Policy-making for digital development: the role of the government

Ismael Peña-López, Lecturer, Open University of Catalonia

Abstract

Our research focuses on whether there is a need for action by governments - and the public sector in general - to promote the Information Society and, if any, what should be the specific role of them.

We first define several stages of digital development at the country level through cluster analysis, which we characterize by means of contingency tables or cross tabulations. One of our first findings is that most countries follow a similar path of digital development, and one that has a strong correlation with socioeconomic development: higher levels of wealth and economic development, education and the existence of digital infrastructures almost always coincide with higher levels of digital development. However, we also find outlying economies that follow their own digital development structure: leapfroggers.

We then perform binomial logistic analysis to find out the reasons of being a digital leader or laggard. Besides the usual socioeconomic indicators causing higher or lower digital development levels, we also find that Governments can accelerate the process of digital development through the adoption of public policies that frame and foster the Information Society – such as Government prioritization of ICT and assigning a high importance to ICT in government vision of the future – and establishing an appropriate Economic Incentive Regime. This will raise the probability of a country of reaching higher stages of digital development.

Author notes: The author thanks Tim Kelly, Senior Policy and Regulation Specialist at The World Bank, for most valuable insight and guidance throughout the making of this research. Joan Torrent, Francisco Lupiáñez and Pilar Ficapal provided unselfish and key guidance in choosing the appropriate statistical apparatus, and I thank them a lot for that.

Keywords: e-readiness, digital divide, policy, information society, digital economy, composite indices, cluster analysis, binomial logistic regression.

Introduction

In recent years, governments – at all levels, from supranational to local – have launched public policies for the promotion of the Information Society in general, and for reaching higher stages of development of the Digital Economy in particular.

But while some voices actively call for active policies to facilitate access to Information and Communication Technologies (Clement & Shade, 1998; Tambini, 2000; Bridges.org, 2002; DiMaggio et al., 2004; Gillwald, 2005; Gillwald & Stork, 2007), other authors state that public access should not be publicly promoted, either because they find it unnecessary or because it is found ineffective for several reasons (Compaine & Weinraub, 1997; Mueller, 1999; Compaine, 2001).

In order to settle on the appropriateness of governments to actively engage in fostering the digital economy, we here drew and depicted the existence of different stages of digital development at the country level, using cluster analysis on a sample of 49 countries and with 22 different variables, covering a comprehensive range of aspects of the digital economy as depicted in Peña-López (2010).

The definition of different stages of development of the digital economy ultimately enabled us to test if the role of government in promoting the adoption of Information Technology and Communication had any impact on the probability of reaching the highest level of digital development and, on the contrary, whether it had any impact on the probability of being allocated in the lowest stage.

Methodology

Following the work performed in Peña-López (forthcoming), the Comprehensive 360º Digital Framework was applied to choose a set of indicators that integrated the different approaches with which the Digital Economy can be measured. As it is explained in the aforementioned work, the set included indicators from the following categories, from both the supply and demand sides: Infrastructures, ICT Sector, Digital Skills, Policy and Regulatory Framework, Content and Services. Analogue or non-digital indicators were also added to provide the socio-economic context.

A total of 157 variables were initially selected from 14 different databases published by international organizations and referred to aggregate values per country for year 2007 – though some isolate values had to be inferred from previous years with an expected insignificant impact on the final results. Finally, and as it is explained following, a total of 91 variables from 10 different databases were used, as it is detailed in Table VI.

The methodology to analyze the data from the indicators was inspired by the works of Ficapal-Cusí & Torrent-Sellens (2008) and Lupiáñez-Villanueva, F. (2009). Firstly, the information from the original data was simplified through non-hierarchical K-means cluster analysis; secondly, the resulting clusters were characterized using contingency tables or cross tabulations; thirdly, the determinants of the probability of belonging to the two of the clusters (most and least digitally developed countries) were calculated using binomial logistic regressions.

As usual, initial data were analyzed to identify problems of multicollinearity with the help of the correlation matrix. On the other hand, and to prepare data and to prepare for the exercise of characterization, the series were dichotomized using as a procedure for assigning values using "high" (= 1) for the top quartile values, and "low" (= 0) for the remaining 75% of values. We used, however, frequency tables and histograms for correcting, in very few cases, the allocation of the values resulting from the previous process of dichotomization, necessary in some cases to stress or make more relevant the high/low value dichotomy.

For the simplification of what was certainly a very complex set of data – the initial 157 variables for the whole set of 257 countries – we decided to standardize the variables and perform a first estimation of non-hierarchical K-means cluster analysis, which provided a good way to group countries so that the groups are significantly homogeneous in their inner composition and significantly heterogeneous between clusters. To calculate the K-means clusters were ended up using 22 variables for a total of 49 countries – see Fig. 1 and section III –, given the low amount of existing data on the digital economy for the vast majority of countries in the world. To perform the cluster analysis we only used indicators belonging to the field of the digital economy and deliberately avoiding “real economy” indicators not to include “analog noise” that could distort the development stages of the digital economy.

