Drone readiness index

Rene Kabagamba, Samuel Nzaramba

Carnegie Mellon University Africa
{rkabagamba, snzaramba} @africa.cmu.edu

Dr. Aminata Garba, Dr. Kate Chandler

Carnegie Mellon University, Georgetown University

aminata@ece.cmu.edu, kfc9@georgetown.edu

Nanjing, China
27-29 November 2017

Background

- From the military drone to civil use.

- Drone use for good: land mapping, wildlife protection, crop monitoring, delivery of medical supplies, etc.

What factors contribute to drone success

- Need to identify the elements of the drone ecosystem and quantify how well countries are doing:
  - For governments, NGOs, commercial drone companies, etc. that want to take advantage of the drone technology.
- In the likeness of:
  - The networked readiness index[1] (broader in scope)
  - The drone governance study[2] (narrower in scope)

1: S. Baller et al, Technology report 2016, in WEF.
2: https://www.droneregulations.info/

Methodology

- Collect data on successful drone projects (Zipline blood delivery project in Rwanda, WeRobotics operations in Zanzibar):
  - Interviews and online sources.
- Identify key factors common across projects. (sub-indices)
- Identify indicators for each sub-index.

Components of the drone ecosystem

- Four components
- Nine subcategories (sub-indices)
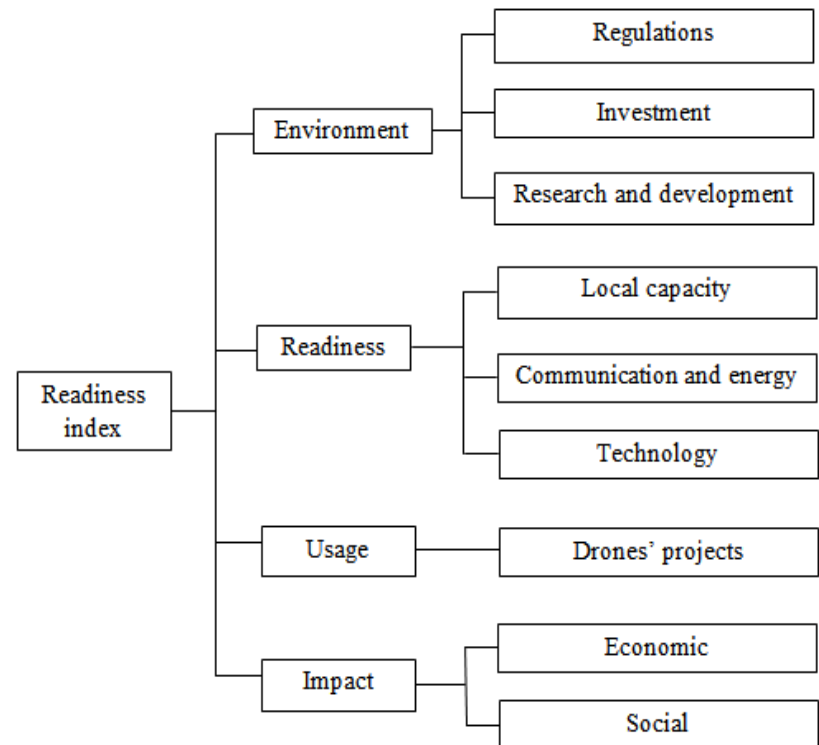
The drone readiness index (DRI)

- Equation (weighted utility function):

$$DRI = k_1 * U_{Reg} + k_2 * U_{inv} + k_3 * U_{R\&D} + k_4 * U_{cap} + k_5 * U_{Com\&En} + k_6 * U_{Tech} + k_7 * U_{Proj} + k_8 * U_{Eco} + k_9 * U_{Soc}$$

- The weights k computed by swing weighting.

Swing weighting

| Attribute swing from worst to best	Consequence to compare	Rank	Rate	Weight
Communication and energy	All scores low except communication and energy	1	100	100/510 = 0.18
Regulations	All scores low except regulations	2	90	90/510 = 0.16
Investment	All scores low except Investments	3	80	80/510 = 0.14
Drones projects	All scores low except drones projects	4	80	80/510 = 0.14
Economic impact	All scores low expect economic impact	5	60	60/510 = 0.11
Social impact	All scores low except social impact	6	60	60/510 = 0.11
R&D	All scores low except R&D	8	40	40/510 = 0.07
Local capacity and facilities	All scores low except local capacity building and drone facilities	7	40	40/510 = 0.07
Technology	All scores low except technology in use	9	20	20/510 = 0.04
Benchmark (Worst Alternative)	all scores low	10	0	0/510 = 0

