FROM THE PUBLIC SWITCHED TELEPHONE NETWORK TO THE PUBLIC DIGITAL COMMUNICATIONS NETWORK:
The Role of Interconnection, Interoperability, Universal Service and Innovation at the Edge in the Digital revolution

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As Jim Speta demonstrated a decade ago, the roots of nondiscriminatory access to the means of communications and commerce stretch back more than half a millennium. Somewhat to Jim Speta's chagrin, I have used his article that dated this concept to the mid-15th century as the basis for a broad claim that the principle of nondiscriminatory access to the means of communications and commerce has been part of the DNA capitalism because the movement of goods and ideas across adequate and open highways of commerce and communications is essential to the success of the capitalist economy and the democratic polity. Mobility, including social mobility, supports a more complex division of labor and weaves small distant places into a national and later global economy.

An intense period of legal activity around this principle took place in the four decades after the expiration of the bell patents. This activity resulted in the extension of the Interstate Commerce Act to telecommunications; an antitrust case that imposed interconnection and equal access requirements on AT&T, and the Communications Act defined the expanded and defined the core concepts of interconnection and the broader public service principles of communications carriers. All this legal activity took place in a period that I call the quarterlife crisis of the second industrial revolution in a forthcoming issue of the Journal of Telecommunications and High Technology Law (see Exhibit 1). This is the moment when the new, maturing mode of production is asked to shoulder the burdens of social goals and public aspirations that are deeply embedded in society. And, in progressive societies, to expand those goals and obligations.

The long sweep of history and the 1996 Telecommunications Act make it clear that that the half a dozen principles have come to constitute the public service obligations of communications carriers should be preserved as the public switched telephone network (PSTN) is transformed into the public digital communications network (PCDN) (see Exhibit 2). Nondiscriminatory access has evolved into interconnection and interoperability added during the progressive era, public safety added in the 1912 Radio Act, and universal service and consumer protection added with the Communications Act of the New Deal. I believe innovation at the edge has been added during the childhood and adolescence of the digital revolution.

The progressive era marked a major change in the approach to public service obligations. It shifted from *ex post* to *ex ante* regulation of nondiscrimination and layered sector specific regulation and general antitrust oversight on the industry. These changes made necessary by two developments in society (see Exhibit 3). First, the importance of interconnection had grown as the division of

labor became more complex and the scope of the economy expanded. Second, the ability of individuals to exercise their rights to nondiscriminatory access had been obliterated by the massive increase in size and power of the dominant owners of the means of communications and commerce.

The historical evidence is clear: ubiquitous, seamless interconnection on nondiscriminatory conditions is not the outcome to expect from unregulated network infrastructure industries. In their early days before they were regulated and in more recent times after they were partially or totally deregulated, they did not produce that outcome. Moreover, during the regulatory period, antitrust was repeatedly forced to backstop sector specific regulation that could not prevent or detect violation of the nondiscrimination principle.

As we confront the quarterlife crisis of the digital revolution, if we value ubiquitous, seamless, nondiscriminatory interconnection and carriage, we need to be more vigilant than ever to preserve and extend it. I believe we not only should value ubiquitous, seamless, nondiscriminatory interconnection and carriage, but the commitment to it should be even stronger and the scrutiny closer in the 21st century political economy.

The convergence of communications and commerce, the increasing importance of communications in economic, social and political life, and the more dynamic, interconnected nature of the digital economy means the failure of interconnection can impose greater harm than ever. More than in the past, the economic harm cannot be remedied by *ex post* action because in a decentralized economy one never knows where innovation will come from or how important it will be. In a profoundly interconnected society that has become a highly recursive system, with dynamic, real time networks, discrimination can be subtle and devastating to rapidly evolving, highly interconnected activity. With a small number of critical choke points that possess a great deal of vertical leverage and the ability to extract massive rents, thereby wasting important resources, the incentive and ability to impose harmful discrimination is strong.

