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Adegboyega Ojo, Tomasz Janowski and Elsa Estevez

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Determining Progress Towards e-Government - What are the Core Indicators?

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Abstract

There are several well-established surveys on e-government. These surveys employ different assessment models for e-readiness, digital divide and other relevant factors, leading to varying conclusions on the global state of e-government. This paper presents a comparative study of 11 international surveys on e-government between 2001 and 2004. It identifies a common set of 'core indicators' for assessing e-readiness and suggests ways to determine the weights for them. The paper also introduces the concept of a 'target e-ready state' and examines how it may provide a scale for determining the progress of individual countries.

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Contents

1 Introduction

e-Readiness measures how well a society is positioned to utilize the opportunities provided by Information and Communication Technologies (ICT). ICT infrastructure, human capital, regulations, policies and Internet penetration are all crucial component of e-readiness.

e-Readiness assessment can be an effective tool to carry out planning, monitoring and evaluation of the initiatives toward Information Society in general and e-Government in particular. Several surveys have been carried out on e-readiness at the national, regional and global levels by different international and corporate organizations (Choucri et al 2003). These organizations include: Accenture, Asia-Pacific Economic Cooperation Forum, Centre for Public Policy of the Brown University, the Economist Intelligence Unit, IBM Institute for Business Value, International Telecommunication Union, McConnell International, Mosaic Group, United Nations Conference on Trade and Development, United Nations Department of Economic and Social Affairs, World Bank and World Information Technology Service Alliance.

Providing an effective e-government readiness assessment framework is a necessary condition for advancing e-government. This framework should not rely solely on the general e-readiness measures, as clearly e-readiness transcends e-government. In fact, one of the major drawbacks of the past e-readiness surveys is lack of a clearly defined purpose, beyond the operational definitions provided. A framework for effective e-government assessment must instead identify and focus on the critical variables for e-government and consider the peculiarities of the environment assessed.

This paper presents a comparative analysis of the survey series consistently carried out by three organizations between 2001 and 2004: United Nations Department of Economic and Social Affairs (UN-DESA), Accenture, and the Centre for Public Policy of the Brown University (CPP-BU). The surveys benchmark countries based on different sets of indicators. For instance, UN-DESA provides information on the maturity of online presence, availability of the basic ICT infrastructure, and human development of UN member states. Accenture examines the breadth and depth (sophistication) of online services of a number of selected countries. CPP-BU reviews official government websites across all countries and regions for specific features and online services. The analysis reveals that the use of different sets of indicators and different weights assigned to them (to signify their perceived importance) lead to varying conclusions on the performance of the countries in terms of e-readiness and e-government.

Following the analysis of the surveys, the paper provides a definition for e-government readiness and identifies a set of ‘core indicators’ that are critical for the countries to avoid digital divide or isolation. In addition, the paper shows how weights may be determined quantitatively to provide the ranking that reveals the digital divide in the global scale. Finally, we introduce the concept of the ‘target e-ready state’ as a way to specify the profile of a typical e-government-ready country in terms of the core indicators, global standards and also the regional peculiarities. The target e-ready state provides a viable alternative to the relative reference usually adopted in most e-readiness surveys, which typically hides the efforts made by the lagging countries towards e-government.

The rest of the paper is structured as follows. Section 2 discusses e-readiness assessment and its applications to e-government. Section 3 describes three survey series by UN-DESA, Accenture and CPP-BU. Section 4 compares these series. Section 5 identifies the core indicators for e-government readiness and Section 6 assigns weights to them. Finally, Section 7 introduces the concept of the target e-ready state and Section 8 presents some conclusions.

2 e-Readiness Assessment and e-Government

The aim of e-readiness assessment is to investigate how the different spheres of society - health, security, education, governance, etc. are able to utilize the opportunities created by Information and Communication Technology, particularly the Internet. The notion of e-readiness broadly covers political, regulatory, organizational, cultural, communication and technological factors.

There are at least three factors to motivate countries to advance e-readiness. First, ICT promises enormous benefits towards solving economic and social problems, for instance job creation through the ICT industry or productivity enhancements for ICT-intensive sectors. Second, non e-ready states risk becoming digitally isolated and non-competitive. Third, ICT development is now firmly on the international organizations' and foreign donors' agendas, through the programmes like the UN's Millennium Development Goals or the World's Bank infoDev programme.

