Towards a conceptual framework for ICT for Development: lessons learned from the cube framework used in Latin America

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***Abstract*—The ICT for Development community is long searching for comprehensive and adequate conceptual frameworks. In 2003, United Nations Regional Commission for Latin America and the Caribbean proposed a three-dimensional conceptual framework that models the transition toward so-called Information Societies as interplay between technology, policy and social change. This model has been adopted throughout the region as a rough guidance for outlining international Action Plans, as an organizational tool to identify actors and priorities for national strategies, as well as a reference a tool to organize scholarly research. This article reviews some of the diverse applications the model has found during recent years and shows how it can be used. Shortcomings and lessons learned are discussed. The remaining challenge points back to the academic community, in search for ever more coherent and useful models that assist in designing meaningful and effective ICT for development strategies.**

***Index Terms*—analysis, digital, framework, ICT for development, policy, strategy, theory.**

I. Introduction

WHILE governments, enterprises, and civil actors around the world are attempting to realize the benefits of Information and communication technologies (ICTs) for economic, social, and political development, scholars are still struggling to come up with a coherent conceptual framework that embraces all relevant aspects of this multidisciplinary endeavor [1]. Despite the lack of a consensus how the transition toward so-called Information Societies is understood, most countries (developed and developing) have begun to set up proactive policy agendas to face the challenges of converting the digital divide into a digital opportunity. A myriad of efforts reach from comprehensive global or regional Action Plans (such as the Action Plan of the World Summit on the Information Society, WSIS, 2003-2005), to national strategies and local agendas and projects.

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This paper reviews one conceptual framework that has been developed and applied to guide these efforts in Latin America and the Caribbean. It is a static frame of references that enables to classify the interdependency between technology, policy and socio-economic sectors that are subject to change (are being "digitized"). After presenting the framework (and its variants), we will review how the countries of Latin America and the Caribbean used it to structure their regional ICT-for-development strategy (called eLAC2007 and eLAC2010). In the following section we will have a closer look at how the conceptual model can be used more concretely on the national level to understand national ICT policy agendas. The framework has also been applied to structure research at the local level, as discussed thereafter. The final section looks at the lessons learned and at limitations of the framework.

II. The "Cube" Framework

A. Theoretical background

The presented conceptual framework finds it theoretical foundation in the Schumpeterian notion of socio-economic evolution [2]-[4], which holds that human progress "goes on in units separated from each other by neighborhoods of equilibrium. Each of those units, in turn, consists of two distinct phases, during the first of which the system, under the impulse of entrepreneurial activity, draws away from an equilibrium position, and during the second of which it draws toward another equilibrium position" [2: p. 142]. The result is an incessant process of "creative destruction", which modernizes the modus operandi of society as a whole, including its economic, social, cultural and political organization.

The motor of this incessant force of creative destruction is technological change [4], [5]. While the key carrier technology of the first Industrial Revolution (1770-1850) was based on water-powered mechanization (based on classical mechanics), the second Kondratiev (1950-1895) was enabled by steam-powered technology (thermodynamics), the third (1895-1940) was characterized by the electrification of social and productive organization (electromagnetism), the fourth by

motorization and the automated mobilization of society (1940-1970) (mechanical and chemical engineering), and the most recent one by the digitization of social systems (based on information theory and computer science) [3]. Each one of those so-called "long waves" has been characterized by a sustained period of social modernization, most notably by sustained periods of increasing economic productivity.[1] According to Perez's seminal 1983 article [5], "this quantum jump in productivity can be seen as a technological revolution, which is made possible by the appearance in the general cost structure of a particular input that we could call the 'key factor', fulfilling the following conditions: (1) clearly perceived low-and descending- relative cost; (2) unlimited supply for all practical purposes; (3) potential all-pervasiveness; (4) a capacity to reduce the costs of capital, labour and products as well as to change them qualitatively."

