A THEORY OF REGULATION AND TECHNOLOGY

1 Introduction

I want to focus on the theory that there is interdependence between technology, institutional framework and organisational structure. Firstly, whether technology affects the availability of resources. Secondly, whether the institutional treatment of technology can influence organisational structure and thirdly, whether taking into account the effect of technology can influence organisational structure that manages the resource to achieve the ends of policy. I think it does but that governments fail to pay sufficient attention to this interdependence. The result is the misallocation, mismanagement and underutilization of resources. It means that the instrument or structures used to develop or deploy them are not as effective as they could be.

I would like to think of government regulation as the systematic application of specialized knowledge and or techniques to the allocation of resources in giving effect to a particular policy position to regulate or not to regulate. This approach requires them to take into account all of the factors and circumstances which constrain or enhance government policy.

Generally speaking government regulation falls short of any such global or systematic analysis. It very often takes into account only the views of the dominant interest groups or players within society. This does not augur well for the development of society as a whole in terms of efficiency goals which will benefit the whole by encouraging innovation, creativity and hence competition.

As a first step this should involve the classification of resources. This is important in so far as effective regulation involves the balancing of the interests of the various stakeholders in society. The various stakeholders are the government, consumers and the market interests or other interest groups. In balancing these interests the regulation should be geared towards the highest and best use of each resource. This is the measure of efficiency, the result of which should be that no one is left worst off by the implementation of any policy. It may mean a policy of action or inaction – a decision to regulate or not to regulate.

Against this background I would like to explore the intersection of policy and technology. Does technology impact on the instrument of choice for the allocation of 'scarce' resources?

2 A Theory of Resource Classification

Resource classification is important for the reason that it determines how much of a resource is available for distribution. This in turn informs the method by which it is to be distributed or regulated. The relationship between the 'longevity' of a resource and the method by which it is to be distributed is affected by the nature of the resource. Economic theory provides a useful analytical tool in this context.

Resources are classified as *excludable* or *non-excludable*. The essential characteristic of an *excludable* resource is that people can be prevented from consuming it. In order to produce this resource the owner must have an incentive. One such incentive is the ability to prevent others from using it. This requires that the owner be able to exercise property rights over the resource and it is he who determines who can use it. A *non-excludable* resource on the other

hand is one which others cannot be prevented from consuming. This means that resources are either controlled or free.

Resources are also classified in terms of their nature and as such are either *rivalrous* or *non-rivalrous*. By *rivalrous* is meant that no two persons can consume the same resource. It means that the more this resource is consumed the less is left for other persons.

By *non-rivalrous* is meant that any number of persons can consume the same resource without affecting the amount that each can consume. On the face of it this type of resource is not a cause for policy concern as by *its nature* it is not subject to scarcity. Resources possess a combination of the various classifications. One important combination is a resource that is *non-excludable* but *rivalrous*. It is classified as a '*common property resource'*. This means that no one can exercise property rights over it and everyone can use it, it is *free*. This resource is prima facie subject to over-exploitation. This will result in a '*tragedy of the commons'* in the sense that it can be over-exploited to destruction. The following broad policy considerations can be extracted from the foregoing:

1. *Rivalrousness is inherent in the nature of the resource.* This is important as it creates a dichotomy between goods that are affected by consumption and goods that are not. It is the first step to a prima facie determination of resources that may or may not become the subject of regulation.

2. *The power to exclude turns on the existence of property rights*. The consideration may be what kind of market structure do we want? Do we want monopoly or competition?

    a. *Excludable resources, rivalrous or non-rivalrous can result in the creation of monopolies.* This is so because the person who has authority or control over the resource has power to determine who has *access* to the resource. It

means that the 'owner' of the resource determines how the resource is *managed and deployed* and he determines how the resource is used.

3. There is *free access* to common property resources.
4. *Free access* will result in the depletion of *common property* resources. Prima facie, it is a scarce resource.
5. If a common property resource is a scarce resource, efficient allocation prima facie determines that access has to be managed.

Managed access presupposes the right to exclude; As Professor Lessig[1] points out that the 'tragedy' is not applicable to every good left in the commons. Factors such as norms and technology regulate consumption thus adequately delimiting the problem of over consumption. This means that control as an instrument of preservation is not always the right answer. The broad principles expose certain tensions. The tensions are between *free* and *property*, between *open access* and *closed access* between *competition* and *monopoly*. Since free access will not always result in the tragedy of the commons how are these tensions to be resolved and what lessons are to be derived from a resolution. The evolution of telecommunications regulation will illustrate this point.