The results of this statistic were 5 clusters that were finally reduced to 4 groups after merging two of them into a single one. This merging of two clusters was done given the high homogeneity of the one that contained a single case (USA) with the following one, differing only by some singular values of this country in certain variables due to the strong effect of globalization (i.e. the number of web servers, contracted to the U.S. from elsewhere in the world).

These 4 resulting groups were characterized to describe a profile of them. For this purpose, contingency tables were constructed. Significant scores for Pearson Chi-Square and Fischer’s Exact test rejected the hypotheses of independence, meaning that a country's allocation to a particular cluster depended on its value for that selected variable – the Pearson and Spearman tests showing the correlation of the distribution between the cluster and the selected variable. We also, we calculated Haberman typified adjusted residuals to test whether there were more (or less) cases than expected in comparison with the case where the two compared variables (the cluster and the other variable in our case) were independent. For our characterization exercise, 65 variables were found to be statistically significant, thus meaning that the four clusters had significantly different values amongst them for each of the 65 variables.

Finally, we selected two of the four groups in which we regrouped the clusters: on the one hand, the digital leaders or most advanced economies and, on the other hand, the digital laggards or less digitally advanced economies. With these two groups we performed a binomial logistic regression to provide a measure of the impact in the probability of belonging to one or another depending on the selected variables; that is, we looked for the causes that would raise or decrease the probability of (a) belonging to the digital leading group and (b) belonging to the digital trailing group.conclusion section is not required

Cluster analysis

As it has been mentioned before, the cluster analysis produced 5 clusters. The variables used to build them obtained a significance of F of p <0.001 in all cases in the analysis of variance (ANOVA).

Figure 1 shows the values of the centers of the clusters. It is easy to see that clusters #1 to #4 form a certain structure of concentric circles, where all countries seem to follow a similar pattern of development of the digital economy, differing only in the levels of the values of the variables that shape it, but not in the overall "structure" of their distribution.

Cluster # 5, however, escapes this scheme and does not seem to be following that same pattern, featuring instead values sometimes greater, sometimes smaller than those of the other four clusters.

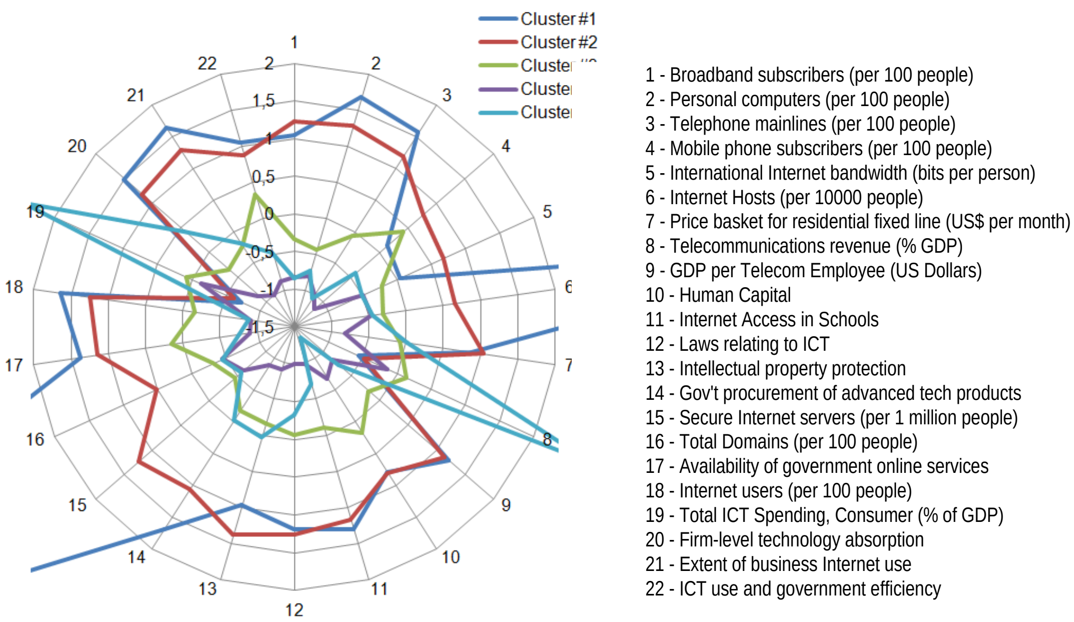
At it has already been explained, were grouped the 5 outcoming clusters into 4, and proceeded to label them in order to make them easily recognizable. The four resulting groups or stages of the digital economy are:

- Digital leaders (cluster # 1 & # 2, n = 1 +14): United States, Australia, Austria, Finland, France, Germany, Ireland, Japan, Rep. of Korea, New Zealand, Norway, Singapore, Sweden, Switzerland, United Kingdom.
- Digital strivers (cluster # 3, n = 17): Brazil, Bulgaria, Chile, Greece, Hungary, Italy, Jamaica, Mexico, Panama, Portugal, Romania, Saudi

Arabia, Spain, Thailand, Tunisia, Uruguay, United Arab Emirates.