Digital Information and Communication Technologies (ICT) fulfill those requirements: the cost-performance relationship of computers, storage and communication devices has seen respective compound annual growth rates of 76%, 72% and 56% during the period from 1980-2005 [6]; their practically unlimited supply has led to a technological diffusion process that is unprecedented in human history (for ICT penetration rates during the past 15 years, see [7]; their nature as a general purpose technology affects all aspects of human conduct (from political will formation, to dating); and the incorporation of this technology has also led to the modernization of social organization [8], most evidently (because most measurable[1]), to productivity increases [9], [10]. The ensuing process of social transformation has been given many names, among them the rise of the "post-industrial society" [11], the "fifth Kondratiev" [5], "Information Society" [12], [13], "digital age" [14], "Network Society" [15], and the "age of Information and Communication Technology" [3]. In the international political arena, the international community took up the topic in the 2000 session of the United Nations Economic and Social Council (ECOSOC) under the theme: "the role of information technology in the context of a global knowledge-based economy". This lead to the creation of the UN ICT Task Force and the realization of two consecutive World Summits on—what was referred to as—the "Information Society".[2] Out of reasons of convenience, we will stick to this last nomenclature.

[1] The reason why most theories on social evolution focus on economics instead of focusing on the modernization of cultural or political processes might simply be due to the fact that the respective performance indicator are much more accessible in the economic realm (i.e. monetary, productive output, etc).

[2] The World Summit on the Information Society (WSIS) was held in two phases. The first phase took place in Geneva hosted by the Government of Switzerland from 10 to 12 December 2003, and the second phase took place in Tunis hosted by the Government of Tunisia, from 16 to 18 November 2005: http://www.itu.int/wsis

B. Interdependencies among three dimensions: technology, policy and social change

The United Nation's Economic Commission for Latin America and the Caribbean (UN-ECLAC) has proposed a three-dimensional reference framework to conceptualize the scope and nature of this transformation. In the midst of the preparations for the World Summit on the Information Society (2003-2005)[2], ECLAC suggested to its 33 member countries to view the transition toward Information Societies as an interplay between the underlying digital general purpose technologies (telecom, hardware and software), the socio-economic sectors that are subject to change (such as business, health, education, government, etc) and normative policy areas that cross-cut both of these areas (including regulation and incentives) [16]-[18]; (see first Figure I).

In line with the Schumpeterian school of thought, the first enabling factor for the associated socio-economic transformations is the existence technological infrastructure. In the case of digital ICT, engineers usually refer to the Open System Interconnection Reference Model (OSI Reference Model or OSI Model[3]) to abstractly describe the layered communications and computer network protocol design. It consists of seven layers. The "ICT-for-development-cube-framework" ("el cubo", as it has been known in Latin America), reduces this technological dimension to only two broad layers: physical infrastructure (i.e. hardware and telecommunications networks: computers, fixed telephone lines and mobile phones, fiber-optic networks, digital TV, and all other tangible access equipment), and generic services (software and other generic digital services, such as Webhosting, browsers and multimedia applications). The "Infrastructure Layer" and "Generic Service Layer" form the grounds upon which the process of digitization takes place and are referred to as "Horizontal Layers".

These technological foundations are the basis for the digitization of information flows and communication mechanisms in different sectors of society (such as the business and commerce sector, the health sector, public administration, education, etc). All of these different sectors of society make use of a more or less similar combination of hardware and software tools to reorganize and modernize their *modus operandi* through digitization. Those "Vertical Sectors" are the application areas of the technology, which provides the "content" of the networks in an Information Society and lead to tangible social change. The focus of Vertical Sectors is on "digital processes", as opposed to the focus on "digital products" in the Horizontal Layers. The fact that information flows and communication processes take place through electronic networks in a given sector is usually identified in literature by adding an "e-" as prefix. There are many different "e-Sectors". The expanding process of digitization is not exclusively restricted to the six sectors depicted in the graph, and the list of Vertical Sectors could be extended to other important fields of interest, as indicated by the arrows in the diagram (such as e-democracy, e-security, e-

[3] See http://en.wikipedia.org/wiki/OSI_model

entertainment, e-banking, e-payment, e-research, e-tourism, e-dating, etc.).

