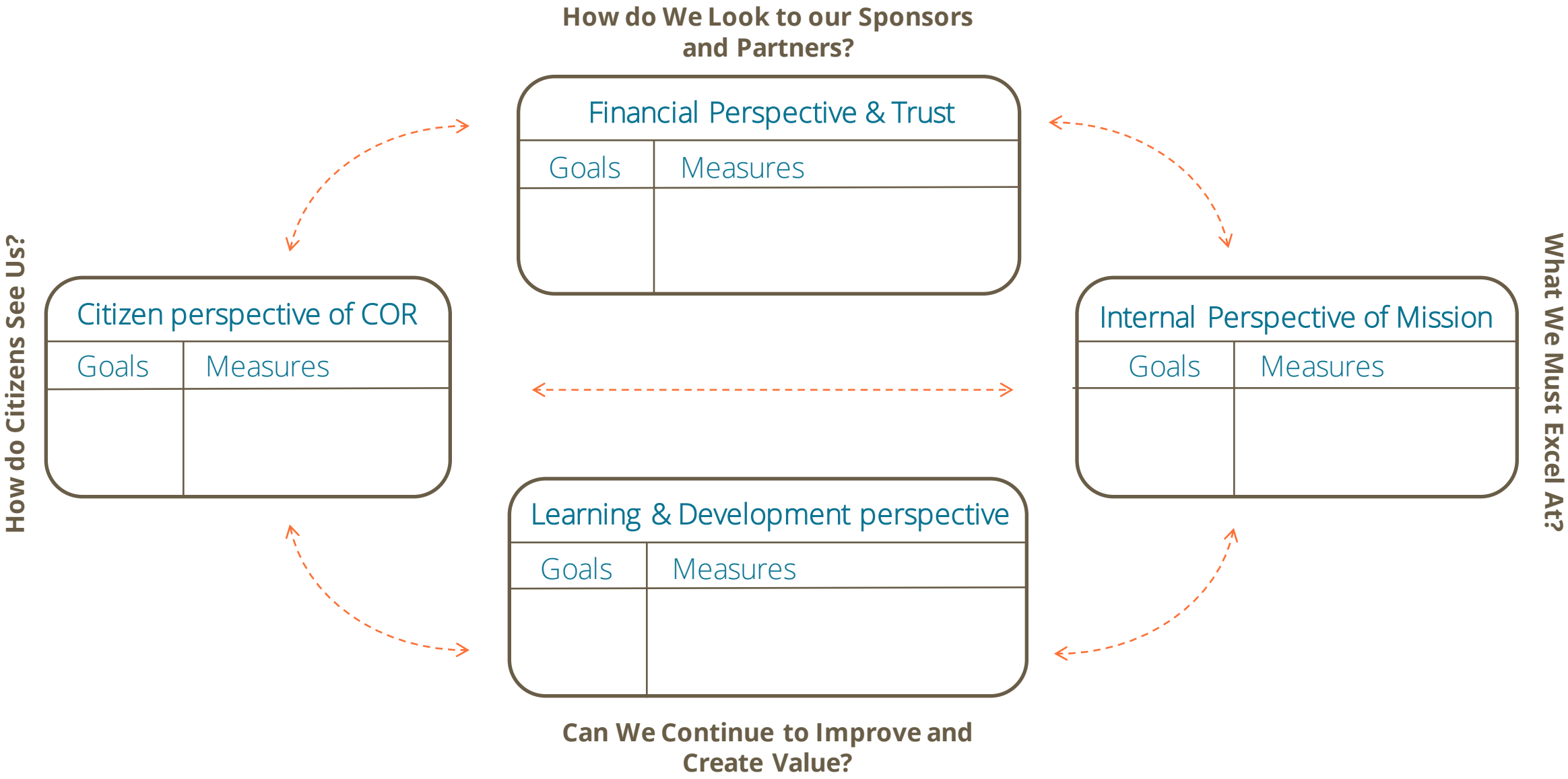
Return Community

Experience

Sentiment
Survey Feedback

Campaign & Outcomes

Balanced Scorecard



Implementation

Short Term Strategy

- Smart Data & Open Source
- Indicators
- Communication

Phase 1
(6 months)

- Require partners to collect more dynamic data to reflect neighborhood information
- Identify academic or research partners to help develop new recommended indicators and indices
- Recommend use of data science startups to help organize data and output through visualization tools
- Identify the different levels of user access to facilitate data cleaning
- Target potential start ups to develop APIs. Possibility of consolidating mobile applications with the different agencies within COR

Short Term Strategy

- Smart Data & Open Source
- Indicators
- Communication

Phase 2
(1st year)

- Identify existing data sources for indicators and check robustness of current indicators through triangulation with external data sources like NASA
- Advise data.rio to release frequent output of reports to highlight value of COR and sustain conversation and funding
- Solidify social media outreach via publicity campaign. Measure its success through social media indicators
- Implementing Balanced Scorecards to measure performance
- Create PENSA 2.0 within COR to facilitate data flows and analysis. The team will continue to include: 1) Strategic planning 2) Data analysis 3) Research 4) Public policy development forecasting

Long Term Strategy

- Smart Data & Open Source
- Indicators
- Communication

Phase 3
(2nd year)

- Determine new data sources/priorities via:
  - Relationship to RioResiliente Plan and/or COR mission
  - Focus groups with stakeholders especially citizens
  - Guidance from academic literature
- Work with academic/research partners to construct the indices using sound research methodology
- Utilize social media platforms to strengthen citizen participation in COR initiatives and crowd source information for real-time personalized response in times of natural disaster
- Create a Damage Assessment Committee (DAC) to improve damage and loss assessment procedures that will help strengthen the country's response capacity (quantify the cost-savings of COR's work)

Long Term Strategy

- Smart Data & Open Source
- Indicators
- Communication

Phase 4
(Beyond)

- Empower and provide the tools for community institutions to become active partners in resilience efforts throughout Rio - including in the areas of water management, sanitation and disaster relief
- Institutionalized data transparent and scale data at a neighborhood level for more targeted data sets
- Adopt a disaster risk reduction mindset versus a disaster relief mindset
- Build upon WhatsApp's popularity

Thank you!
Obrigado(a)!

Rio Resiliente Goals

Better Understand and Mitigate Impacts of Severe Weather and Climate Change

Mobilize Rio to be Prepared to Respond to Extreme Weather Events and Other Shocks

Cultivate Green, Cool, Safe and Flexible Urban Spaces

Provide High Quality Basic Services to All Citizens, Through Sustainable and Resilient Use of Resources

Promote an Inclusive, Diversified, Circular and Low-Carbon Economy

Increase Resilience of The Population and Promote Social Cohesion