- Digital laggards (cluster # 4, n = 14): Argentina, Algeria, Bolivia, Cameroon, Ecuador, Egypt, India, Indonesia, Pakistan, Peru, Philippines, Sri Lanka, Vietnam, Zimbabwe.
- Digital leapfroggers (cluster # 5, n = 3): Jordan, Senegal, South Africa.

Fig. 1. Values of the cluster centres



Characterization

The results of the characterization exercise are those shown in figures 2 through 7. These figures show the percentage of countries whose respective values for the variables selected were "high". The significance is marked by the following legend: (*): p <0.01 (**): p <0.05 (***): p <0.1

These 65 variables used to characterize the clusters are divided in six groups, respectively: Infrastructures, the ICT Sector, Digital Skills, the Political and Regulatory Framework, Usage and nondigital or “real economy” indicators.

Finally, although all four stages of development of the digital economy are presented in the charts and the accompanying legends, we have highlighted in different color both the leaders and the laggards to make easy reading of charts easier and also to help in identifying the key differences amongst these two groups. Indeed, these two stages of digital development are the ones we chose to calculate our binomial logistic regressions mentioned in section II.

We believe that the graphics are, in our opinion, self-explanatory enough; hence we save the reader explanations that would only incur in unnecessary redundancy. As a reading example, though, we can see that in Fig. 2, the blue line scoring 100% for value 2 means that all digital leaders scored high when their number of personal computers (per 100people) was measured

Notwithstanding, as a general comment on figures 2 through 7, we want to above all emphasize a fact that was already mentioned when we commented the resulting clusters from our previous analysis: data systematically show that most countries seem to follow the same pattern of evolution of the digital economy.

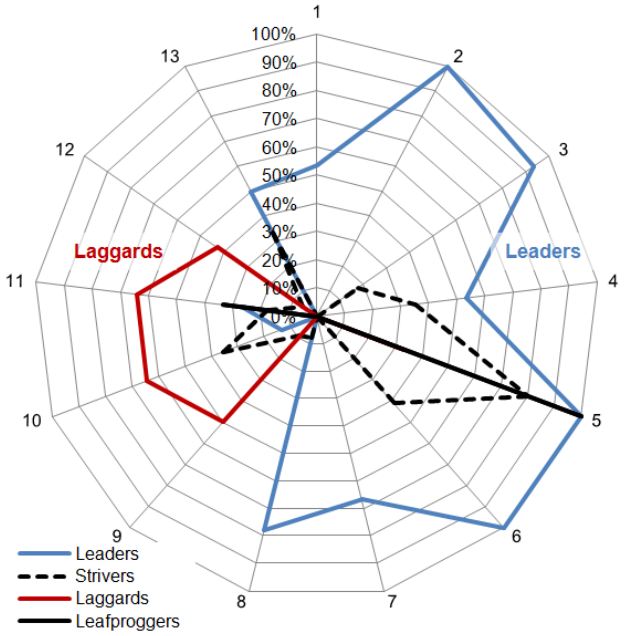
That this pattern – more evident in Figure 1 but also in the other ones – is but a set of strata where the behavior of all countries are similar in all indicators, the exception being that they are in different levels of values for each variable, depending on the cluster they belong to. As we have also previously discussed, the group of leapfroggers – a minority compared to the overwhelming majority of the other clusters – behave differently and do not seem to follow the same stratification path.

Thus, and without implying any kind of causality, we can see that Infrastructures, Digital Skills and Political and Regulatory Framework have an overall similar and sort of synchronized evolution, and are indeed often accompanied by an equivalent level of “analogue” development: income, level of inequality, health and education.

It is also interesting to stress that the existence of digital services and content is accompanied by the corresponding usage level, and the complementary evolution of the three factors that we mentioned in the previous paragraph. It is interesting to note, then, that it is probably the ICT Sector the category that shows the biggest differences between leaders and the rest of the stages of digital development, while on the other hand clearly suggesting an economic locomotive role in the case of leapfroggers.

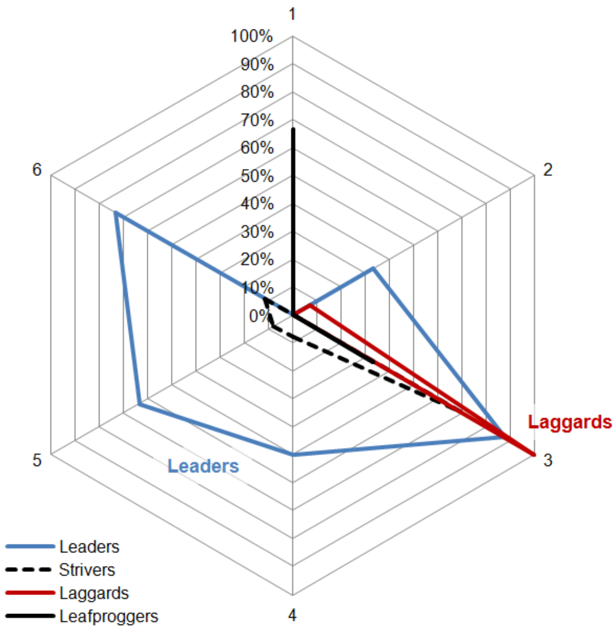
Last, but not least, it is worth noting that the indicators used to measure the digital skills are only approximations to their true values, and that this kind of indicators do not exist as such in the statistics but as proxies.