Various e-readiness assessment models have been developed over the years by different international and corporate organizations especially for the purpose of international benchmarking. In (Bridge.org 2001), a number of e-readiness assessment models were presented including readiness for the networked world, readiness for e-commerce, readiness for participation in the global digital economy, Internet diffusion, and ICT diffusion in general. Presently, there is an impressive number of indices available for international benchmarking: International Telecommunication Union Digital Access Index, World Economic Forum Networked Readiness Index (Dutta et al 2004), United Nations Conference on Trade and Development ICT Development Index (UNCTAD 2003), the Economist Intelligence Unit e-Readiness Index, Mosaic Group Index, Conference Board of Canada Connectedness Index, and ORBICOM Infostate Index. These indices implicitly assume different definitions for e-readiness and consequently their component indicators or measures. As one would expect, their outcomes differ.

We may organize these indices into two categories:

1. General indices measuring ICT capacity, Internet diffusion and other access-related issues without any particular focus on specific aspects of Information Society.
2. Indices that target particular themes, for instance e-commerce or e-government. One example is the Economist Intelligence Unit e-readiness Index which measures the degree to which a society is ready for e-business opportunities. Another is the UN-DESA e-readiness model which targets e-government readiness.

We believe that while the general assessment is needed to identify the basic concerns for societal actions towards the Information Society (IS), the focused assessment for key aspects of IS - e-government, e-commerce, e-education, e-health, e-science etc. are fundamental to achieve substantial progress. This paper is a contribution towards a focused assessment of e-government.

Relatively few models exist for e-government readiness assessment. In addition to the UN e-readiness Index (UNDESA 2004), the e-government ranking (West 2004), Overall Maturity Index (Accenture 2004), and IST SIBIS e-government Index (Grannfland-Essers 2003) have been used for assessing e-government globally and within Europe. These different models, like the typical e-readiness assessment models use different sets of indicators to measure e-government readiness. UN, for instance, considers both general and specific indicators, while all others only consider the indicators pertaining to e-government applications or government websites. In fact, there is presently no common and accepted definition for e-government readiness (Carbo 2004).

The next section carries out a comparative analysis of three survey series on e-government.

3 Three e-Government Survey Series

A number of organizations have consistently carried out e-government surveys since 2001. These include: United Nations Department of Economic and Social Affairs (UN-DESA) which publishes Global e-Government Readiness Series, Accenture which publishes e-Government Leadership series and Centre for Public Policy of the Brown University (CPP-BU) which publishes Global e-Government rankings series. The following sections briefly describe each of these series.

3.1 UN-DESA Global e-Government Readiness Series

The United Nations Department of Economic and Social Affairs (UN-DESA) conducted e-government surveys in 2001, 2003 and 2004. These are documented in (UNDPEPA 2002), (UNDESA 2003) and (UNDESA 2004) respectively.

The surveys benchmark countries based on their online presence, human capacity development and telecommunication infrastructure. The online presence is measured using the UN Web Measure Index which profiles countries based on the five-stage web maturity model: emerging, enhanced, interactive, transactional and networked. Moving towards the higher maturity stages represents the progress from static information offered one-way by the government, through two-way interaction with the government, to full support for complete transactions with the government online. The human capacity development is measured by the literacy level and gross enrolment ratios for primary, secondary and tertiary education. The telecommunication infrastructure considers the number of available PCs, the number of fixed telephone lines, mobile phone subscription, Internet users, citizens with access to TV and the online population (Internet usage).

Online presence, human capacity development and telecommunication infrastructure are all assigned equal weights in computing the overall e-readiness index. The UN survey covers all 191 UN member states. Empirical analysis shows that the outcomes of all three UN surveys were very consistent. The correlation between the e-readiness indices for consecutive survey years are 0.8829 for 2001/2003 and 0.9613 for 2003/2004.

3.2 Accenture e-Government Leadership Series

Accenture has consistently carried out annual e-Government Leadership Surveys since 2000, documented in (Accenture 2001), (Accenture 2002), (Accenture 2003) and Accenture (2004). Unlike the UN-DESA surveys, Accenture surveys considers just over 20 countries.

The survey considers service and delivery maturity. Service maturity is measured by the breadth and depth of e-service delivery. The former is expressed by the number of public services offered online, the latter by the level of sophistication of such services, according to the three-stage maturity model: publish, interact and transact. Delivery maturity is evaluated based on the level of support for customer relationship management provided to users. Service and delivery maturity are assigned different weights in computing the overall maturity. Weights vary from year to year. Correlations between results for consecutive years are extremely strong: 0.8072 for 2000/2002, 0.8952 for 2001/2002, 0.9308 for 2002/2003 and 0.9678 for 2003/2004.