The foregoing Layers and sectors are the basic requirements and building blocks of an Information Society, but they are not sufficient for development. Technological determinism would argue that the mere existence of a new technology predetermines the direction of socio-economic change. However, in a world in which human kind is constantly proving technological determinism wrong and is taking development into its own hands,[4] public policies and private strategies convert the notion of directionless "progress" into normatively guided "development". In practice, the digitization process is supported by institutional developments aimed at the minimization of negative effects, the removal of eventual bottlenecks, and the promotion of normatively desired advances. ICT for Development policies are found here. These crosscutting or "Diagonal Areas" permeate both Horizontal Layers and Vertical Sectors. In the original version of the cube, the identified areas of policy activity were regulatory frameworks that foster and provide scope for these new forms of behavior, financing mechanisms that support the diffusion of these technologies and their implementation, and human capital that acts as the driving force behind the technology.

After discussions within the region at countless conferences and events, UN-ECLAC introduced a slight modification to the framework a few years later, around 2006 [19]-[20]. The policy areas were simplified to "regulation & legislation" and "incentives & financing". This is justifiable since all kinds of public policies or private strategies can broadly be grouped under these two types: incentives (which correspond to positive feedback for the socio-economic system) or regulation (corresponding to negative feedback). In order not to undermine the importance of human capital, a new Horizontal Layer was added, called: "Capabilities and Skills", which focuses on the effective usage of the technology (see second Figure I).

As with other socio-economic organization models (i.e. micro-economics), the dynamics that form the interrelationship between the different fields, are characterized by uncertainty, incomplete contracts, irrational behavior, spillover effects and other deficiencies and failures. An open dialogue between the different players, institutions and organizations from all the different Horizontal Layers, Diagonal Areas and Vertical Sectors is therefore necessary for mastering the complex task of guiding a society in its transformation towards an Information Society. Since the characteristics of every particular field vary in different regions and countries, there is no "one size fits all" recipe for the transition towards an "Information Society". The "optimum transition path" depends on country and region-specific particularities.

Last but not least, it is noteworthy that the logic of the cube can be applied to the local, national and even international levels. The result can be understood as a system of Russian matryoshka dolls, with "cubes inside cubes". The largest cube would embrace the global Information Society, such as discussed at the World Summit on the Information Society, 2003-2005.[2] Some regions have also set up regional strategies, such as Europe (eEurope2002, eEurope2005 and i2010)[5] and Latin America and the Caribbean (eLAC2007 and eLAC2010)[6]. National Strategies have been the subject of much attention [24]-[26], and local communities and municipalities have long set up their digital agendas as well.[7] Individual companies, hospitals, universities and schools might as well recur to a strategy similar to the three dimensions outlined with the cube. It can be expected that those different levels of abstractions are interdependent and are governed by some scale-free dynamics stemming from the characteristics of digitization.

[4] The most cited example against technological determinism is human kind's dealing with the atomic bomb: human history is blindly guided by the deterministic notion of "everything that's technologically possible".

[5] For the history and background of the three consecutive European Action Plans, see http://ec.europa.eu/information_society/eEurope/2002/index_en.htm

[6] For the history and background of the two consecutive Latin American and Caribbean Action Plans, see: http://www.cepal.org/SocInfo/eLAC/default.asp?idioma=IN ; http://en.wikipedia.org/wiki/eLAC

[7] For a longstanding initiative that involves hundreds of municipalities from Latin America, see: http://www.iberomunicipios.org/