3 Telecommunications and technology

3.1 The making of a Monopoly - *1988 - 1990*[2]

For this paper I will use the example of Jamaica, an island in the West Indies, where a new Telecommunications Act[3] came into force on March 1, 2000 (hereinafter the Act).

[1] Lawrence Lessig, The Future of Ideas: (Random House, New York, 2001), 22
[2] I am not focusing on the pre-1988 era because nothing significant happened. I focus on this period because during this period the monopolist changed from being public to private and the principles are clearer and easier to identify in these circumstances.
[3] The Telecommunications Act 2000

Prior to this, the regulatory framework/structure comprised approximately five licences issued to Telecommunications of Jamaica in 1988 which ostensibly made it the exclusive provider of all telecommunications services for a period of 25 years with an option to renew for a further 25 years unless the government within two years prior to the expiration of the first licence bought up all of its assets.

The 1988 licences were issued under the old Telephone Act of 1893, which in technological terms contemplated wire line and voice services only although this was not immediately apparent to the parties. The telephone was defined as

> "an instrument which, *being connected by a wire or wires* with another similar instrument at a distance therefrom, receives and transmits, by electrical or magnetic agency *audible sounds* which are correctly reproduced by the other instrument, and similarly reproduces *audible sounds* received and transmitted thereto by the other instrument… "[4]

and a telephone line or work as "*a wire or wires*, conductor or other means used for the purpose of connecting two or more telephone lines, together with *poles or other supports* for same"[5]. There were no provisions relating to interconnection. This means that there were no provisions for customer premises equipment. The monopoly provider determines what was to be connected to the network and so they provided the telephone instruments.

The policy framework in these circumstances favoured the rate of return regulation. There was no competition in the market and the monopoly provider was content with the Rate of Return regulation that guaranteed it a fixed return on its investment. This was not a cost-based pricing structure. There was no emphasis on efficiency and the monopoly was compensated for losses by a system of cross-subsidies and non-cost or arbitrary mark-ups on subsidised sectors. In concrete terms international rates subsidised domestic rates, urban subsidised rural and business subsidised residential. Innovative pricing such as time of day pricing, or a design of menu tariffs tailored to meet the needs of heterogeneous customers[6] was limited and for the most part absent. If it existed

[4] The Telephone Act 1893 Section 2. (emphases added)
[5] Ibid.
[6] Laffont and Tirole(2000): Competition in Telecommunications p. 3

it was confined to the International Market. There were no incentives to reduce costs and if the monopolist spends wastefully, the prices were automatically adjusted to make up for the shortfall in revenue.

3.2 Technological Transformation and Competition 1990 – present

By the 1990's the world was changing and telephone services came to contemplate the use of more than just wire lines for transmission. Other forms of exploiting communications technology became available. These include services such as

1. Data: transmission storage and retrieval,
2. Value added network services such as voice mail,
3. Transmission Media: fibre optic and wireless transmissions, microwave and;
4. The Very Small Aperture Terminal (VSAT).

These were made possible by the advances in technology. The telephone network was also digitised. This in turn made it possible to take advantage of a new suite of protocols, Internet Protocol (IP), the underlying technology of the Internet.

Although access to the Internet was available in Jamaica since the late 1980's early 1990's it was confined to the University of the West Indies and big businesses, in part on account of the cost of the service. It became popular after 1998 when the Minister of Commerce and Technology granted five new licences to VSAT operators under the Radio and Telegraph Control Act 1973.

The Internet threatened the existing regulatory framework. The Internet's underlying technology Internet Protocol made it possible to by-pass the 'milking cow', the international switch, of the monopoly provider. Consumers and one Internet Service Provider (ISP),

Infochannel Limited,[7] increasingly made use of the 'Voice over IP' and 'voice over the Internet' technology to bypass Cable and Wireless' network to make international calls. Cable and Wireless *attempted to* ***control*** this bypass by challenging the right of the Minister of Commerce and Technology to issue licenses to the VSAT operators and ISP as being in breach of their exclusive licence. It also challenged the right of Infochannel Limited *to interconnect* with its local network. Its immediate defensive or protectionist or *exclusionary* response was to disconnect the lines of InfoChannel Limited. Subsequently, before the Full Court of the Supreme Court of Judicature of Jamaica,[8] challenges were raised by way of certiorari to quash the decision of the Minister. The matters were eventually discontinued but set the stage for Cable and Wireless Jamaica Limited to renegotiate the terms of the licence with the Government of Jamaica.