3.3 CPP-BU Global e-Government Rankings Series

The Centre for Public Policy of the Brown University (CPP-BU) commenced the survey of national government websites in 2001. The surveys are documented in (West 2001), (West 2002), (West 2003) and (West 2004). Between 1197 and 2288 websites are studied each year.

The survey examines the features related to online information, electronic services, privacy and security, disability access, foreign language access, advertisement and user fees, and public outreach. CPP-BU provides a fairly simple methodology for ranking countries. It awards a certain number of points (for instance 4 points in the 2004 survey) for the presence of 18 specific features: publications, databases, audio clips, video clips, foreign language support, absence of adverts, absence of premium fees, absence of user fees, disability access, privacy policy statements, security policies statements, digital signature on transactions, options to pay through credit cards, email contact information, areas to post comments, options for email updates, options for website personalization and PDA accessibility. Countries are further awarded a point for each executable service provided online (up to the maximum of 28 points). The maximum obtainable score is 100.

Interestingly, while the rankings over the years were based on the same fundamental features, only from low to moderate correlations can be observed between the rankings obtained for consecutive years: 0.4849 for 2001/2002, 0.5183 for 2002/2003 and 0.6099 for 2003/2004.

4 Comparative Analysis

Clearly the UN-DESA surveys provide a broader set of indicators for e-readiness assessment than the other two surveys. Accenture and CPP-BU have a relatively similar focus: evaluation of information and services provided online by governments. This observation is empirically supported by the results presented in Table 1.

No	**Survey Pairs**		**Correlations**			
			2001	**2002**	**2003**	**2004**
1	UN-DESA	Accenture	0.3923		0.4486	0.6332
2	UN-DESA	CPP-BU	0.5982		0.6071	0.5793
3	Accenture	CPP-BU	0.5900	0.5502	0.7177	0.7633

Table 1: Correlations between e-government indices 2001 – 2004

The largest disparity between these three e-government rankings occurred in 2001, particularly the rankings between UN-DESA and Accenture - 0.39. Table 1 also shows an increasing agreement between surveys over the years. This may reflect some consensus on the features considered important in online presence assessment. For instance, the UN-DESA web maturity model covers most of the specific features used in the CPP-BU surveys. In addition, the Accenture's service maturity model is implicitly captured by the UN-DESA five-stage web maturity model.

Some of the differences between these surveys may be also explained by the weights assigned to sub-indices within each survey. For instance, UN-DESA considers the features associated with the five stages of web maturity equally important. The additive nature of this index may allow for countries to compensate for their weaknesses in one stage (say transactional services) with their strengths in another stage (say in interactive services). In contrast, Accenture explicitly rewards the sophistication of the online services, as the overall maturity is computed as the product of the breadth and depth dimensions. Thus, a country with a handful of transactional services but with relatively weaker

support for online information is ranked more favourably in the Accenture survey, unlike the UN-DESA survey. Since the features used in the CPP-BU survey are almost entirely covered by the UN-DESA web assessment model and similar weights are assigned to transactional services in both surveys (20% for UN-DESA and 28% for CPP-BU), stronger similarities between UN-DESA and CPP-BU results are indeed expected.

While the above results are useful for obtaining convergence of the different benchmarking efforts, an aggregate index is of a lesser use for diagnostic purposes or as a basis for concrete actions. Information on specific sub-indices and indicators are seldom provided by the benchmarking organizations. There is definitely a need for an e-government readiness policy to underpin 'transparent' assessment models developed by specific benchmarking organizations (Bakry 2003). The policy could provide common assessment measures to analyse e-government readiness for different countries, by unambiguously identifying the core indicators, while making possible to take into account the peculiarities and opportunities existing in particular countries (Choucri et al. 2003).

5 Core e-Government Readiness Indicators

UN-DESA surveys are by far the most comprehensive of the three series examined in Section 4, including both generic indicators to measure e-readiness and specific to measure e-government readiness. The surveys employ 13 basic variables spanning technology, human development and online presence. The 2004 survey considers three additional variables to assess e-participation:

- e-Information - availability of policies, programmes, budget, laws, regulations and tools to aid information dissemination (such as web forums, chat rooms, mail lists and others),
- e-Consultation – places to discuss public policies online and real-time access to video and audio recordings of the public meetings, and
- e-Decision-Making – making possible for citizens to provide input to the decision-making process online, and providing feedback on the outcomes.

These 16 variables provide the basis for identifying the so-called 'core indicators'.