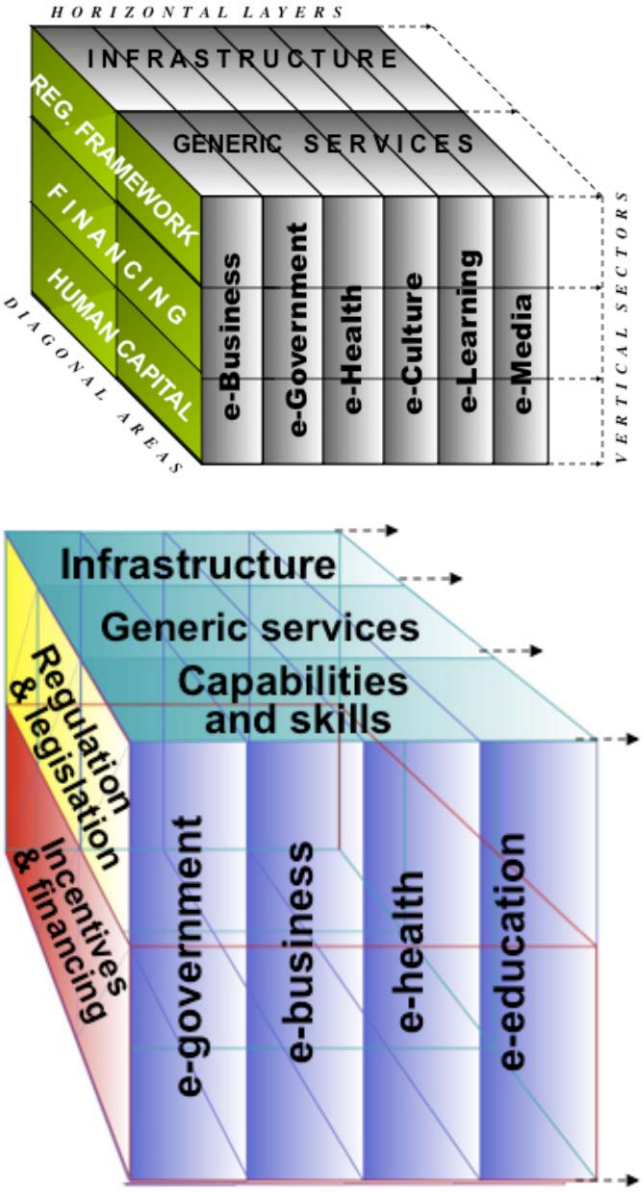

Fig. 1. A three-dimensional conceptual framework for ICT for Development: "the ICT-for development-cube" in its original and modified version.

III. PLAYING AROUND WITH "THE CUBE"

During recent years, the presented conceptual framework has found several applications. The following examples have been selected to show how "the cube" can be applied to the local, national and international levels, and to demonstrate its diverse usage, such as for the design of strategic policies, operative inventories and scholarly research endeavors.

A. Researching local digital developments

First and foremost the "ICT-for-development-cube" has been developed as a tool to structure research, and related research seminars (see the structure of the following books[17], [18]). It provides the opportunity to pick on specific aspects of the ICT-for-development dynamic and to view their interdependencies with related issues of concern. This has also been helpful to structure questionnaires, such as the 31 questions survey that were elaborated by UN-ECLAC, in collaboration with Chile's SUBTEL (Subsecretaría de Telecomunicaciones de Chile), and Peru's CONCYTEC (Consejo Nacional de Ciencia y Tecnología) and INEI (Instituto Nacional de Estadística e Informática) [21]. The questionnaire focused on local e-government and analyzed how municipalities embrace and deal with digital development. Almost one third of the Chilean municipalities (106) and one-third of the Peruvian provincial municipalities (77) participated in this extensive study [21]. The cube provides a flexible structure to systematize such empirical studies. The study used the cube to identify obstacles and how those relate to each other. In short, the conceptual framework can be used as an organizing tool for the systematic identification of eventual shortcomings, bottlenecks, critical areas and interdependencies in the ICT-for-development dynamic.

B. Designing international policy agendas

The cube has found another prominent application as a reference in the design of policy agendas. eLAC is a regionally concerted official ICT-for-development strategy of the 33 governments of Latin America and the Caribbean, which is elaborated and implemented in close collaboration with the private sector and civil society.[6] The strategy contributes to the long-term vision outlined in the Millennium Development Goals (MDGs) and those of the World Summit on the Information Society (WSIS), which focus on the time-frame 2000-2015. Recognizing the dynamic and short-lived innovation cycles of ICT, the region decided to face these long-term ambitions with a series of consecutive short-term Action Plans that are based on concrete qualitative and quantitative goals to be achieved:

* eLAC2007 with 30 goals and 70 activities was successfully implemented during the years 2005-2007;

* eLAC2010 with 83 goals to be achieved during the 2008-2010 period.