The pressures brought on by the dynamics of technology contributed to Jamaica, with the consent of Cable and Wireless Jamaica Limited, signing the World Trade Organisation's Agreement on Basic Telecommunications in 1998. Jamaica committed to full competition in data transmissions, digital mobile data services, personal communication services, paging, teleconferencing, Internet and Internet access (excluding voice), trunked radio systems, video transport (excluding teleconferencing) as well as several value-added services.[9]

The Telecommunications Act 2000 was passed because of the pressures brought on by this new technology. The regulatory structure changed and there has been a move away from rate-based regulation to incentive regulation, which is more cost-based and emphasises efficiency and

[7] Infochannel was the recipient of one of the five new licences that were issued to VSAT operators in 1998 by the Minister of Commerce and Technology under the Radio and Telegraph Control Act 1973.

[8] Infochannel Limited v. Cable and Wireless Jamaica Limited Suit # E. 014/99 and Minister of Commerce and Technology v. Cable and Wireless Jamaica Limited Suit # M. 089/98.

[9] World Trade Organisation (WTO) Commitments Highlights – Jamaica
http://www.tiaonline.org/international/global/wto/jama.cfm

competition. The result has been that Jamaica commenced a process of phased liberalisation[10]. During phase 1 the following markets were open to competition:

- Domestic mobile services;
- Data Services, such as internet service provision – interconnecting with Cable and Wireless Jamaica Limited's facilities;
- The wholesaling of Cable and Wireless Jamaica Limited's international switched voice minutes;
- Free Zone carrier and service provider licences.

Phase II commenced on September 2001 and is to continue for 18 months. During this period "the Minister of Commerce and Technology, may grant licences for the following additional facilities and services:

- Domestic voice facilities and services: e. g. Wireless local loop and wired services including the resale of Cable and Wireless Jamaica Limited's switched domestic minutes; and
- Internet access over facilities of subscriber television (STV) operators.

Phase III is to commence in 2003 when all markets will be opened to competition including voice and data facilities. But even as I write the Internet continues to threaten even the structure. The newest threat is from the Yap Jack.[11], It threatens the incumbent's monopoly on international voice services notwithstanding that voice over the Internet and by-pass have been made illegal under the Act. It does not require a computer connection and it does not require permission from the incumbent to connect to the Internet. The Act removes the monopoly over the physical network in terms of what and who can be connected to it. It also does not make the sale of 'by-pass' technology or equipment illegal. Cable and Wireless Jamaica Limited, is therefore

[10] Offices of Utilities Regulation: http://www.our.org.jm/telecomlicence.shtml (last visited February 7, 2002).

[11] Y@p Talk.com: http://www.yaptalk.com (last visited February 7, 2002)

powerless to block the use of this equipment especially because there are competitor ISP services in Jamaica that do not block the device. The new device promises low cost long distance calls to London, Canada and the U. S. A. There are the rumblings of a new war about control but there is a lot to learn from the past. They are lessons about the Internet and its design and about how this design can influence intelligent decision-making. It is the lesson of the commons, of open access and of what happens when access is *free*.

4 The lessons

Let us construe communication as a resource. One lesson to be learnt from the foregoing is how technology resulted in the liberation of the physical layer. It teaches how policy, designed on the open access philosophy of the commons can influence basic industry conditions in the deployment of communications technologies. A second is about the underlying philosophy of how technology transforms policy or influences policy and legislative initiatives. A third and most important lesson is the design or architecture of the technology and how in broad terms it can influence future policy and organisational structure.

The Internet transformed the way we think about and use communication as a resource. It broke the monopoly gridlock on Jamaica by making available new services that compete with the old wire line technology. It allowed new entrants that introduced innovative services that resulted in diffuse control over and access to the network.

The Internet threatened the existing framework because no one needed permission to use it. It is an example of how technology can make more of less to avert the tragedy of the commons. This is in large measure due to the design to the Internet. The design of the Internet is best understood in terms of the layered design of its network architecture. It has four layers. The layers are the Physical layer, the Logical or Code Layer, the Application Layer, and the Content layer. The physical layer is the transmission media and may be wire line, fibre optic or wireless

or the computers connected to the network. No one controls this layer. Everyone can connect to the Internet once they have a computer and modem or other access.

The Logical or code layer contains the language or the protocols that enable the layers to 'communicate' within the network.

The Application layer refers to the software that enables the network and the content layer is that which passes over the network such as voice or data.