Fig. 2. Characterization of the stages of the digital economy: Infrastructures



1 - Broadband subscribers (per 100 people) (*)
2 - Personal computers (per 100 people) (*)
3 - Telephone mainlines (per 100 people) (*)
4 - Mobile phone subscribers (per 100 people) (*)
5 - Population covered by mobile telephony (%) (*)
6 - International Internet bandwidth (bits per person) (*)
7 - Internet Hosts (per 10000 people) (*)
8 - Internet subscribers (per 100 inhabitants) (*)
9 - Residential monthly telephone subscription (US$) (**)
10 - Price basket for Internet (US$ per month) (**)
11 - Price basket for mobile (US$ per month) (**)
12 - Price basket for residential fixed line (US$ per month) (*)
13 - Telephone average cost of call to US (US$ per three minutes) (***)

Fig. 3. Characterization of the stages of the digital economy: ICT Sector



1 - Telecommunications revenue (% GDP) (*)
2 - High-technology exports (% of manufactured exports) (**)
3 - Telephone subscribers per employee (***)
4 - Telephone employees (per 100 people) (**)
5 - Total full-time telecommunications staff (per 100 people) (*)
6 - GDP per Telecom Employee (US Dollars) (*)

Fig. 4. Characterization of the stages of the digital economy: digital literacy

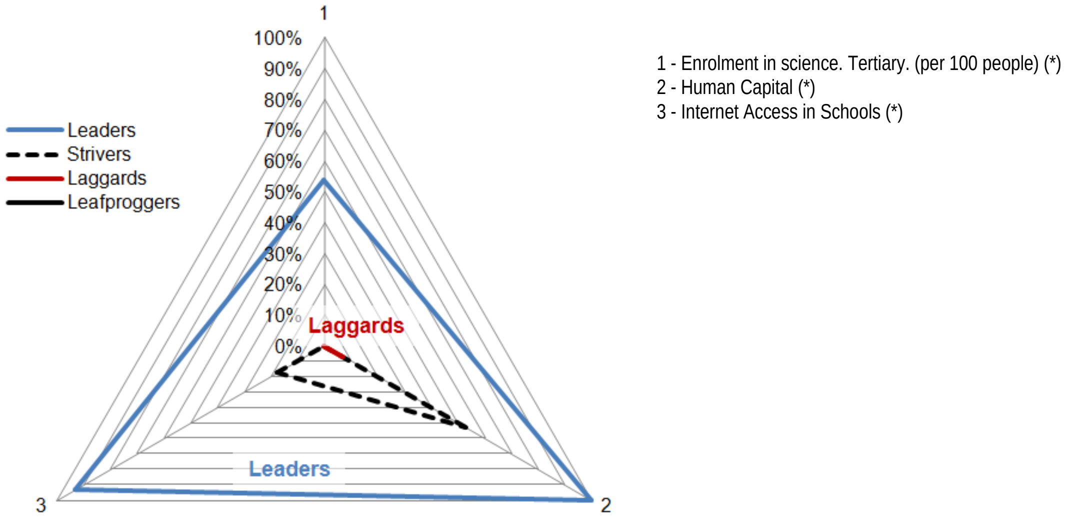


Fig. 5. Characterization of the stages of the digital economy: regulatory framework

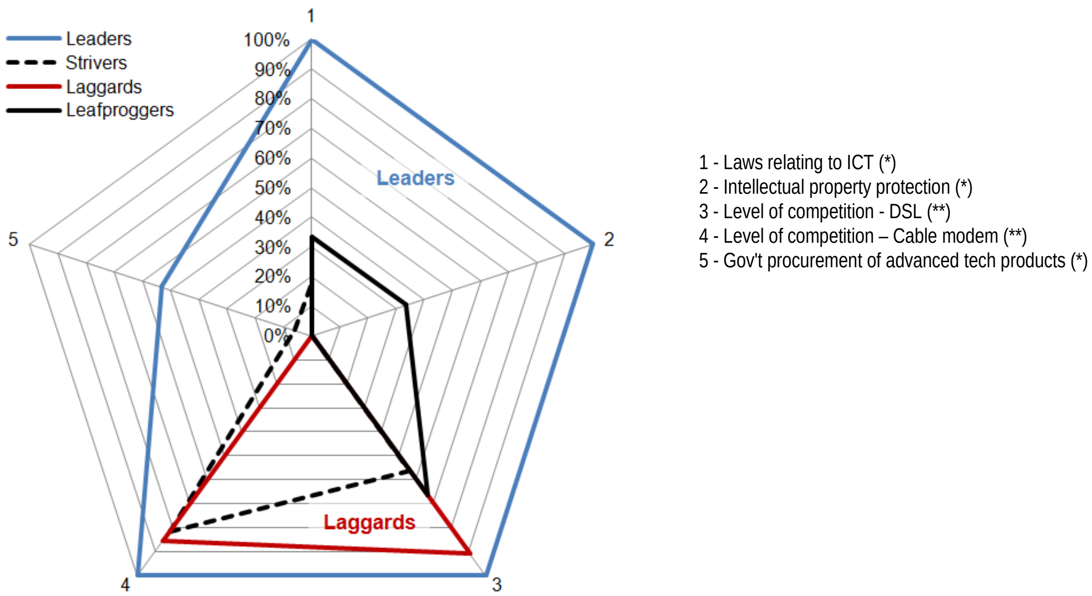


Fig. 6. Characterization of the stages of the digital economy: content and services