The presented conceptual framework has been used by the governments and non-governmental stakeholders of Latin America and the Caribbean to structure the first one of those Action Plans, eLAC2007. Table I presents the final monitoring result of the eLAC2007 Action Plan [22]. It shows that all dimensions of the cube have been incorporated in the outline of the agenda in a linear, one dimensional way. It can also be seen that the stakeholders of the initiative have given those dimensions their public sector signature: private sectors

and civil society has stressed the need for a separate chapter on "capacity-building and knowledge creation", and governments have stressed the need with focusing on publicly relevant e-sectors, "governmental transparency and efficiency".

The linear way with which the cube has been applied in eLAC2007 allowed the involved parties to make some generalized judgments about the level of advancement in the respective areas (see Table I), but this ignores the multidimensionality of the cube. For example, how could it be possible to achieve advancement in e-health (goal 17) if access in health centers (goal 4) and legislative framework (goal 25) do not progress? The authors of the final evaluation of the agenda came to the following conclusion: "The conceptual distinction between access, capacities, applications and policies is based on a technological view that has proven highly useful in research on, and analysis of, information societies. It aids in understanding the phenomenon, its dynamics and the relationships between the different components of the development of information societies. While there is no debate over the analytical advantages of this scheme, eLAC2007 monitoring suggests that the use of this conceptual framework in policymaking may lead to an unintegrated approach to digital development. There is a danger of interpreting access and capacities as ends in themselves, rather than as means. In a non-academic, policy-oriented context, it may be useful to adopt a sectorial approach based on the beneficiaries and targets of digital development—e.g., considering the realities in areas such as education, health, government, business and communities, etc.. Within each of these sectors, the development of access, capacities, applications and policy should be approached holistically. This is particularly true in view of the virtuous circle that links these areas. Access promotes use, which is needed to develop capacity, while capacity in turn generates demand for electronic applications and content, which in their turn increase demand for access. Thus, work must be conducted simultaneously in each of these areas, and policies addressing the specific needs of each economic and social sector must be integrated. ICT development must follow a society's general scheme of organization, not the reverse" [22: p. 7-8].

The consecutive Action Plan, eLAC2010, which was the result of an unprecedented open-ended collaboration among all sectors [23][8], took this conclusion very seriously and stakeholders structured the new plan along the following broad chapters:

1. education and training;
2. infrastructure and access;
3. health;
4. public administration and e-government;
5. the productive sector; and
6. policy instruments and strategic tools.

[8] A five round Delphi exercise has been carried out to identify the priorities and topic on the eLAC2010 agenda. The eLAC Policy Priorities Delphi counted with almost 1,500 contributions and is believed to be the most extensive online participatory policy-making foresight exercise in the history of intergovernmental processes in the developing world to date.

TABLE I
FINAL MONITORING OF PROGRESS OF ELAC2007

Area	Goal	Amount of progress
A. Digital access and inclusion	1 Regional infrastructure	*Progress*
	2 Community centres	*Strong progress*
	3 Online schools and libraries	*Progress*
	4 Online health centres	No progress
	5 Employment	Moderate progress
	6 Local government	*Strong progress*
B. Capacity-building and knowledge creation	7 Alternative technologies	Moderate progress
	8 Software	Moderate progress
	9 Training	*Progress*
	10 Research and education networks	*Strong progress*
	11 Science and technology	No progress
	12 Businesses	*Progress*
	13 Creative and content industries	*Progress*
	14 Internet governance	*Progress*
C. Governmental transparency and efficiency	15 e-Government	*Progress*
	16 e-Education	*Strong progress*
	17 e-Health	No progress
	18 Disasters	No progress
	19 e-Justice	Moderate progress
	20 Environmental protection	Moderate progress
	21 Public information and cultural patrimony	*Progress*
D. Policy instruments	22 National strategies	*Progress*
	23 Financing	No progress
	24 Universal access policies	No progress
	25 Legislative framework	No progress
	26 Indicators and measurement	*Strong progress*
E. Empowering environment	27 Monitoring of the World Summit and execution of eLAC2007	*Strong progress*

As a result from this experience we can see that the three-dimensional framework is rather hindering when applied linearly in a one-dimensional sense for policy design. This is one of the lessons learned and we will return to this in the conclusion. Let us take a look at other possible applications at the national level.