Definition [Core e-Government Readiness Indicators]
Core e-government readiness indicators are those e-government readiness indicators that account for the wide disparity between the 'top ready' and 'not ready' countries.

Those indicators typically exhibit a relatively high variability among countries and have low global averages. Thus, we may be able to identify them by computing their coefficient of variation (standard deviation divided by the mean value). Table 2 provides for each of the 16 variables a number of statistical measures: minimum value, index of the 25% percentile, index of the 75% percentile, maximum value, global average, global average index and coefficient of variation. The values are based on the 2004 UN-DESA survey.

Indicators	Min	25% Index	75% Index	Max	Mean	Mean Index	Variation
PCs/1000 persons	0.0000	0.0043	0.1449	760.00	93.35	0.1228	163.89%
Internet Users/ 1000	0.0000	0.0061	0.1843	607.60	107.30	0.1766	147.78%
Persons Online/1000	0.0000	0.0034	0.1475	699.00	92.09	0.1317	170.50%
Telephonelines/1000	0.0000	0.0228	0.3251	921.00	194.80	0.2115	109.85%
Mobile Subscriptions/1000	0.0000	0.0092	0.3188	1013.00	217.80	0.2150	129.19%
TV/1000 persons	0.0000	0.0366	0.4297	875.00	237.60	0.2715	95.14%
e-Information	0.0000	0.0588	0.3529	17.00	3.61	0.2122	111.57%
e-Consultation	0.0000	0.0000	0.1923	26.00	3.28	0.1260	173.56%
e-Decision Making	0.0000	0.0000	0.2000	15.00	1.86	0.1243	154.93%
Stage I	0.0000	0.2500	1.0000	100.00	64.99	0.6499	60.70%
Stage II	0.0000	0.1030	0.7130	100.00	40.15	0.4015	81.19%
Stage III	0.0000	0.0830	0.5120	100.00	32.45	0.3245	84.70%
Stage IV	0.0000	0.0000	0.0259	92.70	7.62	0.0822	239.58%
Stage V	0.0000	0.0000	0.1902	77.80	11.07	0.1423	149.61%
Adult literacy	12.8000	0.6491	0.9828	100.00	81.24	0.7849	25.35%
Gross Enrolment	19.0000	0.4105	0.6632	114.00	69.11	0.5275	28.46%

Table 2: Statistical properties of 16 representative e-government readiness indicators

The variables with the largest variation are clearly: Stage IV Maturity (239.58%), e-Consultation (173.56%), Persons Online (170.50%), PCs Penetration (163.89%), e-Decision Making (154.93%), Stage V Maturity (149.61%) and Internet Users (147.78%). From our definition, they can be justifiably considered the core e-government readiness variables. Mobile Subscription and e-Information also exhibit large variability levels and could be considered core variables as well.

Table 3 presents five clusters of countries identified based on the 2004 UN-DESA survey. These clusters were generated using the so-called Self Organizing Map algorithm. This algorithm takes as input the 16 e-readiness variables for the 191 UN member states and organizes them into classes (clusters) of the countries with similar profiles. Clusters 1 and 2 in Table 3 are singleton classes. Clusters 3, 4 and 5 contain 18, 25 and 146 countries respectively. From the values presented, Clusters 1 to 4 contain the most e-ready countries, while Cluster 5 contains the least e-ready countries. For instance, while Cluster 1, 2 and 3 countries have between 366 to 425 PCs for every 1000 persons, Cluster 5 countries only have 30 PCs for every 1000 persons. Also, while Cluster 1 to 4 countries have an online population of between 190 and 598 per 1000 persons, Cluster 5 countries have an online population of 26 persons per 1000 persons.

Indicators	Overall	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
PCs/1000 persons	93.4	366.2	625.0	424.5	191.4	30.2
Internet Users/ 1000	107.3	406.2	537.5	433.1	223.4	42.2
Persons Online/1000	92.1	553.2	597.5	435.3	191.3	26.2
Telephone lines/1000	194.8	587.4	658.9	554.9	364.5	115.4
Mobile Sub./1000	217.8	844.9	488.1	701.5	532.0	98.3
TV/1000 persons	237.6	661.0	854.0	565.7	430.4	157.0
e-Information	3.6	17.0	16.0	11.4	7.3	1.8
e-Consultation	3.3	26.0	25.0	13.9	6.7	1.1
e-Decision Making	1.9	15.0	15.0	7.2	3.5	0.8
Stage I	65.0	100.0	100.0	99.3	94.0	55.3
Stage II	40.1	97.7	100.0	93.0	75.5	26.8
Stage III	32.4	94.0	100.0	81.3	57.8	21.2
Stage IV	7.6	92.7	92.7	44.7	13.9	0.8
Stage V	11.1	77.8	77.8	44.0	19.5	4.7
Adult literacy	81.2	99.0	99.0	98.4	94.7	76.6
Gross Enrolment	69.1	113.0	92.0	96.0	81.7	63.2