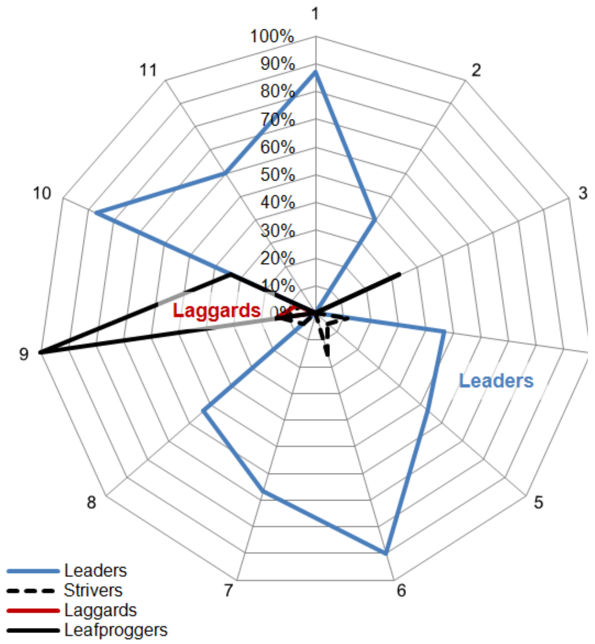
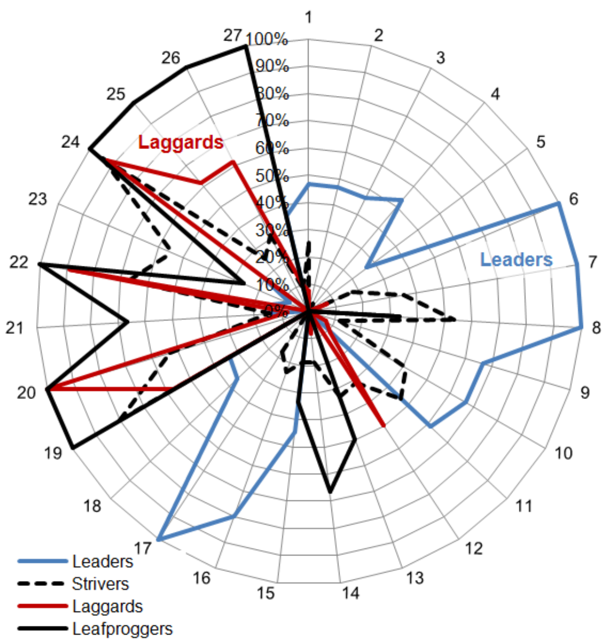


Fig. 7. Characterization of the stages of the digital economy: analogue indicators



Binomial Logit Analysis

Finally, and to find the determinants of a country to have a higher or a lower probability of being among the digital leaders or among digital laggards, we estimated two binary logistic regressions, taking in both cases as the dependent variable being or not being part of the analyzed group.

Hence, the dependent variable took the value of 1 when the country belonged to the group of digital leaders, and 0 when it belonged to any other stage of digital development. The exercise was repeated for the case of digital laggards (1 = belongs to the group of digital laggards, 0 = belongs to any other stage of digital development). Results are featured in Tables II to V.

In both cases, the Chi-Square test confirmed that the power of the effect of the independent variables taken jointly is statistically significant, and the Hosmer and Lemenshow test rejected the null hypothesis that there was no difference between the observed and predicted values of the dependent variable, thus confirming the goodness to fit of the overall model. Furthermore, both models predicted nearly 100% of the cases – though slightly less in the case of digital leaders. The high value of Nagelkerke R-square implied a high degree of the explanatory power of the model. We can also see that, on the other hand, although models adjusted quite well in their overall, the independent variables had a significance ranging between 95% and 90%, which certainly weakens the conclusions that we could infer from them. Indeed, in the case of digital laggards, the constant had an incredibly high value, which leads to think that although the model could be formally correct, many explanatory variables were left out of it and were then gathered by this constant.

Let us be provide more specific reflections about the causes or determinants of being a digital leader and a digital laggard.

In digitally developed countries, the causes that actually determine these economies to be labeled as digital leaders include life expectancy at birth, economic inequality (at 20%), urban population, the economic incentive regime and the government prioritization of ICT.

Life expectancy at birth has a very small but negative impact on digital development. We can infer from the negative relationship between digital development and life expectancy (more life expectancy, less digital development) that this might be due either to the trade off between welfare (in a very broad sense) and the building of a new economy, or (more likely) to a positive relationship between a younger and more dynamic population and the building of a new Information Society. It could or course also be an explanation that, simply, that variable collected spurious relationships not properly identified in our model.