C. Identifying national actors and priorities

Almost all countries in Latin America and the Caribbean have by now established some kind of national ICT-for-development agenda (for reviews see [24]-[26]). The nature, structure and functioning of those agendas is quite heterogeneous. Different countries have different priorities

(with access and e-government being the two most prominent topics) and the authorities in charge of leading the policy initiative can be found at different levels of governmental hierarchy (in some countries at the Vice-Presidency, in others a specific Ministry is in charge and in others the independent telecom-regulator takes the leading role).[9] One aspect all of them have in common is that they are to some degree decentralized and involve several governmental and often also private sector authorities.

For example, Peru's "Multi-sector Commission for Information Society development (CODESI)" counts 87 organizations and 207 specialists[10]. In Bolivia, the National Strategy for Information and Communication Technology (ETIC) is based on a 14 months consultation (starting in 2003) and counted with the contribution of 3,176 people from 770 organizations [27]. Participation and interest went far beyond the public policy-making circles. The sector with the strongest interest was civil society (40% of the participants), among them NGOs working in poverty reduction programmes and in development sectors such as agriculture, gender and education, followed by representatives of the private sector (22%) as well as the academic sector (17%) [28]. The e-Dominicana strategy from Dominican Republic[11] follows a similarly multi-sector approach. The plan refers to the cube as a "structural model of the Information Society" and its authors underline that the policy dimension of the cube "requires also an active participation by the productive sectors in processes of financing the different projects and in coordinating the actions, in order to avoid duplicate or counterpoising efforts" [29: p. 23]. In line with this multisectorial nature of the challenge, the government of the Dominican Republic (led by the telecom-regulator INDOTEL) organized a series of consultation meetings over a 15 month period around 2006, which was structured according to the dimensions of the cube and mainly consisted in the identification of relevant actors and projects from the public and private sectors.

The multiple dimensions of the cube can be useful to reveal the interdependencies between the different actors and to visualize how they relate. It provides a multidimensional conceptualization of the crosscutting nature of the transformations provoked by general purpose technologies that do not fit within with the traditional organization of political institutions, such as the ministries of telecommunication, education, transport, health, trade and public administration, and so forth. There are authorities for infrastructure and science and technology, but connectivity is only the first step, while the introduction of ICT in the different sectors of society requires the expertise of each of their authorities and actors.

For example, a policy regarding an incentive structure to facilitate connectivity of a country's municipalities would crosscut the horizontal layer of infrastructure (and therefore require the involvement telecommunication authorities, be they from the private, public or nonprofit actors), mayors and municipal representatives (vertical sector e-government), and actors that have the tool to create such an incentive structure (Ministry of the Interior, Ministry of Finance, local communities, private banks or donor agencies, among others) (see Figure II).

These intersection do not need to be restricted to one specific coordinate of the three-dimensional setting, but can also be expanded along an entire vector. For example, legislation on privacy protection involves legislators and regulatory authorities on the policy side, software and service industry representatives from generic digital service in the horizontal layer. As can be seen in Figure II, such legislation is crosscutting for all e-sectors, and will therefore need to serve as diverse sectors as banking and health, which are essential when setting up the related policy agendas.