At the same time, we must recognize that the form of regulation needs to fit the nature of the networks and develop as they do. Ponderously slow moving common carriage may have been well-suited perhaps for railroad tracks, copper wires, and electricity grids, whose products are relatively homogeneous and static, but it is ill-suited to the dynamic digital environment. We should be open to alternative ways of ensuring nondiscrimination in the digital economy, even as we reject the *ex post* approach (see Exhibit 4).

Fortunately, we already have two excellent examples of a remarkably new approach to the regulation of communications – the Internet protocols and the development of Wi-Fi.

Both of these communications systems are based on brutally simple obligations of interconnection that open the communications space to all on a nondiscriminatory basis in a way that dramatically increases the scope of freedom to act. It is supported by voluntary standards, managed by multi-stakeholder processes that promote interoperability.

In both cases, the government played an important role with a key precipitating regulatory decision and a backstop of the threat of further governmental oversight. It adopted rules that created the environment in which an entirely new approach to communications could thrive, but the rules were structured in such a way that the government did not have to get involved in the day-to-day regulation of behavior. The presumption was shifted in favor of the freedom to act. This is a

space that lies between the market and the state in the sense that the abuse of power by dominant communications companies and government regulators was held in check.

The Carterphone and the Computer Inquiries ensured that nondiscriminatory access to the telecommunications network would extend to the flow of data and that innovation in customer premise equipment could flourish. Without decisive public policy action by the FCC, the telecommunications companies might have defeated decentralized communications altogether, certainly would have slowed its development down and probably would have distorted its growth, if only by forcing the government to regulate the space more intensely. The voluntary action of the developers of the new communications protocol to fill the space opened by government action was a key ingredient for success.

The decision to liberate a sliver of spectrum from the tyranny of monopoly licenses subject to simple rules of use had a similar effect (see Exhibit 5). It ensured access to an irreplaceable, raw communications resource in the most deregulatory, free market approach imaginable, unlicensed, universal access. The private sector concluded, to its credit, that a common communications protocol would expand the market and the best approach was to create voluntary institutions to adopt and defend those standards. Had they not done so, there is a good chance that the government would have stepped in to ensure interoperability, with rules that would have been significantly less friendly to innovation, entrepreneurship and consumers.

These were the two most successful examples of deregulation in the mature industrial society because they used governmental action to expand the scope of economic and political freedom to act. They lay the basis for the new social model and they must be seen as the origin and foundation for a significant shift in the thrust of public policy with respect to the communications network. They introduce the principle that innovation at the edge of the network is a primary driver of economic, social and political activity. The social institutions they developed and used to manage the decentralized network for thirty years deserve close study and deference as candidates for the future governance structure of the communications network.

Ironically, the network operators had the opportunity after the declaration of the four Internet freedoms, which is part of the legacy of this conference, to follow the model of the IP-community and the Wi-Fi-community and fill the space opened by the Cable Modem and Wireline Broadband orders with a vigorous voluntary process to demonstrate a commitment to and reinforce these freedoms. They failed utterly to do so, immediately attacking and infringing the principles. History repeats itself; incumbent network operators have never willingly conceded constraints on their market power in half a millennium. Open spaces like the Internet and Wi-Fi protocols are the meat and potatoes of new entrants and entrepreneurs; but anathema to entrenched incumbents.

It is a grave miscalculation to think that incumbents will support and promote open standards, which is why I reject calls for a new "social contract." We never had one. A contract implies a willing exchange of values between the parties, but the network infrastructure industries never willingly accepted the public interest obligations, challenged them at every opportunity, and violated them continuously.

We shall have to impose a new form of governance on the communications carriers of the 21st century that expands the space between the market and the state and we face a major dilemma. On the one hand, I do not want the state regulating communications, since it will be too slow and

has a tendency to overemphasize control at the expense of freedom. On the other hand, I certainly do not want the communications corporations to be allowed to run wild, since their private interests are not synonymous with the public good, particularly in a space that is typified by weak competition at best and powerful sources of vertical leverage. The dilemma arises because the only institution that is available with the power necessary to confront and negate the worst instincts of the increasingly powerful communications carriers is the state.