Table I: Determinants of stage of digital development for most digitally developed countries (digital leaders).

Binary logistic regression with digital leaders (1 is a digital leader, 0 is not a digital leader) as the dependent variable.						
	B	S.E.	Wald	df	Sig.	Exp(B)
Life expectancy at birth, total (GEN30)	-.399	.208	3.664	1	.056	.671
Inequality-20 (GEN05)	-1.066	.578	3.403	1	.065	.344
Urban Population (%) (GEN07)	.138	.079	3.030	1	.082	1.148
Economic Incentive Regime (GEN08)	1.671	.877	3.628	1	.057	5.317
Government prioritization of ICT (LEGAL_D_04)	2.869	1.737	2.727	1	.099	17.611
N	46					
Correctly predicted cases	95.7%	96.8% (leaders)	93.3% (rest)			
-2 Log likelihood	15.970					
Cox & Snell R-square	.646					
Nagelkerke R-square	.862					
Chi-Square (sig)	47.799	(.000)				
Hosmer and Lemeshow Test Chi-Square (sig)	1.546	(.981)				

Table II: Correlations of the determinants of stage of digital development for most digitally developed countries (digital leaders).

Binary logistic regression with digital leaders (1 is a digital leader, 0 is not a digital leader) as the dependent variable.					
	Life expectancy at birth	Inequality-20	Urban Population	Economic Incentive Regime	Government prioritization of ICT
Life expectancy at birth	1,000	,529	-,745	-,879	-,871
Inequality-20	,529	1,000	-,553	-,560	-,561
Urban Population (%)	-,745	-,553	1,000	,591	,465
Economic Incentive Regime	-,879	-,560	,591	1,000	,668
Government prioritization of ICT	-,871	-,561	,465	,668	1,000

Table III: Determinants of stage of digital development for least digitally developed countries (digital laggards).

Binary logistic regression with digital laggards (1 is a digital laggard, 0 is not a digital laggard) as the dependent variable.

	B	S.E.	Wald	df	Sig.	Exp(B)
Constant	38.214	16.958	5.078	1	.024	$3.945 \cdot 10^{16}$
Inequality-10 (GEN06)	-.235	.138	2.909	1	.088	.790
Health Public Expenditure (% of total Health expenditure) (GEN14)	-.176	.081	4.665	1	.031	.839
Population covered by mobile telephony (%) (INF_S_06)	-.100	.050	3.936	1	.047	.905
Importance of ICT to government vision of the future (LEGAL_D_01)	-4.304	2.239	3.696	1	.055	.014

N	47		
Correctly predicted cases	94.6%	96.4% (laggards)	88.9 % (rest)
-2 Log likelihood	11.391		
Cox & Snell R-square	.551		
Nagelkerke R-square	.823		
Chi-Square (sig)	29.663	(.000)	
Hosmer and Lemeshow Test Chi-Square (sig)	3.684	(.815)	

Table IV: Correlations of the determinants of stage of digital development for least digitally developed countries (digital laggards).

Binary logistic regression with digital laggards (1 is a digital laggard, 0 is not a digital laggard) as the dependent variable.

	Constant	Inequality-10	Health Public Expendit. (% of total H.expend.)	Population covered by mobile telephony (%)	Importance of ICT to govt. vision of the future
Constant	1,000	-,812	-,735	-,854	-,926
Inequality-10	-,812	1,000	,618	,645	,702
Health Public Expenditure (% of total Health expenditure)	-,735	,618	1,000	,571	,489
Population covered by mobile telephony (%)	-,854	,645	,571	1,000	,708
Importance of ICT to govt vision of the	-,926	,702	,489	,708	1,000

future					

Also related to human development and the welfare of the population, inequality has a negative impact – and bigger than life expectancy at birth – in digital development. Thus, the greater the economic unbalances in the real economy, the less likely this economy is to reach a higher stage of digital development. This is an remarkable finding as it raises a cautionary remark that (digital) development goes hand in hand with a socially-balanced development strategy.

With an opposite sign, but with an impact as small as the case of life expectancy at birth, the percent of urban population also determines, in some degree, digital development. In this case, it does follow prior findings by other researchers that highlighted the importance to the development of the Information Society of clustering around cities as a focus of innovation.

Indeed, innovation and, more generally, the economic incentive regime play a positive and more important role in the probability of reaching the stage of digital leader. As it has been shown during the characterizations, a suitable economic regime and the existence of high levels of research and development are some of the watermarks of digital development. What we here find is that they are not only a watermark, but a cause in its full sense.

Moreover, the Government prioritization of ICT has the highest and most positive impact on digital development of all the determinants found in our model, multiplying by 18 the odds of an economy being allocated in the highest rank of digital development and three times stronger than the economic incentive regime. We have to be cautious, however, not to misunderstand prioritization with direct intervention, as the indicator measures the political and legal role of the government and not its direct participation in the economy.

Concerning less digitally developed economies, it is interesting to see that the causes of digital underdevelopment are similar (though opposite) to those of digital development, with the inclusion of some particular aspects. So, we find that the determinants for not being digitally developed are Inequality (at 10%), public expenditure on health (as a % of total Health expenditure), the population covered by mobile telephony (%) and the Importance of ICT to government vision of the future.