Table 3: Cluster profiles for UN-DESA e-government readiness indicators

Figure 1 provides a clearer view of the relative capacity of the countries belonging to each of the clusters. Clearly, Cluster 5 members are the least competitive in terms of the Stage IV Maturity, Online Population, PC penetration, Internet Users, e-Consultation, Stage V Maturity and e-Decision Making. The divide between Cluster 5 and other clusters is narrower considering human capacity development, Stage I, II and III of web maturity, TV and fixed telephone lines.

In general, Figure 1 shows that the Cluster 5 countries generally fall below the global averages for almost all 16 e-readiness indicators. For these countries to improve their e-government status, serious attention must be given to: advancing online presence beyond the basic interaction to full transactional and networked levels; improving access in terms of Internet users, online population and PC penetration; and promoting e-participation.

These results show that e-government readiness is determined by:

1. mature online presence characterised by full transactional services,
2. support for citizens' engagement in consultation and decision-making, and
3. availability of the requisite access infrastructure (PCs, Internet, mobile phones and others).

This definitely does not imply that other e-readiness indicators should be ignored. The purpose of identifying the core indicators is primarily to provide a basis for defining common assessment measures to analyse e-government readiness for different countries.

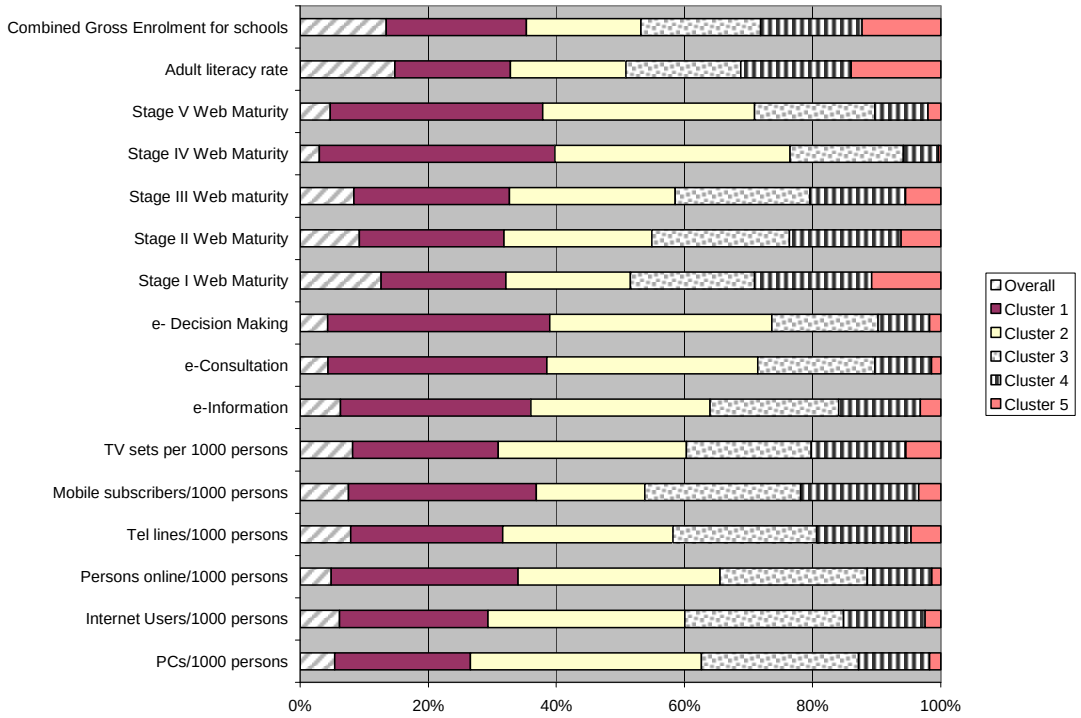

Figure 1: Relative cluster capacities for e-government indicators

6 Assigning Weights to Core Indicators

Most international benchmarking surveys rely on the use of a single index to reflect the relative readiness of different countries. The adequacy of this index is measured by how well it describes the actual state of e-readiness. Weighting is the primary mechanism for fine-tuning the assessment model, especially considering the targeted assessments. In general, assigning weights to indicators is subjective and therefore a source of concern. While a completely mechanical determination of weights may not be ideal, some degree of objectivity will no doubt improve the effectiveness of the compound indices. However, to account for peculiarities and opportunities existing in different countries, the determined weights could be adjusted.

