Global Competitiveness Improvement: E-Government as a Tool

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***Abstract*—The major objective of this study is to know if the development in e-government will support the global competitiveness of a country. This study utilized two famous indices for this purpose: the first is the United Nations' e-government readiness index (UN-EGRI) and the second is the global competitiveness index (GCI) published by the World Economic Forum. An association was estimated between the sub-dimensions of the UN-EGRI and the GCI. Results supported our premise with a highly significant correlation between the two indices and a significant correlation between all e-government sub-dimensions and the GCI. Finally, only the ICT infrastructure and the web index significantly predicted the GCI, and the human capital and participation did not. This study is the first to compare the two metrics (UN-EGRI & GCI) and to link the competitiveness measure to e-government development on a global scale. Conclusions are stated at the end.**

***Index Terms*—Global competiveness, e-government, archival data, GCI.**

I. Introduction

The concept of e-government opened doors for countries to be more transparent and offer more information about their available resources and human capital available. Such information is important for foreign investment and for global businesses to invest in the target country. The prosperity of e-government would depend on three major measures: information and communication technology infrastructure (ICT), the human capital in the country, and capabilities and improvement of the e-government website. Based on that, it is assumed that e-government improvement would yield to more investment and would improve the global competitiveness of a country.

This research assumed a relationship between the prosperity of e-government and the global competitiveness of a country. The study utilized the United Nations e-government index (UNEGOV) published by the Department of Economic and Social Affairs, Division for Public Administration and Development Management, to represent the e-government level of development in a country. The second side of the equation of the relationship under consideration is the Global Competitiveness Index (GCI), published by the World Economic Forum. This study is organized as follows: Section II will review the literature related to this study. The third section will explain the research method, data analysis and discuss the results. The last section will state the conclusions, limitations and future work.

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II. Literature Review

A. E-Government Concept

The e-government concept evolved early in the last two decades. The main definition and objective of e-government reported by many researchers is to provide an enhanced service utilizing ICT or the Internet [1]-[6]. Such definition lacks the overall perspective of e-government, where more focus towards e-democracy and public participation is embedded [7], [8]. On the other hand, the perspective of social contribution of e-government was introduced through the improvement of social life of citizens [9]-[12], and the digital divide [13].

B. E-Government Readiness Index

The United Nations measure for e-government development (UN-EGRI) reflects data collected from various countries of the world [14]. The report depends on three major dimensions and promotes success stories in e-government. The used data is distilled from the latest report of 2014 [15] to keep data close to the same period for the global competitiveness index used and described in the following section. The report included data for 190 usable sets. The following are simple descriptions of the three major dimensions of e-government [16].

Web Measure Index: The web measure index is a quantitative index measuring government's capabilities to inform, interact, transact and network. Web measure index is based upon the UN web presence model which defines the stages of e-government readiness according to a scale of progressively sophisticated services, these stages are: Emerging presence, enhanced presence, interactive presence, transactional presence and networked presence. In the web presence model, countries are ranked based on whether they provide products or services according to a numerical classification corresponding to the five stages.

Telecommunication infrastructure index: Telecommunication infrastructure index is a weighted average of six indices that measure country's ICT infrastructure capacity. The following are the indices per *100* persons: number of PCs, Internet users, number telephone lines, on-line population, number of mobile phones, and number of TVs.

Human Capital Index: Human Capital Index is a composite measure of adult literacy rate and the combined primary, secondary and tertiary gross enrolment ratio, with two thirds of the weight given to adult literacy and one third to the gross enrolment ratio. We note that the major human

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rights factors are not incorporated into this index.

C. Global Competitiveness Index

Countries are now keen on promoting their competitiveness in global market as it brings investments and more market opportunities. The image of countries, in relation to their legal framework, and the supporting policies, reflects their eagerness tot increase the opportunity of to compete globally. Such perspective might seem strange. Still, many countries are following such path.

