Data-rich scenarios for the future

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A New Wave of Regulatory Governance?

• First wave: structural reforms (1970s-1980s)
  • Privatizations, liberalizations: market-oriented reforms

• Second wave: regulatory reform (1980s-1990s)
  • Ex ante filters + “Less is more”

• Third wave: regulatory governance/management (2000s)
  • Policy cycle concept + importance of oversight

• Fourth wave: re-designing government (2010s)
  • Experimental, adaptive regulation, design-based rules, embedded compliance
  • Beyond efficiency, towards coherence?
  • Algorithmic and data-driven regulation
  • Citizen engagement and innovative foresight
Innovation and the public sector

• BEFORE: Regulating for innovation
  • Diffusion of CBA and, more generally RIA
  • “Innovation principle”
  • “Innovation deals” and negotiated rulemaking
  • Demand-side measures

• AFTER: Orchestrating and nurturing innovation
  • Mission-oriented innovation policy and agencies
  • Large public-private partnerships
  • Intra-preneurs in the public sector
  • Prizes and contests (e.g. datapaloozas, hackathons)
  • IP and tech transfer rules
  • Smart specialization and cluster policies
Innovation in the public sector

• BEFORE: Incentives to reduce cost
  • Regulatory budgets
  • Targets to reduce burdens or compliance costs
  • Stock-flow linkage rules (OIXO)

• AFTER: Towards e-administration
  • Interoperability and re-use of information
  • “one stop shop” reforms
  • “ask only once”
  • “zero contact”
  • Use of eID and blockchain for specific services
The HPC/blockchain/AI/IoT stack

• One trillion device connected by 2035 (ARM forecast): edge/fog and quantum computing to enable unprecedented use of the IoT

• “Sensing government”: sectoral (challenge-based) policy could make use of distributed data collection and embedded compliance (Examples: DG DIGIT’s building blocks, smart contracts on blockchain)

• Public-private data sharing can use differential privacy methods to enable randomized policy monitoring and ongoing evaluation

• Industrial data spaces and “data commons” projects likely to be the testbeds for enhanced data-driven policymaking in the near future

• Key problem: adequate stakeholder involvement in the design of AI-enabled systems
Problem definition

Risk assessment, dose-response

Emerging, disruptive technology: risks and opportunities

Alternative options & Impact Analysis

Risk management

Policy strategy, data strategy, experimentation

Regulatory cycle

Evaluation

Learning and feedback (continuous adaptive IA)

• Scientific input and foresight
• Mission-led assessment
• Long-term pathways (SDGs)

• Pilots, sprints, sandboxes
• Tech-enabled regulation

• Ongoing monitoring
• Pathway updates
“Laws that learn”

Upcoming trends

- Further expansion into other markets
- Further virtualization of network functions
- Artificial Intelligence and quantum computing
- ....

Foundations of ICT
- Computing power and Moore’s Law
- Modularity
- e2e architecture and neutrality
- Digital information goods

Key trends
- Platformization
- Virtualization
- Openness & collaboration
- Big data
- Internet of Things
- Internet of Value

Innovation
- Co-evolution and co-dependency
- R&D important mostly at lower layers
- Fragmentation of entrepreneurial functions
- Human factor as essential input

Policy
- Need for flexible, adaptive policymaking
- IPRs and data policy have different role in different layers
- Focus on infrastructure and mission-led platforms
- Education policy is a key area for governments
“Regulatory engineering”

• New screens
  • Openness/neutrality
  • Interoperability
  • Scalability
  • Contestability
  • Resilience
  • Enforceability
  • Input/throughput/output/outcome accountability
  • Trusted/trustless systems

• New experiments
  • RCTs and cybernudges
  • (Virtual) sandboxes
  • Ideation Sprints and rapid prototyping
  • Regulation via “extensions”
  • Algorithmic auditing and differential access to data
  • “Texturing”
  • Industrial Data Spaces
  • Other anticipatory rulemaking
An industrial data space for autonomous cars?
Problems to be solved

• “Slicing data”: defining different levels of permission for cooperation, competition, compliance, monitoring purposes
• “Anonymisation” can have various levels and meanings: interpretive guidance will be needed for policymakers and industry players
• Blockchain- or DLT-based solutions must be reconciled with the GDPR (e.g. through various hashing algorithms, or simply keeping the data offline where possible)
• Algorithmic bias in data-driven inspections/RegTech code?
• Governance: one/more agencies for data-driven policy?
“Code is an efficient means of regulation. But its perfection makes it something different. One obeys these laws as code not because one should; one obeys these laws as code because one can do nothing else. There is no choice about whether to yield to the demand for a password; one complies if one wants to enter the system. In the well implemented system, there is no civil disobedience. Law as code is a start to the perfect technology of justice”

Example: self-driving cars
Reasoning and Decision Layer

"That car in the next lane is stopped behind a garbage truck. It is likely to enter this lane."

"This road is next to a school, and its 2:30pm. Slow down and watch for children."

"That is a driveway up ahead, and its 9am. Slow down and watch for cars pulling out."

Scene Layer

LEVEL 0 Static objects. Road network, permanent features.
LEVEL 2 Dynamic. Road works. Snow and foliage cover.
LEVEL 3 Real time. Vehicles, pedestrians, etc.

Localization Layer

Prior maps
Localization to ~10cm

Path Planning Layer

Reasoning to driving strategy
"Slow down to 30 mph." Overtake that car Turn left
Driving primitives
Turns, lane changes, braking actions, acceleration
Generate trajectory
Track trajectory

Sensor Fusion

Sensor Layer

LIDAR
- Distance, size, orientation and speed of objects
- Point cloud and reflectivity's

Camera
- Objects, lanes, pedestrians, etc. Structure from multiple frames
- RGB pixel values

RADAR
- Objects
- Reflected raw radar data

GPS
- Lat / long of location. ~5-10m error
- Raw GNSS or GPX data

IMU
- Vector distance travelled size initialization
- Acceleration and angular velocity along multiple axes

Wheel Odometry
- Distance travelled since start
- Number of wheel turns

Control Layer

Wheel angle
Brake settings
Accelerator

Source: Murthy Nukala
A complex policy issue

• Several policy fronts
  • Infrastructure
  • Data sharing
  • Third party providers access to data
  • AI: bias, transparency, agency
  • Liability
• Impact on Jobs
• Experimental strategy: precaution v. forgiveness