

## Comparison and Evaluation of International e-government Benchmarking Studies

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### Abstract

E-government benchmarking provides a prioritized roadmap to countries in order to improve their own e-government services that affect their economy in a positive direction. Because of this high impact and due to the increasing speed of technology, international benchmarking has become more important and the number of research studies have increased in e-government benchmarking area especially in the last 20 years.

This comparative research analyses 16 international e-government benchmarking studies completed between 2001 - 2016 and identifies the common points and the differences with respect to 22 different criteria such as benchmarking target, country coverage, benchmarking period, measurement organization class, focus stages, pillars, indexes and sub-indexes, indicators, measured values, cooperation ecosystem, transparency levels, gross domestic product (GDP) and regional considerations for five major International e-Government Benchmarking (IEGB) studies defined according to the study selection criteria. The research identifies the mostly covered areas, the common benchmarking criteria and their prioritizations, scope of application, the most preferred collaboration channels, the preferred methodologies, the differences between benchmarking approaches by analysing benchmarking reports and methodologies.

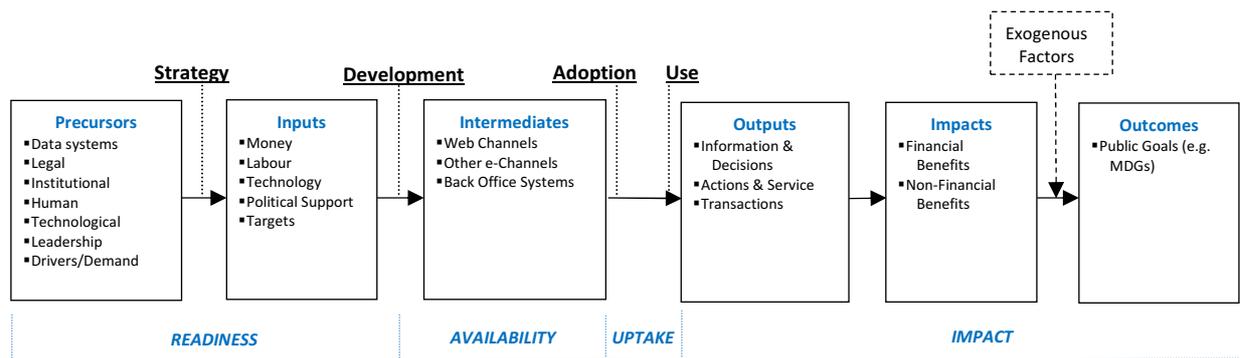
It has been observed that each measurement study has strong and weak perspectives. In almost all of the studies, two out of nine focus stages of the e-government benchmarking framework were found to be in common, while some stages were not taken into account in any of the measurements. Some benchmarking studies targeted specific development areas and identified the criteria list according to these targets. This research will help improve the benchmarking methodologies for future studies, identify the main areas (common index categories) of measurements that will help the e-government development in the countries by focusing those specific prioritized areas and guide the prospective researchers to prepare a framework for increasing e-government maturity.

**Keywords:** E-government, Benchmarking, Measurement, Comparative e-government, Indicators

### 1. Introduction

E-government can be defined as “the use by government agencies of information technologies (such as Wide Area Networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government” (The Word Bank et al, 2002). An e-government project has a value chain that is composed of inputs that are turned into value (outputs) by a government as shown in Figure 1.

E-government provides very powerful tools and ways for most efficient and effective government services, transparency, accountability and participation in our daily lives. Due to this importance, measuring the level of e-government services has become a very important indicator for the success of an e-government in a country. Comparison between many countries by using suitable criteria in e-government area provides the opportunity of identifying and improving the weak points of services. A benchmarking provides the status of a government in both national and international levels. As a result, continuous and regular benchmarking is very important while providing better e-services.



**Figure 1:** E-government Value Chain (Heeks et al 2006).

E-government benchmarking is a review of comparative performance of e-government between nations or agencies. E-government benchmarking studies have two purposes: internal (benefit achieved for the individual or the organization undertaking the benchmarking study) and external (benefit achieved for users of the study). Different benchmarking methods may serve as hints for improvements within different phases of an e-government value chain (Heeks et al 2006). According to the e-government value chain, different types of benchmarking models can be prepared in order to measure the development or to improve the e-government maturity with respect to other countries or through time.