The global competitiveness index (GCI) was established in 2004, and defines competitiveness as "*the set of institutions, policies, and factors that determine the level of productivity of an economy, which in turn sets the level of prosperity that the country can earn"* [17]. Such definition emphasizes the economic look of such measure. The major framework used to assess the GCI is broken down in Appendix A, where three major dimensions are included in the framework: 1) the basic requirements index, 2) efficiency enhancing index, and 3) innovation and sophistication factors index. The following list comprises the major factors included in the measure:

Factors included in Institutions pillar
Factors included in Infrastructure and connectivity pillar
Factors included in Macroeconomic Stability pillar
Factors included in Health pillar
Factors included in Education pillar
Factors included in Goods market efficiency pillar
Factors included in Labor market efficiency pillar
Factors included in Financial market efficiency pillar
Factors included in Technology adoption pillar
Factors included in Market size pillar
Factors included in Innovation ecosystem pillar
Factors included in Innovation implementation pillar

The index utilizes few equations to measure each sub-index and the partial factors contributing to it [17]. The major factors incorporated into each pillar are shown in Appendix A.

The data reported in the 2015 report included 140 countries. The report also included for each country the set of data for each measure used in calculating the overall measure of global competitiveness index. This study will utilize only the overall measure in the calculation.

III. Data Analysis and Discussion

Previous research utilizing secondary data related to the UN-EGRI explored more than one factor and compared it to the UN measure. The major sources for such type of research investigated human rights data [16], and corruption data as a surrogate for transparency [18]. The e-government initiatives are conceptually related to attracting foreign investments [19], where an empirical support is tested using secondary data by [20]. Also, the same idea was approached empirically by [21] when they utilized data related to foreign investment. The authors used the Global Opportunity index to represent the foreign investment direction. The Global Opportunity Index helps identify opportunities for companies contemplating making investments of 'patient' capital [21].

This study aimed at improving our understanding of the relationship between e-government initiative and the improvement of the global competitiveness of countries. Such relationship is not explored previously (up to the knowledge of author) and raise awareness of the importance of e-government.

This study utilized the UN-EGRI to represent the e-government readiness, and the GCI, to represent the level of competitiveness of a country. The data used was the common countries of both reports [15], [17]. The data for e-government is not available for the year 2015, where such data is issued each two years and the latest version is the 2014 data. Previous reports published by the UN are for the following countries: 2003, 2004, 2005, 2008, 2010, and 2012.

The data used is for 138 countries, where only 2 countries were removed from the GCI set. The UN-EGRI data is larger than the available data for GCI. To answer our research question, we conducted correlation matrix estimation with GCI data against the UN-EGRI and its sub-dimensions. The matrix represents the bivariate correlations between the four dimensions of e-government and GCI. Results are shown in Fig. 1 below.

Results indicated significant correlations between the GCI data and the four sub-dimensions of e-government. Also, the overall e-government index yielded significant relationship with GCI data. A similar test was estimated using e-government index as the independent variable and GCI as a dependent variable. Such test is similar to the bivariate correlation in Fig. 1. The model is significant at the 0.001 level with an $F_{1,132}$ = 291.8. The coefficient of determination R^2 is equal to 0.689, which means an explanation of variance equal to 69%.

Constructs	**GCI**	EGRI	E-Part	WI	HI	TI
Global Competitiveness Index (GCI)	**1.000**					
E-Government Index (EGRI)	**0.860**	1.000				
E-Participation Index (E-Part)	**0.692**	0.845	1.000			
Online Web Service Index (WI)	**0.784**	0.916	0.948	1.000		
Human Capital Index (HI)	**0.736**	0.909	0.658	0.719	1.000	
Telecommunication Infrastructure Index (TI)	**0.854**	0.950	0.702	0.786	0.850	1.000

All correlations are significant at the 0.01 level

Fig. 1. The correlations matrix.