We believe that the core indicators should be assigned larger weights than others to clearly reveal the e-readiness gap that exists between countries. To maximize the e-readiness divide, the relative weights of indicators may be computed as normalised values of their coefficient of variation. Another approach is to assign higher weights to the indicators with low global averages. Based on the results in Table 2, possible weights for the 16 indicators are shown in Table 4. The weights were calculated as normalized values of their coefficient of variation. We can see that the Stage IV Maturity which has the highest variability in Table 2 is assigned the weight of 1.00 in Table 4.

PC/s	0.68	e-Information	0.47	Stage IV Maturity	1.00
Internet Users	0.62	e-Consultation	0.72	Stage V Maturity	0.62
Online Population	0.71	e-Decision Making	0.65	Adult literacy	0.11
Telephone lines	0.46	Stage I Maturity	0.25	Gross enrolment	0.12
Mobile subscription	0.54	Stage II Maturity	0.34		
TVs	0.40	Stage III Maturity	0.35		

Table 4: Computed weights for e-government readiness indicators

7 Defining a Target e-Ready State

The use of absolute and relative indices in benchmarking continues to enjoy a wide debate. The International Telecommunication Union noted in their 2002 World Telecommunication Development Report that an approach based on comparative rankings may be more meaningful than one that uses an absolute growth rates (UNCTAD 2003). Relative rankings, such as the UN-DESA e-government readiness rankings are based on the countries with the maximum scores. This makes the year-to-year comparison of results difficult.

We therefore propose the use of an 'absolute' reference for all indicators. This reference would be determined by benchmarking or other organizations by considering the realities of the major regions of the world. It would not be tied to the performance of any particular country, but rather to a hypothetical ideal e-ready country, called the 'target e-ready state'.

Definition [Target e-Ready State]
A target e-ready state is a hypothetical "ideal e-ready state" constructed for the purpose of computing e-government readiness indices. It is an absolute reference – not related to the performance of any particular country, and at the same time relative – it is constructed taking into account the realities of the region under assessment.

When used as a basis for international rankings this target e-ready state would allow for objective year-to-year comparisons of the progress of individual countries, regions and also globally.

8 Conclusions

Assessing e-government readiness is crucial for advancing e-government. At present, there are no clear prescriptions to carry out such assessment. Different sets of indicators are used by different benchmarking organizations. Most of them concentrate on the features available on government websites and on the delivery of online services, for instance the Accenture and CPP-BU e-government readiness surveys. The UN-DESA survey provides the most comprehensive assessment of e-government so far, covering human capacity development, telecommunication infrastructure, online presence, and e-participation in assessing readiness of UN member states.

The disparity and lack of standards for e-government assessment lead to varying conclusions on the global e-government readiness. We have shown in this paper that the outcomes from the three e-government surveys by UN-DESA, Accenture and CPP-BU do not in general agree on the relative readiness of countries. To aid the provision of standards in e-government assessment, we identified the set of core indicators that are central to e-government readiness, based on the data provided through the 2004 UN-DESA survey. We determined that later stages of web maturity (transactional and networked), e-participation (e-consultation and e-decision-making), Internet usage and access

(online population, Internet users, PC penetration) are all central to advancing e-government. We assert that e-government readiness depends on three crucial factors: mature online presence with transactional services, support for citizens' engagement in consultation and decision making, and availability of the access infrastructure (PCs, Internet, mobile phones).

We provided an approach for determining weights for the indicators based on their variability, to yield rankings which clearly separate countries. The computed weights could be refined as required to take into account some other considerations. Furthermore, the paper suggested the notion of a 'target e-ready state' as a reference to construct rankings providing a more balanced view of global e-readiness, with due regard paid to the realities of regions or groups of countries.

We believe that a firm theoretical basis is essential for any sound e-government readiness assessment, whether carried out locally, regionally or globally. (Bakry 2003) describes a framework for international e-readiness which could be rigorously adapted for e-government readiness. The e-government readiness assessment methodology presented in (UN-DESA 2003b) could also serve as a foundation for developing international e-government readiness assessment models. These are possible directions for our future work.

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