I propose that we expand the governance structure that has contributed so mightily to the success of the digital communications resource system by institutionalizing participatory governance, based not only on the practical reality that command and control will not serve us well in the digital age, but also recognizing that the political institutions are in need of reform as well. As the mode of production changes, the social relations of production must change, not only in the economy, but also in the polity. As the homogeneous, passive public of the era of representative democracy has been replaced by an increasingly complex and heterogeneous "ensemble of publics" with much greater desire and ability to be actively involved in political action, representative democracy needs a transfusion as well.

Participatory governance moves toward "governance without government." It rests on a great deal more collaboration in the development of norms and standards and the crowd sourcing of enforcement (see Exhibit 6). It represents an enrichment of the democratic experience that rests on two state based constitutional and collective choices: (1) the selective and strategic delegation of responsibility to self-organized, self-governing policy sectors and (2) holding accountable the sectors and power actors by establishing effective monitoring and accountability. It requires directly involving civil society and business interests in collaborative efforts to define standards and regulations and crowd source enforcement.

It is my sincere hope that we can diminish the extent of formal regulation and litigation in the oversight of communications, but I have no illusions that it will be easy to accomplish that goal.

Getting policy makers and their constituencies on both the left and the right to accept the limitations of **both** the market **and** the state is challenging enough; it is even more challenging to get them to institutionalize the idea that we can use the state to create a space of freedom in which the economy and the polity can thrive. Yet that novel idea was the foundation on which the youth of the digital revolution in communications has been built and it is the best way to preserve and extend its success while addressing the maturation challenges.

EXHIBIT 1: LIFE CYCLE OF INDUSTRIAL REVOLUTIONS

Invention	Date	Socio-Political Turmoil	Primary Means Mass Communications
1st Industrial Revolution			
Flying Shuttle	1733		
Cotton Mills	1742		
Water Frame	1764		
Spinning Jenny	1765		
Steam Engine	1769		
Steam Ship	1775	Age of	
Threshing Machine	1784	Revolution	
Power Loom	1785	1775	
Cotton Gin,	1793		
Interchangeable Musket Parts	1798		
Steam Locomotive	1804	Luddism	
Steamboat Service on the Hudson River	1807		
Typewriter	1829		
Telegraph, revolver	1836		Penny Press
Sewing Machine	1844,1851	1848	Telegraph
	1860s		Photography
2nd Industrial Revolution			
Bessemer Steel	1855		
Synthetic Dye	1856		
Machine Gun	1862		
Transatlantic Cable, dynamite	1866		
Modern Typewriter	1867		
Tungsten Steel	1868		
Barbed Wire	1873		
Telephone	1876		
Phonograph,	1877		Telephone
Incandescent Light bulb	1879		
Induction Electric Motor	1888	Progressive	
Diesel Engine	1892	Era, 1987	
Radio	1901		
Airplane	1903		
Model T Ford, Assembly Line	1908, 1913		Radio
	1930s	New Deal	
	1940s		Television
3rd Industrial Revolution			
Transistor	1947		
Integrated Circuit	1958		
Micro Computer	1968	Carterphone/	
Internet	1969	Computer Inquiries	
Microprocessor, E-mail	1971		
Modem	1997		
PC-IBM	1980		
Commercial Internet	1986		
Commercial Wireless Service	1984		
WorldWideWeb	1991		
ISOC	1992	CALEA, DMCA,	
	1996	Telecom Act	Broadband
	1998	ICANN	
	1999	COPA,	
	2000		YouTube
	2003	WSIS	
	2004		Social media
	2012	SOPA,PIPA	

Source: Various Wikipedia entries, Brad Smith, "The third Industrial Revolution: Policymaking for the Internet," ***Receuil Des Cours 229 (Martinus Nijhoff 2001.***