TABLE I: The Coefficient Table of Regression

Construct	Unstand. Beta	Std. Error	Stand. Beta	t	Sig.
(Constant)	3.241	0.128		25.273	0.000
E-Participation Index (E-Part)	-0.689	0.353	-0.263	-1.950	0.053
Online Web Service Index (WI)	1.443	0.393	**0.**571	3.672	0.000
Human Capital Index (HI)	-0.029	0.281	-0.008	-0.105	0.917
Telecommunication Infrastructure Index (TI)	1.574	0.243	**0.597**	6.479	0.000

Dependent Variable: Global Competitiveness Index (GCI)

The other test is the multiple regression to predict the relationships between the four dimensions of e-government. The results indicated also a significant prediction model

with an $F_{4,133}$ = 110.6, and a p <0.001. The coefficient of determination R^2 = 0.769, which means also that we can explain the variance in GCI with a 77% value. The coefficient table of regression is shown in Table I.

IV. Conclusions

This study aimed at empirically relating the competitiveness image of a country to the level of e-government readiness. The e-government projects are crucial to more than one factor, where improved services, better government performance and political participation are major contributions. Researchers also asserted that the development of e-government web portals will open doors for global investments. Such relationships are empirically tested by previous research.

Still new directions in e-government research indicated a focus on other types of contributions like improving the image of global competitiveness. Such image is important to countries as it reflects the business investment atmosphere and the attractiveness of a country for foreign investment.

This study utilized data from the UN e-government report for the year 2014, and associated it with data published by the WEF on the competitiveness of countries. Results supported our premise significantly and associated all dimensions of e-government with GCI (refer back to the correlation matrix in Fig. 1). Also, when regressed on GCI, the four dimensions of e-government predicted GCI with a coefficient of determination equal to 70%. Such explanation of variance is considered high as reported by social sciences statistical sources [22].

The regression equation for predicting the GCI can be the following:

$$\mathbf{GCI} = 3.241 + 1.443\ \mathrm{WI} + 1.574\ \mathrm{TI} + e$$

The regression results indicated a significant prediction by web index and the ICT infrastructure. The other two dimensions (e-participation and human capital) were not significant predictors. This result explains the importance of ICT infrastructure in facilitating the competitiveness of countries. Also, the development of e-government portals is associated with the competitiveness of the country. The significant level of e-participation factor is close to 0.05, which might benefit from extra analysis of outlier data points that might improve such value. We kept the model and results as is to adhere to ethical research values and report original results as is.

It is always important to look at research from practitioners' view, where the government (represented by its officials) is the addressed by such implications. This result implies that governments need to improve their web portals and offer more information and services online. The second thought on this result is the importance of infrastructure available in a country. Finally, it is important to find measures that improve countries' competitiveness.

This study suffered from a major limitation, which is related to the nature of the GCI measure. The GCI measure includes 12 pillars that included some items related to ICT infrastructure and human capital. To avoid such limitation a segregation of the GCI measure need to be conducted to see if the ICT factor is isolated to build such relationship empirically. Still, such small portion of the GCI index would not cause such high correlations. Other limitations might be the nature of secondary data and its deficiencies. Future research can utilize a survey (national scale) that measures such relationships through other empirical paths. Such research is costly and needs financial support.

Appendix A: GCI Index Sub-dimensions and Their Measurement Factors

(Compiled by author from WEF (2015)