The purpose of this paper is to analyse all well-known international e-government benchmarking studies and find out the mostly covered focus stages, common benchmarking criteria, scope of benchmarking for each study, mostly preferred collaboration channels and methodologies while benchmarking. Within this framework, all organizations are categorized according to the activity status. Focus stages of active organizations are determined in Section 2. In Section 3, search strategies (SS) are defined according to the research questions (RQ) and study selection criteria (SSC) are prepared for benchmarking organizations. In Section 4 provides the answers of research questions and comments coming from this research is presented in Section 5.

## 2. Background and Related Work

Many international organizations, consultancy firms and universities measure countries' e-government readiness and activities within different perspectives periodically according to their benchmarking criteria. There are some studies that analyse international benchmarking studies such as Janssen, Rotthier and Snijkers et al (2004) provides an assessment about country scope and indicator category, Adegboyga, Tomasz and Elsa et al (2005) identifies the common set of core indicators based on UN-DESA surveys using outcomes from three e-government surveys (UN-DESA, Accenture and CPP-BU), Berntzen and Olsen et al (2009) compares three studies from Accenture, Brown University and UN-DESA, Almufteh, Weerakkody and Sivarajah et al (2016) examines 17 e-government models to find commonalities among them.

In this study, most known 16 benchmarking studies will be evaluated according to their criteria for the selected benchmarking systems. Also comparison of all studies will be prepared according to 22 criteria. In addition, direct relation to the e-Government of all studies are categorized according to the activity status.

The publications in the last 16 years can be summarized in Figure 2. Those organizations can be grouped into three categories as Activity Status (AS):

- Active Organizations: Organizations that are currently publishing periodic reports: EU and Cappemini et al (2016), OECD et al (2015), UN et al (2016), Obi et al (2016) and WEF et al (2016).
- Related Organizations: Organizations that measure e-government partly or studies in related axes of e-government in their reports published: Accenture et al (2014), AAO et al (2005), Deloitte et al (2016), EIU and IBM et al (2010) and EIU et al (2014), ITU et al (2011), Rutgers and Sungkyunkwan University et al (2016) and World Bank et al (2016).
- Inactive Organizations: Organizations that have published periodic reports but no longer produce reports: ADB et al (2011), Brown University et al (2007), DEEDS et al (2003) and RAND Europe et al (2003).

CATEGORY Report Publication Year	ACTIVE ORGANIZATIONS					RELATED ORGANIZATIONS							INACTIVE ORGANIZATIONS			
	WEF	WU	EU	UN	OECD	WB	Deloitte	Accenture	EIU	RUTGERS&SU	ITU	AAO	BU	SIBIS	ADB	DEEDS
2001	●		●	●				●					●	●		
2002	●		●	●				●					●	●		
2003	●		●	●				●	●				●	●		
2004	●		●	●		●		●	●	●			●	●		●
2005	●	●	●	●		●		●	●	●		●	●	●		●
2006	●	●	●	●	●	●		●	●	●		●	●	●		●
2007	●	●	●	●	●	●	●	●	●	●		●	●	●		●
2008	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
2009	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
2010	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
2011	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2012	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
2013	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
2014	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
2015	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
2016	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
2017	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
TOTAL PUBLICATIONS	16	12	11	9	6	14	10	9	8	7	3	1	7	3	1	1

Legend: ● Publication ○ No Publication ○ Discontinued Study ● Publication only once

Figure 2: E-government Benchmarking Report Publications – Activity Status of Organizations

An e-government service lifecycle for benchmarking can be summarized in nine stages as “State”, “Target”, “Inputs”, “Process”, “Outputs”, “Usage”, “Outcomes”, “Coordination” and “Impacts” (see Figure 3, adapted from Heeks et al 2006, Codagnone and Arne Undheim et al 2008). It can be easily seen that; the focus stages of benchmarking studies of active organizations vary from “state” to “impacts”. It is seen that, there is no generic approach to the stages of lifecycle while benchmarking, since different studies focuses on different stages. Having more stage better range of evaluation but also causes difficulties while providing related data during limited benchmarking study time. In this paper, all active studies are analysed and associated with the corresponding states (Figure 3).

