Wireless Networks for the Developing World - the regulation and use of license-exempt bands in Africa

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Wireless technology can be used to achieve connectivity at different levels

- 2.4 & 5GHz Bands
- Low cost, especially for localized coverage
- Standards available for different levels (802.11b, 802.16, etc)
- Combinations with other technology possible (e.g. VSAT, etc)
- Different solutions for end-user equipment: laptops, WiFi phones, asynchronous reception models, etc

Motivation

- Changing nature of technology (e.g. spread spectrum) and spectrum management
  - Growing use of unlicensed bands: 2.4 and 5GHz Band
- Institutions and the developing world context
  - Corruption, inefficiencies, obstacles
- Entrepreneurship
  - Value of bottom-up approaches
  - Unlicensed bands as friendly environment for entrepreneurs
- Very little information available on regulation, use and best practice notes
  - ITU (limited info), State department (confidential), W2i conference

Hypothesis: Unlicensed bands can spur entrepreneurship solutions and enhance connectivity
Methodology: the survey

- **Survey covering:**
  1. Spectrum licensing / enforcement on 2.4 & 5GHz Bands
  2. Background to regulations
  3. Implementation and experiences of use

- **Sent to all African countries (54 countries):**
  - Regulators
  - Other people who work in ICT sector (e.g. ISPs)

- **Distribution via e-mail (total of ~260 e-mails sent):**
  - Reminders, contact by phone

- **All contacts in French, Portuguese and English**
Level of response

Responses obtained mainly from regulators

Results by population

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Difficulties & delays

- From ~260 contacts
  - 20% unreachable
  - 35% response to e-mail
  - 20% response to survey

- Need to account for connectivity and other problems
- People very cooperative
Key findings

- **Uncertain and heterogeneous environment**
  - Significant variation in rules, enforcement
  - Creates confusion and discourages small players
  - Deters bigger players because no economies of scale

- Still, **bands being used everywhere, both for localized and surprisingly high for wider area coverage**
Licensing regimes

Detailed Licensing Regimes, 2.4GHz Band
- No regulation or regulator
- Unlicensed, no registration
- Unlicensed, registration
- Licensed, automatic
- Licensed, not automatic
- Use barred
- Not Available

Detailed Licensing Regimes, 5GHz Band
- No regulations, no regulation
- Unlicensed, no registration
- Unlicensed, registration
- Licensed, automatic
- Licensed, not automatic
- Use barred
- Not available

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Licensing regimes (cont.)

- Around 50% licensed (mostly automatic)
- Most unlicensed requires a registration: unlicensed, as we know it, almost non-existent
- Generally 5GHz band more restrictive (newer technology)

2.4GHz Band

- 40% Licensed, automatic
- 19% Unlicensed, registration
- 6% No regulation or regulator
- 13% Not available
- 13% Use barred
Heterogeneity and uncertainty

- Mali: no regulation in place
- Eritrea: free use for incumbents, ISPs pay a fee
- Botswana: automatic, but ISPs need to be registered in country and present business plan
- Namibia: unlicensed, but only allowed within property boundaries
- South Africa, Mauritius: unlicensed within single premises, licensed between premises
- Mozambique: Only for non commercial purposes
- Additional parameters: Power/range/services restrictions, certification, etc
- Regulation undergoing changes, and sometimes uncertain
Low enforcement & capacity to enforce

- Enforcement likely to be even lower, since most responses from regulators
- Reports of significant illegal use
Despite this…
Ubiquity of use

- Significant use, given context
- More use in 2.4GHz (5GHz newer)
- Main users ISPs (56%), followed by Telecom operators (28%)
Bands used mainly for localized but also wider area coverage

- Relatively more countries deploying wider area networks in licensed environments
More licensed => wider area coverage?

- More appropriate: require a greater degree of coordination, etc

- Alternative explanation: countries allowing license-exempt use have more stringent restrictions (e.g. maximum power outputs, range, etc)

Restrictions may in practice be limiting possible uses in bands
Cross-correlation with indicators

- Studied correlation with several indicators
  - Teledensity, GDP, governance, competition
- GDP per capita and teledensity do not correlate strongly with the type of licensing regime in place
- Countries with lower competition in local & long distance markets impose more restrictions on use (e.g. on power & range)
- Less capture?

Restrictions in bands may be used to control market power and raise barriers to entry.
Recommendations

- Strengthen ITU role

- Establish better business environment (e.g. UService policies)

- Aim for more balanced regulatory models
  - Now, regulatory regimes tending to over regulate – protecting incumbents?
  - Err on the side of laxity
A key role for the ITU?

ITU very influential…

Background to Regulations

- take a firmer position and issue clearer guidelines
- serve as a convening forum to establish common regulatory strategies

… but its regulations are somewhat vague in these bands

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ITU is very important in promoting policies

Background to regulations by licensing type

ITU regulation somewhat vague in these bands
Importance of establishing the right business climate

- Certainty and stability
- Lower barriers to entry
- Access to capital - Universal Service Policies?

**Universal Service Policies in place**
- Not available, 11, 21%
- No, 17, 32%
- Yes, 17, 32%
- Yes, but not yet implemented, 8, 15%

**Have Universal Service funds been used for the 2.4 and/or 5GHz Band?**
- Yes, 3, 6%
- Not Available, 21, 39%
- No, 30, 55%

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### Right balance needed

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<tr>
<th>Type of restriction</th>
<th>Advantages</th>
<th>Disadvantages</th>
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<tr>
<td>Unlicensed bands</td>
<td>- Lower barriers to entry, promoting competition in the market&lt;br&gt;- Avoid regulatory capture, in particular in concentrated markets</td>
<td>- Lower guarantees&lt;br&gt;- More difficult to manage interference&lt;br&gt;- More revenue for the government</td>
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<tr>
<td>Low restrictions on power &amp; range</td>
<td>- Enables wider area coverage, increasing population covered&lt;br&gt;- Higher competition in the long distance market&lt;br&gt;- Encourage innovation and experimentation</td>
<td>- Levels of interference can rise&lt;br&gt;- Bands may become congested and unusable</td>
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<tr>
<td>Certification required</td>
<td>- Ensures quality and reduces interference</td>
<td>- Discourages innovation and experimentation</td>
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<td>Services restricted (e.g. no voice allowed)</td>
<td>- Good for incumbent and traditional telecom companies (can have monopoly over voice)</td>
<td>- Bad for users, there will be less competition in the market for those services</td>
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<td>Strict Enforcement</td>
<td>- If regulations are set at an appropriate level, enforcement is good, since it will control interference and punish offenders, ensuring the well functioning of the bands</td>
<td>- Can be a form of capture if restrictions are set too high</td>
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Err on the side of laxity?...

- The objective should be to maximize output
  - i.e., connectivity may come at the cost of some interference
- Spectrum is renewable resource (unlike fish, or forests)
- Africa has very weak teledensity – going from ‘no service’ to ‘SOME service’?
- Need to lower barriers to entry
- Since little use, lower probability for congestion
Suggestions for further research

- More info on use
  - Look at amount of use (e.g. talk to suppliers, operators)
  - Cross users with type of use (e.g. who is doing rural coverage?)
- Develop case studies, to look at closer level
- Look further for reasons why spectrum policies differ in different countries
- Study models for common use management of resources
- Work on specific recommendations to improve regulatory balance
- Further look into enabling business environment
Thank you!

Any questions?