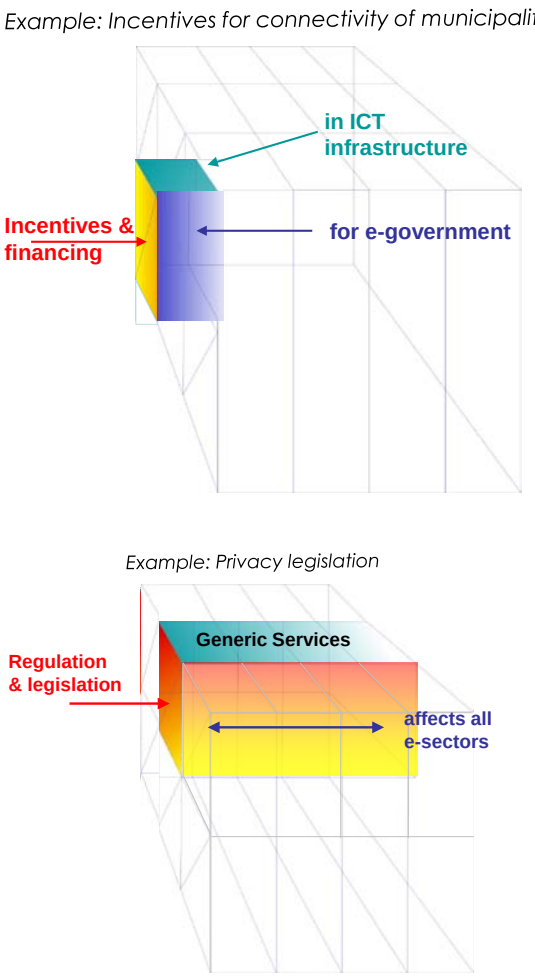

Fig. II. Identifying actors and their relationships with help of the cube.

[9] The same, of course, is true at the international level among the different specialized agencies of the United Nations and other international actors and organizations. The World Summit on the Information Society (WSIS)[2] was led by United Nations' telecommunication authority ITU, but involved international organizations from different areas of expertise (especially UNESCO, UNCTAD, ILO, UN-DESA, the UN Regional Commissions, etc) and an unprecedented participation from the private sector and civil society.

[10] See Comisión Multisectorial para el Seguimiento y Evaluación del "Plan de Desarrollo de la Sociedad de la Información en el Perú – La Agenda Digital Peruana"; http://www.codesi.gob.pe/

[11] Comisión Nacional para la Sociedad de la Información y el Conocimiento, República Dominicana; http://www.cnsic.org.do

The need for a decentralized and multi-sector approach to ICT-policy making goes inevitably back to the fact that ICT are general purpose technologies. One of the most tangible consequences of this particularity for policy-making in the field of ICT-for-development is that the budget for ICT activities is dispersed among the different institutions and organizations, each of which is working on initiatives to move its sector forward into the digital age. This typically spans spending priorities like expanding telecommunications infrastructure and providing public access centers, integrating ICT in the school curriculum, digitizing health systems and introducing databases in hospitals, training entrepreneurs, supporting new legislation or property rights options for software choices, supporting tele-working modalities or digital tools for cultural heritage, and managing disasters and assuring national security, among many others.

Much in line with the use of the cube to identify actors, the presented conceptual framework can be used as a tool for the identification and designation of resources in a national ICT-for-development strategy. In one of the only known best practices in this regard, the Chilean government took inventory of its nationwide public ICT spending as part of their Digital Agenda [30].[12] The inventory covered 210 institutions from 22 budgetary rubrics, focusing on agencies of the centralized national government (excluding entities that respond directly to Congress and higher education). The total spending in 2003 summed up to US$205 million and therefore widely multiplied the US$ 5 million that were assigned to the much-cited Chilean telecommunications development fund in the same period.[13] Tables II and III take a closer look at where these resources can be found.

Table II depicts the intersection along the dimensions of the Horizontal Layers and the Diagonal Areas of the cube in percentage of total spending. It shows that, contrary to what might have been expected, the government at large does not spend most of its resources on promoting ICT hardware or telecommunications infrastructure, but rather on purchasing and maintaining ICT-software and digital services (more than half of the total spending). It also shows that the administration of ICT projects, which usually receive most of the visibility, only represent a fraction of the total fiscal spending on promoting the countries transformation toward an Information Society. Another fact which is shown with surprising clarity is that the large majority of public policies do not focus on the provision of incentives, but on regulation. Incentives provide positive feedback to guide digital development into the desired direction and are usually very resource intense. The case of Chile shows that regulation, which guides development through negative feedback, and therefore provided stability to a self-organizing system, takes up most of the attention.