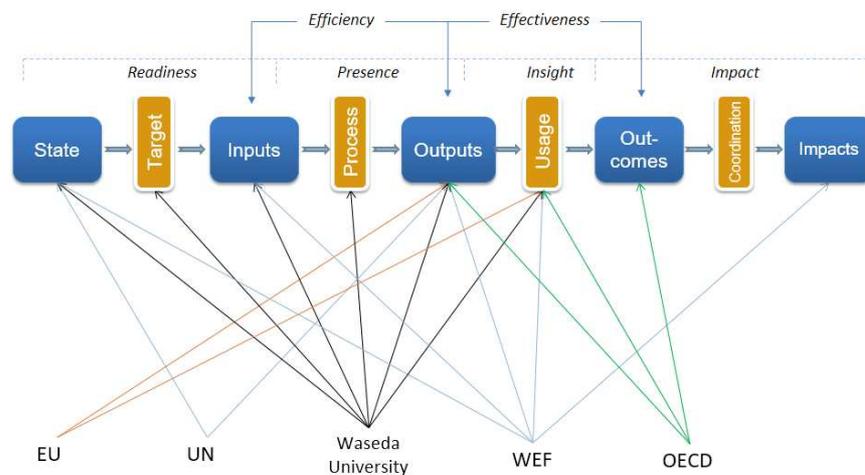


Figure 3: “Focus Stages” of Selected Benchmarking Studies on the “Benchmarking Framework for E-government”

Since it is important to be active to make comparisons between years, the scope of this research covers only the active organizations. According to selected criteria, all active organizations are analysed in detail. The current states of benchmarking organizations according to their published latest benchmarking studies are presented in Table 1. In this table only the active organizations have been evaluated since the related organizations do not have a full coverage of the e-government benchmarking. The inactive organizations are also not included in the study due to the fact that they have either obsolete results or are outdated.

### 3. Research Method

This research targets to find answers to the following research questions (RQ) for International e-Government Benchmarking (IEGB) studies:

- RQ1: Which focus stages are mostly covered by IEGB studies?
- RQ2: What is the common benchmarking criteria in IEGB studies?
- RQ3: How wide (scope of) benchmarking is applied?
- RQ4: What is the most preferred collaboration channels?
- RQ5: Which methodologies are preferred in general?

While trying to answer the research questions, the following methodology is used that consist of five basic steps:

- Identify global actors and their reports on IEGB related to RQ's with the following search strategies (SS):
  - SS1: Publications/reports/documents of intergovernmental/international and supranational organizations and universities that deal with IEGB.
  - SS2: Desktop research on the internet about the reports, researches and books on IEGB to fill out the gaps in previously mentioned reports.
  - SS3: Contacting with the central government bodies that are responsible for data about IEGB for details.
  - SS4: Contacting with the national delegations of IEGB in international decision-making meetings in order to provide information about benchmarking issues.
  - SS5: Desktop research of academic papers.
- Prepare an inventory of all publications (found in SS1) applicable to IEGB studies.
- Prepare a criteria list that will be applied to all benchmarking studies.
- Fill out the criteria list by using the last published benchmarking study/report
- Prepare comparison table that answer the research questions.

Study selection criteria (SSC) is prepared according to the following items while taking into consideration of the search strategy:

- Number of published reports (for experience and measurement maturity)
- Coverage of the benchmarks (i.e. number of countries)
- Sustainability (i.e. consistent report publishing period)
- Supranational or academic research support
- Transparency in procedures
- Comparability
- Verifiability with data sets and open formulation

Since sustainable publication of report and transparency in procedures are the conditions for SSC, all materials are collected with desktop research method. Re-arranged reports are reviewed according to the selected comparison criteria. When answers to some criteria could not be found in a report, related institutional presentations and conference proceedings published by the benchmarking institution (or university) are taken into consideration due to the fact that in some cases methodology is preferred to be detailed in a separate document.