- Weights values
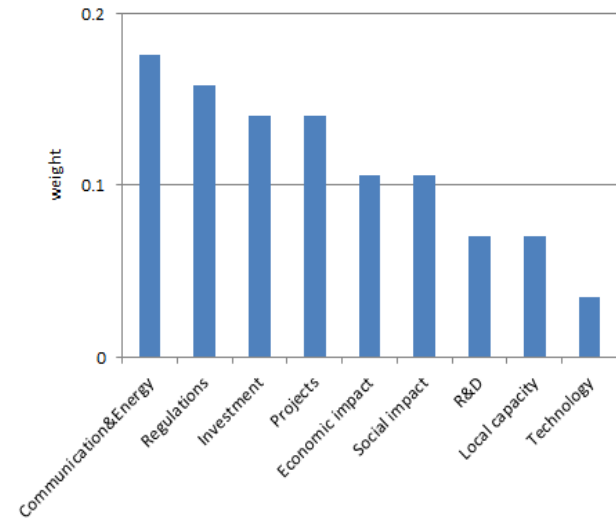
Sub-indices and indicator scores

Sub-index	Indicator	scores
Regulations	Global Drone regulations database and civil aviation websites	0, 0.5, 1
Investment	Investment instances	0, 0.5, 1
R&D	Research and development work instances	0, 0.5, 1
Local capacity	Gross enrolment ratio, tertiary (World Bank)	Percentage out of 1
	Number of drone training schools	0, 0.5, 1
Communication and Energy	Mobile subscriptions/100 pop (ITU)	Percentage out of 1(rounded to 1 for values greater than 1)
	Quality of electricity supply (WEF)	Indicator normalized to range [0,1]
Technology	Availability of latest technologies (WEF)	Indicator normalized to range [0,1]
	Government procurement of advanced technology (WEF)	Indicator normalized to range [0,1]
Drone projects	Number of commercial projects	0, 0.5, 1
	Maturity of the projects	0, 0.2, 0.4, 0.6, 0.8, 1
Economic impact	Observed impact: job creation, etc.	0, 0.5, 1
Social impact	Observed impact: improvement of the people welfare, etc.	0, 0.5, 1

The drone readiness index applied to selected African countries

- Top performers:
  - Mauritius
  - South Africa
  - Tanzania and Rwanda
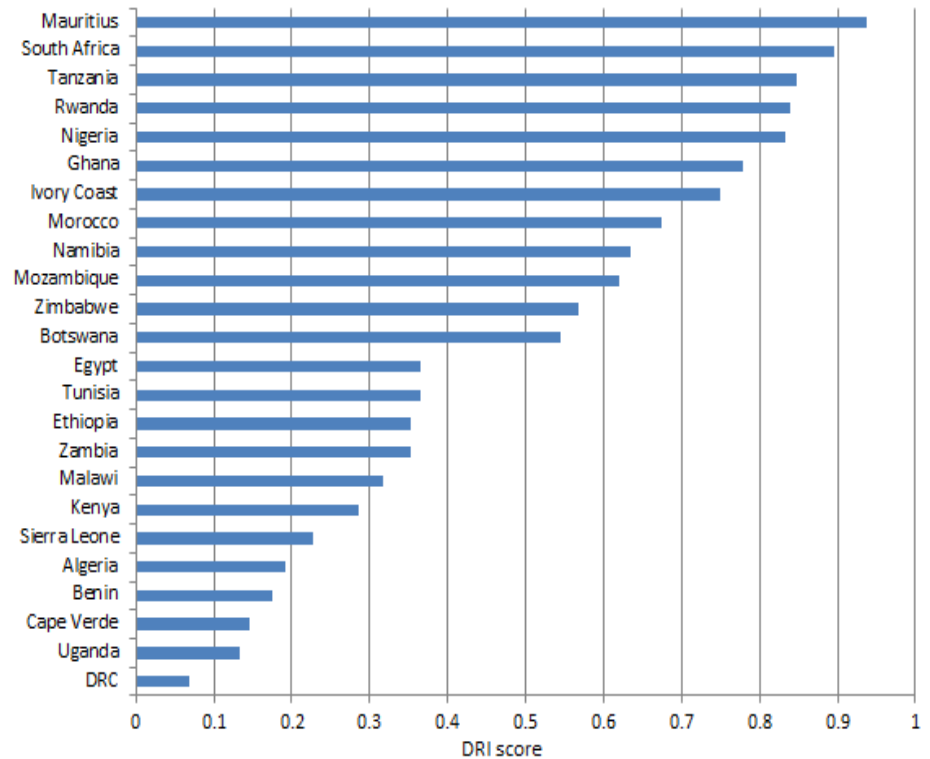
Conclusion & Future work

- Novel drone readiness index.
- Tool for Governments, NGOs, commercial drone companies interested in countries ranking as to their readiness for drones.
- Website documenting all assessed drone projects per country.

- Collect more data through crowd-sourcing.
- Using a finer granularity evaluating the sub-index scores.
- Apply the drone readiness index to more countries.

The drone readiness website

- https://drones-readiness-index.herokuapp.com