Table III looks at the same numbers from the perspective of the intersection between the cube's Vertical Sectors. It shows that the largest public spender is the Ministry of Finance itself, spending 15.2% of the total, closely followed by the Ministry of Education and the Ministry of Defense. It is characteristic that most national ICT-for-development strategies are dominated by telecommunications and technology authorities and that the agencies that turn out to be the largest catalysts of digital development in the country often are not even present at the table when setting up the digital agenda. These numbers show that the Chilean Ministry of Education has spend 6.3 times more on ICT-for-development than the much-cited Chilean telecommunications fund13, managed by the telecom regulator SUBTEL. Even the Chilean Ministry of Health, with is notoriously absent in the elaboration and execution of the national strategy, is spending 4.5 times more than the telecom authorities are managing. This analysis shows that in national ICT-for-development strategies, the money is not necessarily where the mouth is.

In this sense, the multidimensional perspectives of the cube allow for the identification of spending realities and priorities. It can also lay the basis for cross-fertilization, synergies and the avoidance of double-efforts, which is especially important in a resource intense challenge in resource-scarce developing countries. From a theoretical perspective, it is interesting to view the cube from the perspective of actual resource intensity, as we can see how the cube "deforms" (with larger and smaller parts of the whole cube). This deformation represents the process through which decision-makers of the

TABLE II
HORIZONTAL CROSS-TABULATION OF PUBLIC ICT SPENDING IN CHILE, 2003 (IN % OF TOTAL)

Symbol	Regulation	Incentives	
Infrastructure	0.12	0.04	**0.16**
Generic Services	0.35	0.18	**0.52**
Capacities and Skills	0.16	0.05	**0.20**
Project Administration	0.11	0.00	**0.12**
	0.73	**0.27**	**1.00**

TABLE III
VERTICAL CROSS-TABULATION OF PUBLIC ICT SPENDING IN CHILE, 2003 (IN % OF TOTAL)

Ministry of Finance	Ministry of Education	Ministry of Defense	Judicial Power and Ministry	Ministry of Health	Ministry of Labor, Social Security	Others	
0.152	**0.149**	**0.140**	**0.124**	**0.107**	**0.086**	**0.243**	**1.0**

[12] Chile was one of the pioneers in national agenda setting for digital development in developing countries. The first generation of the plan, between 2004-2006, was called Agenda Digital Chile, while the 2007-2012 plan is called Digital Strategy: http://www.estrategiadigital.gob.cl/node/91

[13] The Chilean Telecommunications Development Fund is seen as a worldwide best practice to expand ICT services in developing countries with challenging geographies. The fund subsidies the expansion of network coverage and maintains a network of public access centers: http://www.subtel.cl . These types of funds are typically seen as the main financing instrument for ICT-for-development policies, even so, as shown here, they only constitute a very small part of what the public sector actually spends on ICT.

strategy decide on priorities and the main concerns of the agenda.

IV. Lessons learned

The so-called "ICT-for-development-cube" is a conceptual framework that depicts the transition toward Information Societies as a mutually dependent interplay between technology, policies and social change. Its focus on technology as a driver of development is based on the Schumpeterian notion of social evolution that is driven by innovation and technological change. It has been applied to structure research efforts and to design policy agendas.

Experience has shown that the framework is not very efficient when applied in a linear, one-dimensional manner, which separates the technological means from social ends. The three-dimensional framework unfolds its explanatory power when used as a tool to structure processes, such as those aimed at the identification of priorities, actors and their relationships.

One of the main drawbacks of the cube is that it is a mere conceptual framework, not a dynamic model. It serves as a broad classification system of the dynamics, actors and activities involved in the transitions toward Information Societies, but it does not allow to make predictions and to test hypothesis. As such, it runs into the same problem as most Schumpeterian approaches to socio-economic change: the fact that the world is dynamic and constantly changing prevents us from applying equilibrium analysis [31], and leads us down a path of studying complex social systems which, per definition, are only partially following predictive patterns (e.g. [32], [33]). Eventually, the elaboration of a coherent model that captures the dynamic of how Information and Communication Technologies affect development comes down to working on the broader challenge of elaborating a modern socio-economic theory that recognizes complex change at its core. We do not have such theory yet. For now, rough conceptual frameworks are a first step to assist policy and decision-makers in their enormous tasks of guiding societies in their transformation toward becoming Information Societies.

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