As it has been said, we find again inequality as a cause, and again with a negative sign which has to be read carefully in this case. Regarding digital laggards, a negative coefficient in equality means that more inequality represents a lower probability of not being digitally developed, of being a digital laggard. In other words, higher inequality will decrease the probability of being a laggard. Though we can state that its power is lower than in the case of digital leaders, it is nevertheless surprising that more inequality would be "good" for digital development in its early stages. A possible explanation would be that of the last mile, where the deployment of infrastructures would never be completed if, at the margin, the cost of universal access overrides the profits achieved by the carriers. Or, what is the same, a critical mass or a minimum threshold or purchasing power is needed in early stages of digital development.

Slightly lower in power, the role of the Government in the provision of health services (Public expenditure in Health as % of total Health Expenditure) also has a negative impact on the probability of being a digital laggard. In this case, the finding follows intuition: the healthier the population – and the higher the commitment of the government to their welfare – the better for development.

The percent of the population covered by mobile telephony is another confirmation of intuition, and in two different ways. First of all, it statistically demonstrates that mobile telephony is a driver of digital development in lesser developed countries, which is something that researchers in the field have stated to exhaustion – and by focussing, in their methodologies, on those technologies that are less affordable or have lower penetration, many ICT4D projects are implicitly denying this fact. Second, this is an indicator that does not appear when analyzing digital leaders but only in the case of digital laggards, which sort of pictures the structural differences between both groupings of economies and reinforces the need for separate policy designs to foster the Information Society when addressing such different realities.

If mobile telephony represents the difference between digital leaders and laggards, the Importance of ICT to government vision of the future surely represents the similarity. Though slightly different to Government prioritization of ICT among digital leaders, the over-riding concept is whether governments care about fostering the Information Society. And if the case of digital leaders was clear, it is even more powerful in the case of developing countries; orders of magnitude more important. On the other hand, while the case of digital leaders and the Government prioritization of ICT was the answer to the question of whether "ICTs is an overall priority for the government", the case of digital laggards and the Importance of ICT to government vision of the future wants to answer the question of whether "the government has a clear implementation plan for utilizing ICTs for improving the country's overall competitiveness" which is, to our understanding, a stronger commitment of the government, where not only its overall priorities are questioned but also whether real policies and strategies have been planned.

Conclusion

Our results show that except for a small and exceptional group of countries, most economies will behave similarly as far as digital development is concerned, differing only in general and the level of the indicators used to characterize them. In fact, and at the country level, it can be observed that digital development happens in stages.

These stages can be characterized by common features and distinguished by the scores achieved on certain key indicators. The improvement of its general economic indicators – such as income and wealth – majorly characterizes the progression of a country along this continuum. Thus, in terms of the real economy, digital development is always accompanied by a strong traditional economic development: income, health and human capital.

Besides these basic economic aspects, if there is an appropriate Economic Incentive Regime, strong Government prioritization of ICT and a high importance afforded to ICTs in the Government's vision of the future, then digital development is much more likely to happen. In some cases, these policies may allow leapfrogging so that a country can progress faster in its digital development than would be predicted by its general level of economic development.

In general terms, we can state that public policies to foster the Information Society increase by several orders of magnitude the probability of being amongst the leading countries in digital development or amongst the lagging ones. In other words, public policies determined being on the "good" or the "bad" side of the digital divide. In the light of the context provided by the characterization exercise, we believe that it can also be inferred that these policies should focus on strategies to incentivize the demand, although not necessarily through direct intervention policies on the aggregate demand, but by means of pull-based strategies to promote the development of electronic content and services, along with strengthening human capital and digital skills.

Appendix

Following we present the choice of indicators that were used to perform our calculations and that made up the Comprehensive 360º Digital Framework as has been explained in section II. The indicators are grouped by category and indicate the original source database.