EXHIBIT 2: TITLE I GOALS AND TITLES II AND III TOOLS OF THE COMMUNICATIONS ACT

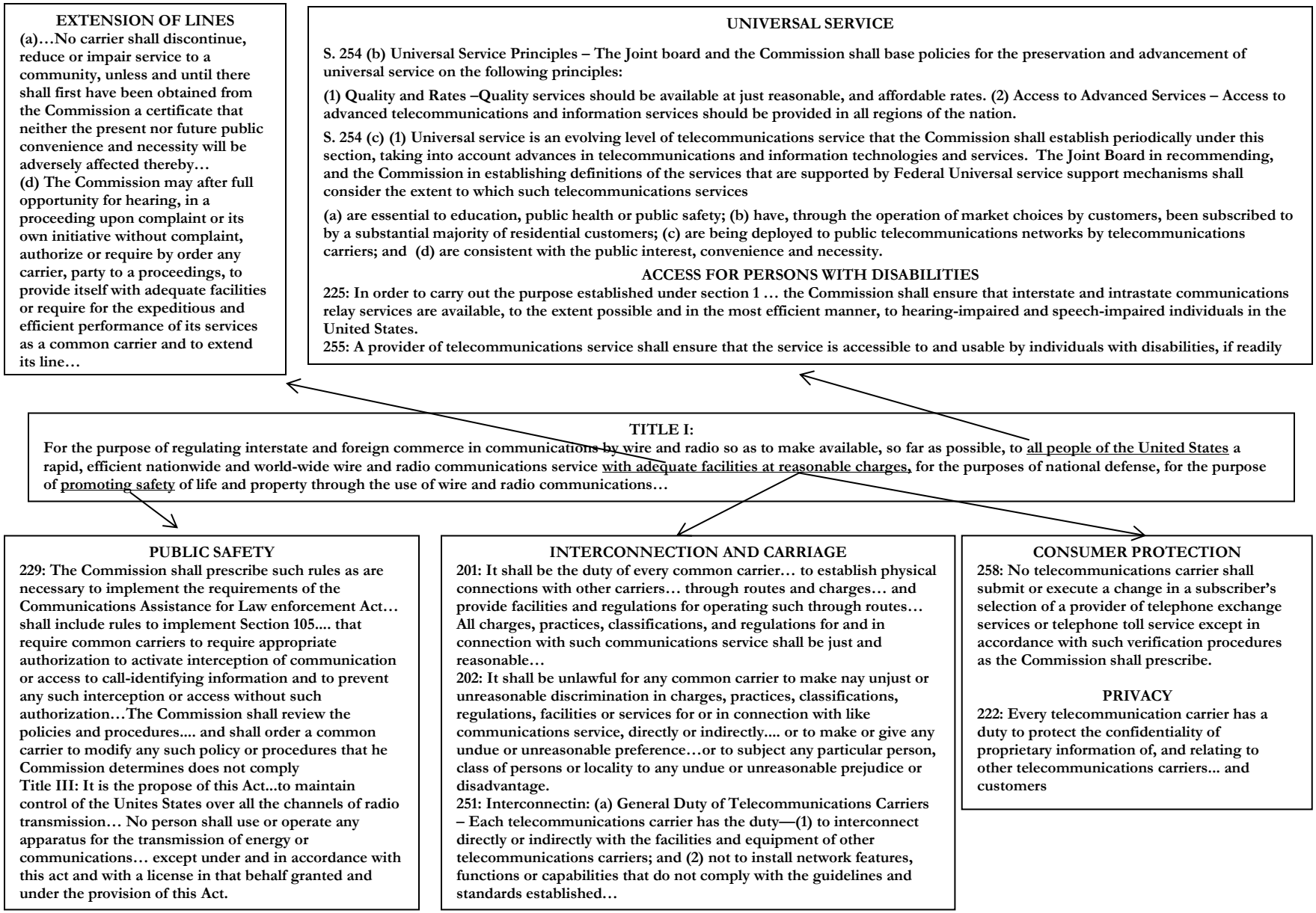


EXHIBIT 3: ECONOMIC AND INSTITUTIONAL CONDITIONS DICTATE THE NATURE OF EFFECTIVE REGULATION

EXTENT OF PUBLIC HARM

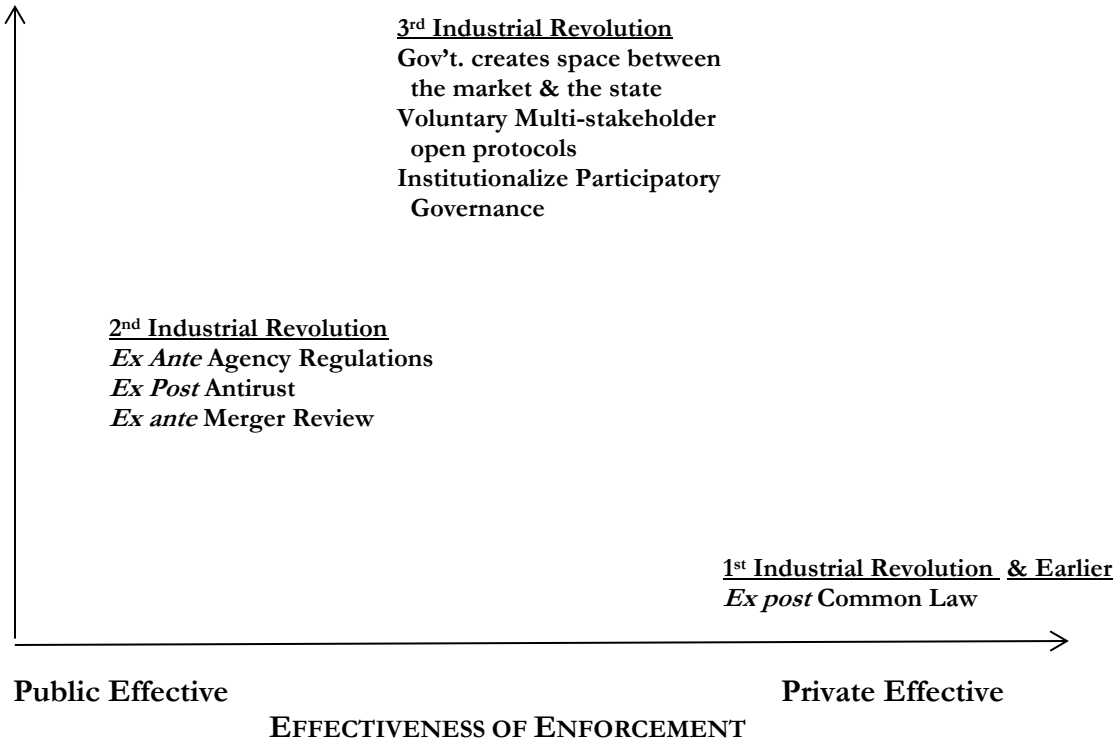


EXHIBIT 4: THE GROWING STOCK OF REGULATORY APPROACHES

Civil Society Participation

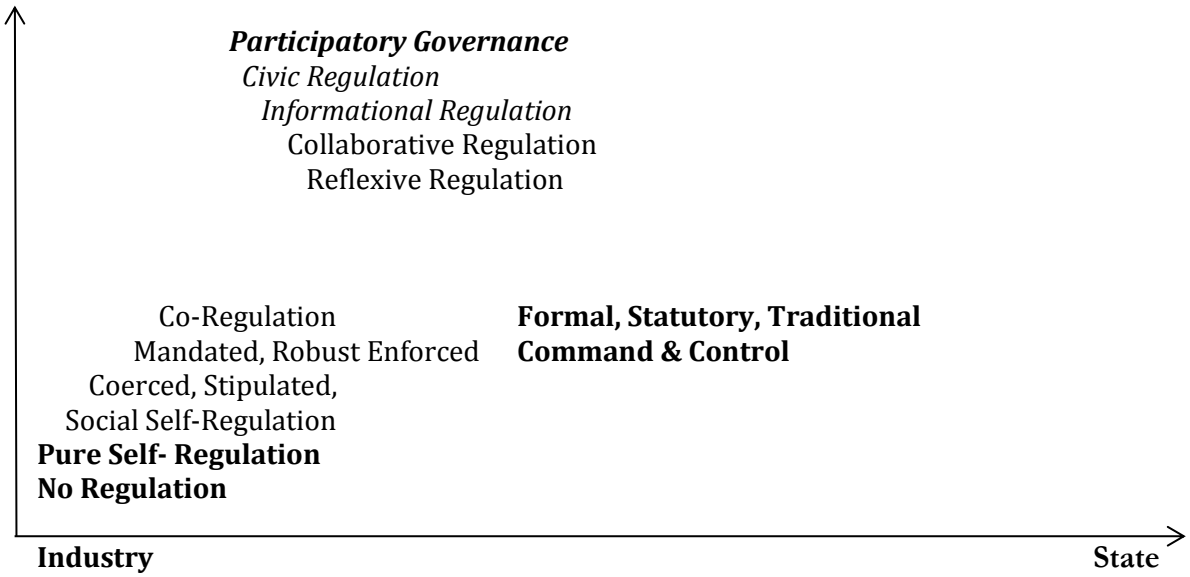


EXHIBIT 5: THE INGREDIENTS OF UNLICENSED SUCCESS

Addresses Traditional Sources of Market Failure

- Removal of Spectrum Barrier to entry,
