Smart City Business Models

May 2014
Dr. Catherine Mulligan
Research Fellow, Imperial College Business School
Smart Cities Business Models – A Complex Problem

• No “one size fits all” approach

• Cities are complex systems
  • Nexus’ for citizens, companies and many other aspects of society

• Dependent on physical infrastructure
  • Often deeply integrated into Business Models
Source: Mulligan et al, 2014 – From M2M to IoT: An Introduction to a New Age of Intelligence
1) Where does your shirt come from?
2) Who made it?
Value Chains
A Traditional View

- Inputs
- Production/Manufacture
- Processing
- Packaging
- Distribution and Marketing

Höller et al, 2013

Sustainable Society Network
Figure 1. The Apparel Global Value Chain

SOURCE: Gereffi and Memedovic, 2003
But what about Data?
Big Data Landscape (Version 2.0)

Infrastructure
- NoSQL Databases
  - Couchbase, Cassandra
- Hadoop Related
  - Cloudera, HADOPT
- NewSQL Databases
  - MarkLogic, Hyperion
- MPP Databases
  - Vertica, Greenplum
- Management/Monitoring
  - Kibana, Collectors
- Cluster Services
  - Apache Hadoop, Stormpath
- Security
  - CipherStorm, HashiCorp

Analytics
- Analytics Solutions
  - Palantir, DataRobot
- Data Visualization
  - Tableau, Quid
- Statistical Computing
  - R, Python
- Sentiment Analysis
  - IBM Watson, IBM Sentiment
- Location/People/Events
  - Facebook, Twitter

Applications
- Ad Optimization
  - Google AdWords, Facebook
- Statistical Tools
  - SPSS, R
- Machine Learning
  - TensorFlow, Scikit-learn

Data Sources
- Data Marketplaces
  - AWS Marketplace, Azure Marketplace
- Data Sources
  - Google, Amazon

Open Source Projects
- Framework
  - Hadoop, Spark
- Query/Data Flow
  - Hadoop, Cassandra
- Data Access
  - MongoDB, Cassandra

Coordination/Workflow
- ZooKeeper, Kafka
- Real-Time
  - Apache Storm, Apache Kafka
- Statistical Tools
  - R, Python

Cloud Deployment
- AWS, Azure
- Open Source Projects
  - Hadoop, Spark

Cross Infrastructure/Analytics
- SAP, IBM
- Google, Oracle
- IBM, Microsoft
- VMware, Amazon

© Matt Turck (@mattturck) and Shivon Zilis (@shivonz) Bloomberg Ventures
Information Marketplaces

Inputs → Production/Manufacture → Processing → Packaging → Distribution and Marketing

- Devices/Sensors
  - Asset information
- Open Data
  - Open data sets
- OSS/BSS
  - Network Information
- Corporate Databases
  - Corporate Information

Large-Scale System Integrators

Infrastructure Enablers (discussed in Chapter 2)

Höller et al, 2013, © Elsevier
Smart Cities – A Complex System

Value Chain Governance Procedures

Real-time data inputs
- Citizen
- Mobile device
- Public transport
- Mobile network
- City areas
- City maps

Raw data
- Date/Time
- Location
- Communication Pattern
- Services Accessed
- Location and time of use
- Number of passengers
- Journey time
- Potential delays
- Location
- Cell Tower Information
- Services Accessed
- Length of time and extent of use
- Usage patterns of subscribers
- Temperature
- Environmental data
- Usage patterns
- Demographics
- Routes
- Geospatial Information

Information component
- Number of mobile subscribers on bus in neighbourhoods
- Usage patterns of public transport in different neighbourhoods
- Load on mobile network in certain neighbourhoods during different events, e.g. crime reporting or concerts
- Demographics of Mobile Internet Usage
- Mapping of cities digital divide

Information products
- Improved decision making
  - Feedback to improve public transport services
  - Reducing cost of delivery of government services
  - Improving crime response rate
- Product for sale
  - Feedback to improve public transport services
  - Reducing cost of delivery of government services
  - Improving crime response rate

Source: Information Marketplaces, the New Economics of Cities
Business Models in Smart Cities

• **Cost cutting / Efficiency improvements;**
  - ICT investments relate to environmental quality or reduction in operating costs.