Table 1 Institutions of IEGB Studies - Comparison Table

	UNDESA	WEF	EU	WU	OECD
<b>Report Name</b>	UN e-Government Survey	The Global Information Technology Report (GITR)	European e-Government Benchmark Report	IAC International e-Government Ranking Survey	Government at a Glance
<b>Master Ranking</b>	E-Government Development Index (EGDI)	Networked Readiness Index (NRI)	EU-eGov	IAC International e-Government Ranking	Government at a Glance
<b>Benchmarking Target</b> (Explained target of benchmark study in the report)	Measure e-Government readiness of a country in three pillars [Online Service Index (OSI), Telecommunication Infrastructure Index (TII) and Human Capital Index (HCI)] that may be comparable with other countries and the previous measurements	Measure e-Government Networked Readiness which assesses the factors, policies and institutions that enable a country to fully leverage ICTs for increased competitiveness and well-being	Measure e-Government Maturity for member states and candidate countries for life-events which are selected w.r.t. EU e-Government Strategy	<ul style="list-style-type: none"> <li>▪ to share best practices,</li> <li>▪ to show the progress of e-Government development in a country,</li> <li>▪ to identify trends in e-Gov development,</li> <li>▪ to be a valued resource and cited report by the researchers and scholars</li> </ul>	<ul style="list-style-type: none"> <li>▪ Social Media Use by Government,</li> <li>▪ Digital Government Performance,</li> <li>▪ Open Government Data,</li> <li>▪ Use of e-Government services by Individuals and Businesses.</li> </ul>
<b>Country Coverage</b>	193 Countries	143 Countries	33 Countries	65 Countries	43 Countries
<b>Number of Published Reports</b>	9	16	11	9	6
<b>Benchmarking Period</b>	2 years	Yearly	Yearly	Yearly	2 Years
<b>Report Language</b>	English, Chinese	English	English	English	English, French
<b>Measurement Organization Category</b>	Intergovernmental Organization	Non-profit Foundation	Consultancy Company on behalf of Supranational Organization (EU)	University	Intergovernmental Organization
<b>Focus Stages</b>	State (for TII and HRI), Output (for OSI)	State, Input, Output, Usage and Impact	Output and Usage	State, Target, Input, Process, Output, Usage	Output, Usage and Outcomes
<b>Number of Pillars/Sub indexes</b>	Three pillars / sub-indexes: <ul style="list-style-type: none"> <li>▪ OSI: Scope and quality of online services (Aim: Most</li> </ul>	Four sub-indexes: <ul style="list-style-type: none"> <li>▪ Environment</li> <li>▪ Readiness</li> </ul>	Five pillars: <ul style="list-style-type: none"> <li>▪ User Centricity</li> <li>▪ Transparency</li> </ul>	-	Nine sub-indexes with four pillars: <ul style="list-style-type: none"> <li>▪ Social Media Use by</li> </ul>