4.1 Technology affects the availability of resources.

Communication is a resource. It is free and non-rivalrous. It has no utility however, unless it can be exploited. Exploitation threatens this *resource* to the extent that in Jamaica it was based on technology that contemplated wires and voice only. Exploitation in these circumstances meant control. It meant closed access and excludability. The wires were connected to an intelligent network, which is expensive and had to be protected. The owner of the wires controlled the network. The result is that the *commons* is enclosed and the owner determines who could have access and what could be connected to the network. The result here is a monopoly. The lesson is keep pace with technology it may be the only chance for *free* markets and *free* access.

4.2 The institutional treatment of technology can influence organisational structure.

The legislative framework influenced the institutional treatment of technology in 1988. The regulatory structure and framework were influenced by the available technology, which favoured a monopoly. When negotiating the licenses in 1988 no consideration was given to technology. The fact that technology is dynamic and that changing technology can influence the future uses of a resource. The result was a 'lock-in' for 25 years into a system that had no benefits for consumers or the country generally.

The Internet has brought about several changes, which has implications for the way we design telecommunications policy in Jamaica. The changes can be characterized as tensions between the old and the new in terms of the design of the structure of telephone networks and its implications for policy. Traditional telecommunications infrastructure design facilitates vertical control over the network. It was technology specific and in terms of policy created an institutional framework that protected and perpetuated monopoly control. The monopoly owned the physical infrastructure and was able to determine what can be connected to the network.

The Internet changed this by creating a platform for innovation. It was built on the philosophy of the end to end design which contemplates diffuse control over the physical infrastructure with the technology – code layer being 'free' open to innovation and to different applications. It is a tension between property and the 'commons'. It is the free access that leads to new and innovative ways to force down the price of International calls by utilising devices such as the Yap Jack. The lesson here is that by freeing the physical layer the code layer can become a platform for innovation. The code layer can be analogised to a market structure or institutional framework that creates open access to ideas enabling the system to evolve strategies for the efficient utilisation of resources. It enabled the change from an inefficient system to one that stressed efficiency and hence competition.

4.3 Technology influences Organisational Structure

Jamaica under the new Act separates the administration of spectrum allocation from telecommunications administration. Currently, therefore two licences are required if wireless communication is being contemplated, one for telecommunications and one for spectrum. Auctions were adopted as the instrument for allocating spectrum. Having regard to the technology of today and the framework of the Act this is an inappropriate organisational structure. For the same reason the allocation process, which pre-supposes control is misguided. It has failed to appreciate the lesson to be learnt from the design of the Internet. The lesson of

how technology is dynamic and how open access encourages innovation and the availability of services.

The idea of allocating or managing spectrum is based on the technological history of radio spectrum (hereinafter spectrum). Spectrum was regarded as scarce resource. It was felt that in order to allocate Spectrum it had to be licensed or sliced up and auctioned. Spectrum was used mainly for broadcasting and this scarcity provided the rationale for regulating broadcasting as opposed to the treatment afforded the print media. *The organisational structures were premised on the effect of the available technology.* Technology, dynamic as it is, has however undermined this rationale. With the Internet came convergence so that radio spectrum can be utilised in new and innovative ways not only for broadcasting but also as a communications medium, this is not ignore that wireless communications were possible prior to the Internet being made public. The limitations, which caused interference, have now been improved by the development of spread spectrum technology. Jamaica needs to adopt an organisational structure, which fuses spectrum and telecommunications administration. By doing this it can take advantage of the benefits to be offered by this new technology to encourage the spread of basic telecommunications services to all citizens. It can do so by the deployment of wireless technologies.

> "Providing appropriate regulatory space for unlicensed wireless operations is the only available option for allowing the development of un-owned information infrastructure. Such an un-owned component of the infrastructure could provide a communicative space in the digitally networked environment that would be the equivalent of public sidewalks, street and roads in our physical environment".[12]

This is suggested in light of the open access model of the Internet and the benefits that it has brought in terms of competition. The war for control continues and the deployment of unlicensed spectrum will reinforce and enhance the objectives of the Act. It will be open and *free.* The change in the organisational structure that envisions a move away from managing spectrum will also promote the efficient allocation of scarce resources. It means sharing of

[12] Yochai Benkler, "Overcoming Aroraphobia: Building the Commons of the Digitally Networked Environment, " *Harvard Journal of Law and Technology* 11 (1998): 106.

resources, such as human capital and infrastructure and ideas to take advantage of joint research and technology. It means not expending resources to manage spectrum as under a fully licensed regime. It means keeping the physical layer *free* new entrants will be encouraged which means more competition and more benefits for the society.