• **Value Addition;**
  - ICT investments create added value to public services and also generate positive externalities for the private sector

• **Revenue Generation;**
  - ICT investments create new or increased revenue streams for private sector companies
Smart City Business Models – Four Key Questions

1. Who covers the costs of implementation and installation?
2. How are revenues generated?
3. Who receives the revenues? and
4. How are these shared across the value chain?
A Framework for Smart City Business Models

Typology

Urban Structure

Business Model Selection and Design

Cost Cutting/Efficiency

Value Addition

Revenue Generation

Private

Public

PPP

Private
<table>
<thead>
<tr>
<th>City Environment characteristics</th>
<th>Cash-rich</th>
<th>Cash-poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash-rich</td>
<td>• Those cities have the most freedom in defining the scope of their initiatives because they can rely both on their own resources but also on a generous environment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Adoption of changes is the main challenge faced by cities</td>
<td>• The city has to rely on its own resources which might constrain the size of its initiatives</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Adoption is a challenge</td>
</tr>
<tr>
<td>Cash-poor</td>
<td>• Cities have to turn to either the central government or private partners outside of the city to gather resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• It should favor projects that are likely to bring in revenues which could be reinvested in further initiatives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Failed projects might complicate obtaining further resources from the environment</td>
<td>• Cities have to make the most of bottom-up approaches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Initiatives that rely on citizens contributing time and money are to be favored</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Those initiatives might then be used as proof that the demand exist to attract partners to further upgrade the city</td>
</tr>
</tbody>
</table>
Urban Structure of a City

- A city with an urban centre
- A city with a centre that stretches beyond city boundaries
- A city with multiple centres
- A city that shares its urban centre with another city
- Urban centres and greater cities
The Infrastructure Lifecycle Conundrum

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Lifecycle Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilities, water, gas, electricity</td>
<td>50 years</td>
</tr>
<tr>
<td>Automotive</td>
<td>10 years</td>
</tr>
<tr>
<td>Roads</td>
<td>40 years</td>
</tr>
<tr>
<td>Railways</td>
<td>30 – 100 years</td>
</tr>
<tr>
<td>Corporate Buildings</td>
<td>Offices: 73 years, Retail: 15 years</td>
</tr>
<tr>
<td>Housing Stock</td>
<td>50 years</td>
</tr>
<tr>
<td>Mobile Network Infrastructure</td>
<td>10 years</td>
</tr>
<tr>
<td>Mobile Devices</td>
<td>18 months</td>
</tr>
<tr>
<td>Sensors</td>
<td>5 years</td>
</tr>
<tr>
<td>Enterprise ICT systems</td>
<td>5 years</td>
</tr>
</tbody>
</table>
Mass-Customisation of Services

- Mobile architecture is ideally suited to smart cities
- Security, Privacy, Data Provenance
- Mass Customisation of public service delivery
- Enabler for both public and private business models
Evolving Business Models for Smart Cities
Evolving Business Models

- Cities are constantly evolving, updating and reconfiguring.
- Technologies implemented need to be flexible and cities need to keep their “digital options” open.
- Vendor-neutral technology installations avoid lock-in.
Evolving Business Models – Part 1

1. Creation of Business Opportunity Based on connectivity
2. Investment of public money to “connect the city”
3. Traditional Industrial Development
4. Service Integration for infrastructure * Improved planning
5. Attracting new value added industries; Media, IT, Local Broadcast
   • Job Creation
   • New Industry Development

Connecting Existing Silos

Rebuilding of areas and digital assets

Development of new high tech “Marketplaces”
Evolving Business Models – Transport Example

1. Investment of public money for ITS

2. Connecting Existing Silos

3. Mobile + Cloud Implementation of Smart Car Systems
   - Car Sales – Consumer Pays for implementation of smart car systems

4. Service Integration for Transport – Cars + ITS
   - Improved planning, better traffic flows
   - Rebuilding of city spaces

5. Driverless Cars and Service Integration
   - Removal of parking spaces in cities
   - Opens up prime real-estate
   - Insurance Business Models

Development of new high tech “Marketplaces”

Rebuilding of areas and digital assets

Traditional Industrial Development
Evolving Business Models – Smart Utilities

SMART UTILITIES

Traditional Industrial Development

Service Integration
water + energy
• Improved planning
• Reduction of energy costs in water processing

Smart Grids Implementation
* Private and Public sector investment in smart grid infrastructure

Connecting Existing Silos

Rebuilding of areas and digital assets

1. Private sector investment in smart meters

2. Development of new high tech “Marketplaces”

3. Smart Grids Implementation
   * Private and Public sector investment in smart grid infrastructure

4. Service Integration
   water + energy
   • Improved planning
   • Reduction of energy costs in water processing

5. Adaptive Grid and Meter Systems
   • Reduction in CO2
   • Cheaper water and energy for citizens
   • Cleaner city
   • Competitive advantage compared to other cities
Extra Resources

- Consultancy Report with GSMA:
From M2M to IoT: An Introduction to a New Age of Intelligence

http://store.elsevier.com/product.jsp?isbn=9780124076846&pagename=search
THANK-YOU

c.mulligan@imperial.ac.uk
@API_Economics