- Eliminate threat of hold up,
- Lowers the hurdle of raising capital, by eliminating the need for a network and focusing on devices.
- Fosters an end-user focus and allows direct end-user innovation.
- De-concentrates the supply of services compared to the exclusive licensed model.

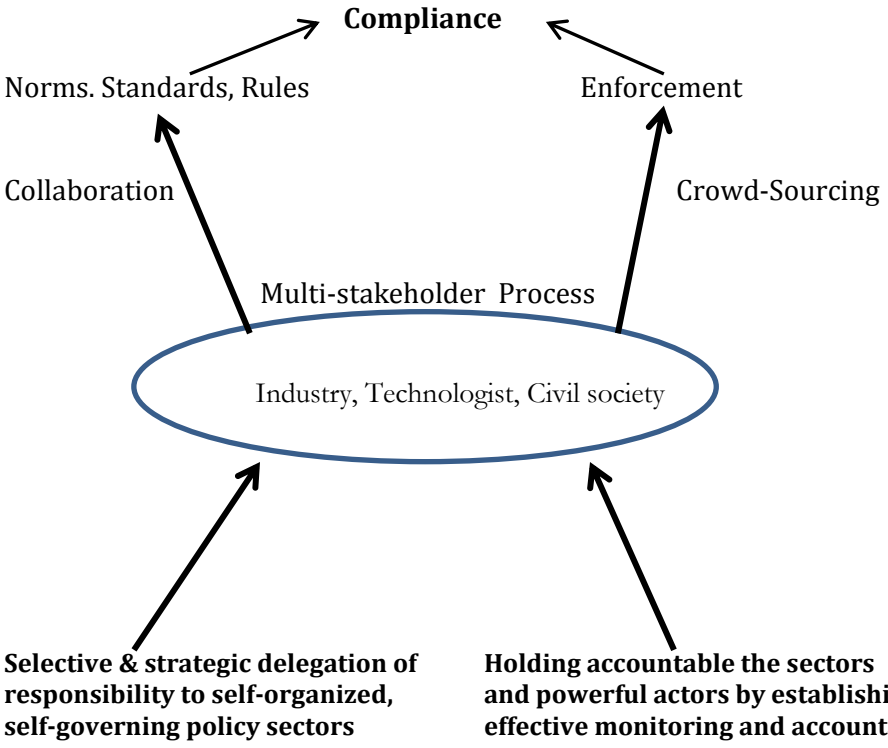
Lowers transaction costs

- The use rules were simple and established an easy set of conditions with which devices had to comply.
- They did not require intensive, continuous monitoring and coordination.
- There were no membership rules.
- Effective interference management

Increases Systemic Diversity

- A different ownership model provides the uniquely significant benefit of introducing a different perspective that is ideal for enhancing diversity.
- variety (the number of firms),
- balance (market shares of firms) and
- disparity (the differences between the firms).

EXHIBIT 6: THE STRUCTURE OF PARTICIPATORY GOVERNANCE



CONSTITUTIONAL & COLLECTIVE CHOICE:
STATE-BASED DECISION TO DELEGATE WITH STATE BACKSTOP CREATES THE LEGAL CONNECTION