Factors included in Institutions pillar
Property rights (property rights; intellectual property protection) *Security* (Business costs of crime and violence; Homicide rate; Business cost of organized crime; Index of terrorism incidence; Reliability of police services) *Undue influence and corruption* (Irregular payments and bribes Average; Diversion of public funds; Judicial independence; Favoritism in decisions of government officials) *Checks and balances* (Consistency of judicial system; World Press Freedom Index). *Public sector performance* (Burden of government regulation; Government Online Service Index; Efficiency of legal framework in settling disputes; Efficiency in provision of public goods and services; Effectiveness of law-making bodies; Government ensuring policy stability) *Corporate ethics and governance* (Ethical behavior of firms; Strength of auditing and accounting standards; Efficacy of corporate boards; Extent of conflict of interest regulation index; Extent of shareholder governance index
Factors included in Infrastructure and connectivity pillar
Transport infrastructure (Road quality index; Quality of roads; Air Connectivity Index; Quality of air transport infrastructure; Liner Shipping Connectivity Index; Quality of port infrastructure; Quality of railroad infrastructure) *Energy infrastructure* (Electrification rate; Quality of electricity supply) *ICT infrastructure* (Mobile-cellular telephone subscriptions; Fixed-broadband Internet subscriptions; Wireless-broadband subscriptions; Internet users)
Factors included in Macroeconomic Stability pillar
Macroeconomic Stability (Debt coverage ratio; Government budget balance; Gross national savings; Inflation; Foreign debt; Hysteresis indicator)
Factors included in Health pillar
Health (Years of life lost (YLLs): Non-communicable diseases; YLLs: Communicable diseases; YLLs: Injuries; Years lived with disability (YLDs): Non-communicable diseases; YLDs: Communicable diseases; YLDs: Injuries; Infant mortality)
Factors included in Education pillar
Skills of the current workforce (Primary attainment rate; Secondary attainment rate; Tertiary attainment rate; Extent of staff training) Skills of future workforce (School life expectancy (SLE): Primary level; SLE: Secondary level; SLE: Tertiary level; Quality of the education system; Quality of vocational training; Classroom connectivity; Encouragement to creativity)
Factors included in Goods market efficiency pillar
Domestic competition (Extent of market dominance; Effectiveness of anti-monopoly policy; Competition in professional services; Competition in public services; Cost required to start a business; Time required to start a business; Bankruptcy proceedings costs; Strength of insolvency framework index; Total tax rate; Distortive effect of taxes and subsidies) *Foreign competition* (Prevalence of non-tariff barriers; Trade tariffs; Complexity of tariffs index; Burden of customs procedures)
Factors included in Labor market efficiency pillar
Flexibility and matching (Redundancy costs; Hiring and firing practices; Cooperation in labor-employer relations; Flexibility of wage determination; Ease of finding skilled employees; Ease of hiring foreign labor; Active labor market policies) *Use of talent and reward* (Pay and productivity; Reliance on professional management; Female participation in labor force; Male participation in labor force; Salary tax wedge)
Factors included in Financial market efficiency pillar
Efficiency and depth (Availability of financial services; Domestic credit to private sector (% of GDP); Financing of SMEs; Venture capital availability; Bank overhead costs; Depth of credit information index; Financing through the local equity market; Market capitalization of listed companies (% of GDP); Money supply (% of GDP))

Stability (Soundness of banks; Bank nonperforming loans; Bank Z-score; Regulation of securities exchanges; Stock price volatility)
Factors included in Technology adoption pillar
Technology adoption (Availability of latest technologies; Firm-level technology absorption; FDI and technology transfer; FDI stock; Local supplier quality)
Factors included in Market size pillar
Market size (Domestic market size index; Exports as a percentage of GDP; Potential market)
Factors included in Innovation ecosystem pillar
Innovation ecosystem (Quality of scientific research institutions; Number of researchers in R&D per capita; Availability of scientists and engineers; Number of scientific and technical journal articles per capita; PCT patent applications; Cooperation and Interaction; Encouragement to idea generation; Diversity in patents applicants; Diversity in company workforce)
Factors included in Innovation implementation pillar
Innovation implementation (Capacity to commercialize new products; Charges for the use of intellectual property; Post-incubation performance; Attitudes toward entrepreneurial risk; Companies embracing disruptive ideas; Willingness to delegate authority; Extent of marketing; Buyer sophistication)

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