Table V Data Sources

C	Indicator	Source
I	Broadband subscribers (per 100 people)	WB - World Dev. Indicat.
I	Personal computers (per 100 people)	WB - World Development Indicators
I	Telephone mainlines (per 100 people)	WB - World Development Indicators
I	Mobile phone subscribers (per 100 p.)	WB - World Development Indicators
I	Population covered by mobile telephony (%)	WB - World Development Indicators
I	International Internet bandwidth (bits per person)	WB - World Development Indicators
I	Internet Hosts (per 10000 people)	ITU - World Telecomm. Indicators
I	Broadband subscribers (per 100 people)	WB - World Development Indicators
I	Personal computers (per 100 people)	WB - World Development Indicators
I	Telephone mainlines (per 100 people)	WB - World Development Indicators
I	Mobile phone subscribers (per 100 people)	WB - World Development Indicators
I	Population covered by mobile telephony (%)	WB - World Development Indicators
I	International Internet bandwidth (bits per person)	WB - World Development Indicators
I	Internet Hosts (per 10000 people)	ITU - World Telecomm. Indicators
I	Internet subscribers (per 100 inhabitants)	ITU - World Telecomm. Indicators
I	Price basket for residential fixed line (US$ per month)	WB - World Dev. Indicat.
I	Residential monthly telephone subscription (US$)	ITU - World Telecomm. Indicat.
I	Price basket for Internet (US$ per m.)	WB - World Dev. Indicat.
I	Price basket for mobile (US$ per m.)	WB - World Dev. Indicat.
I	Price basket for residential fixed line (US$ per month)	WB - World Dev. Indicat.
I	Telephone average cost of call to US (US$ per three minutes)	WB - World Dev. Indicat.
S	Telecomm.s revenue (% GDP)	WB - World Dev. Indicat.
S	Telecomm.s revenue (% GDP)	WB - World Dev. Indicat.
S	High-technology exports (% of manufactured exports)	WB - World Dev. Indicat.
S	GDP per Telecom Employee (US Dollars)	WITSA Digital Planet
S	Telephone subscribers per employee	WB - World Dev. Indicat.
S	Telephone employees (per 100 people)	WB - World Dev. Indicat.
S	Total full-time Telecomm.s staff (per 100 people)	ITU - World Telecomm. Indicators
S	GDP per Telecom Employee (US Dollars)	WITSA Digital Planet
L	Human Capital	UN e-Government Readiness Survey
L	Enrolment in science. Tertiary. (per 100 p.)	UNESCO Stats
L	Human Capital	UN e-Government Readiness Survey
L	Internet Access in Schools	WEF Exec. Opinion Survey
L	Internet Access in Schools	WEF Exec. Opinion Survey
R	Laws relating to ICT	WEF Exec. Opinion Survey
R	Intellectual property protection	WEF Exec. Opinion Survey
R	Laws relating to ICT	WEF Exec. Opinion Survey
R	Intellectual property protection	WEF Exec. Opinion Survey
R	Level of competition - DSL	ITU World Telecomm. Regulatory DB
R	Level of competition - Cable modem	ITU World Telecomm. Regulatory DB
R	Gov't procurement of advanced tech products	WEF Exec. Opinion Survey
R	Importance of ICT to government vision of the future	WEF Exec. Opinion Survey
R	Gov't procurement of advanced tech products	WEF Exec. Opinion Survey
R	Government prioritization of ICT	WEF Exec. Opinion Survey
		(continues)

Table V Data Sources (continued)

C	Indicator	Source
U	Secure Internet servers (per 1 million people)	WB - World Development Indicators
U	Total Domains (per 100 people)	Webhosting.info
U	Availability of government online services	WEF Exec. Opinion Survey
U	Secure Internet servers (per 1 million people)	WB - World Development Indicators
U	Total Domains (per 100 people)	Webhosting.info
U	Total ICT Spending. Retail Trade (% of GDP)	WITSA Digital Planet
U	Web Measure	UN e-Government Readiness Survey
U	Availability of government online services	WEF Exec. Opinion Survey
U	Internet users (per 100 people)	WB - World Development Indicators
U	Total ICT Spending, Consumer (% of GDP)	WITSA Digital Planet
U	Firm-level technology absorption	WEF Exec. Opinion Survey
U	Extent of business Internet use	WEF Exec. Opinion Survey
U	ICT use and government efficiency	WEF Exec. Opinion Survey
U	International outgoing telephone traffic (minutes) (per 100 people)	ITU - World Telecomm. Indicators
U	Internet users (per 100 people)	WB - World Development Indicators
U	E-Participation	UN e-Government Readiness Survey
U	Total ICT Spending. Consumer (% of GDP)	WITSA Digital Planet
U	Firm-level technology absorption	WEF Exec. Opinion Survey
U	Extent of business Internet use	WEF Exec. Opinion Survey
N	GDP	WB - World Development Indicators
N	GDP Capita	WB - World Development Indicators
N	HDI	UNDP - Human Development Report
N	Inequality-20	UNDP - Human Development Report
N	Inequality-10	UNDP - Human Development Report
N	Urban Population (%)	WB - World Development Indicators
N	Economic Incentive Regime	WB - KAM
N	Innovation	WB - KAM
N	Gross National Expenditure (% of GDP)	WB - World Development Indicators
N	General Govt. final consumption expenditure (% of GDP)	WB - World Development Indicators
N	Health Public Expenditure (% of govt. expenditure)	WB - World Development Indicators
N	Health Public Expenditure (% of total Health expenditure)	WB - World Development Indicators
N	Education Public Expenditure (% of govt. expenditure)	WB - World Development Indicators
N	Population growth (annual %)	WB - World Development Indicators
N	Population in urban agglomerations > 1 million (% of total population)	WB - World Development Indicators
N	GDP deflator (base year varies by country)	WB - World Development Indicators
N	GDP per capita. PPP (current international $)	WB - World Development Indicators
N	GNI per capita. Atlas method (current US$)	WB - World Development Indicators
N	GNI per capita. PPP (current international $)	WB - World Development Indicators
N	Life expectancy at birth. total (years)	WB - World Development Indicators

Categories: I, Infrastructures; S, ICT Sector; L, Digital Literacy; R, Policy and Regulatory Framework; U, Usage; N, nondigital or real economy.

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