	UNDESA	WEF	EU	WU	OECD
	<p>frequently used services, Values are provided from public agencies web pages and a questionnaire, with value 1=Exists, 0=Not exist)</p> <ul style="list-style-type: none"> <li>TII: Development Status of Telecommunication Infrastructure (Aim: More accessibility, Data is provided from ITU)</li> <li>HCI Inherent human capital (Aim: Narrowing digital gap, Data is provided from UNESCO)</li> </ul>	<ul style="list-style-type: none"> <li>Usage</li> <li>Impact with ten pillars</li> </ul>	<ul style="list-style-type: none"> <li>Seamless Government-Cross Border Mobility</li> <li>Smart Government-Key Enablers</li> <li>Effective Government</li> </ul>		<p>Government</p> <ul style="list-style-type: none"> <li>Digital Government Performance</li> <li>Open Government Data</li> <li>Use of e-Government services by Individuals and Business</li> </ul>
<b>Number of Indicators</b>	15 Indicators OSI: 1 indicator for National Portal + 5 indicators for selected e-Services, TII:5 indicators, HCI:4 indicators	53 Indicators	20 Indicators	10 Indicators with 35 Sub Indicators	-
<b>Measured Values (Main and sub index/categories/axis that is scored separately in order to obtain final measurement score)</b>	<p>Measures EGDI that is composed of three independent composite equal-weighted measures:</p> <ul style="list-style-type: none"> <li>Online Services Index, OSI</li> <li>Telecommunication Infrastructure Index, TII</li> <li>Human Capital Index, HCI</li> </ul>	<p>Calculating NRI, by using 53 individual indicators. NRI has four sub-indexes and ten pillars. NRI, pillars and indicators have their individual score between 1 (worst) to 7 (best).</p>	<p>Six top level benchmark items</p> <ul style="list-style-type: none"> <li>User Centricity,</li> <li>Transparency,</li> <li>Seamless Government-Cross Border Mobility,</li> <li>Smart Government-Key Enablers,</li> <li>Effective Government</li> </ul> <p>Seven Life Events</p> <ul style="list-style-type: none"> <li>Starting up a Business</li> <li>Losing and Finding a Job</li> <li>Studying</li> </ul>	<p>10 main and 35 sub indicators, 154 questions:</p> <ul style="list-style-type: none"> <li>National portal,</li> <li>online services,</li> <li>Government CIO,</li> <li>e-Government Promotion,</li> <li>e-Participation / Digital Inclusion,</li> <li>Open Government,</li> <li>Network Infrastructure Preparedness,</li> <li>Cyber Security,</li> <li>Management Optimization/Efficiency,</li> <li>The Emerging Technology</li> </ul>	<p>Four pillars</p> <ul style="list-style-type: none"> <li>Social Media Use by Government</li> <li>Digital Gov Performance</li> <li>Open Gov Data</li> <li>Use of e-Gov services by Individuals &amp; Business</li> </ul>

	UNDESA	WEF	EU	WU	OECD
			<ul style="list-style-type: none"> <li>▪ Justice</li> <li>▪ Economy</li> <li>▪ General Management</li> <li>▪ Transportation</li> </ul>	in e-Government	
<b>Open Criteria List</b>	No	Yes	Yes	Yes	Yes
<b>Transparent Methodology</b>	Yes	Yes	Yes	Yes	Yes + All data is open to the public in the internet
<b>Uninterrupted Report Period</b>	Yes	Yes	Yes	Yes	Yes
<b>Stable Country Attendance</b>	Yes (190+ Countries since 2001)	Yes (140+ Countries since 2001)	Yes (28 up to 33 countries w.r.t. member states)	Yes (But number of countries varies year by year)	Yes
<b>Regional Evaluation</b>	Yes	Yes	Yes	Yes	First regional edition is released on 2014
<b>GDP Considered Comparisons</b>	Yes	Yes	Yes	Yes (for population greater than 100 Million)	No
<b>Cooperation Ecosystem Level</b>	5	5	2	4	3
<b>Cooperation with Countries</b>	Yes since 2012	Yes	Yes	Yes (in University and NGO level)	Yes
<b>Cooperation with Private Sector</b>	Yes (for OSI)	Cisco, Booz & Company	Yes	-	-
<b>Cooperation with Academy</b>	Yes (for OSI)	Cornell University	-	Yes (International Academy of CIO (IAC), 11 universities from different countries)	-
<b>Cooperation with International Organizations</b>	ITU for TII and UNESCO for HCI	INSEAD	-	Yes (OECD, APEC, ITU, WB, UNDESA)	Yes (European Commission for the Efficiency of Justice (CEPEJ), Gallup and the European Commission)
<b>Other Cooperation</b>	International and Regional Experts	160 partner institutions for Executive Opinion Survey	-	Think-tanks and NGO/NPOs	International Labour Organization (ILO), the World Justice Project

Most of the comparison criteria can be extracted from the main benchmarking report. If a report does not include an expected data, presentations and information presented in the website of (or published book by) the benchmarking institution is used. Since the data is collected from the official sources directly the contents were not required to be verified.

#### 4. Results

Five international e-government benchmarking studies are analysed and following results were obtained for research questions RQ1 to RQ5.

RQ1 - Focus Stage Trends: When benchmarking studies are categorized according to focus stages (derived from Figure 3) that are common to all studies as shown in Figure 4, it is observed that, all institutions have focused on "Output" (100%) and most of them focused on "Usage" (80%) and three of them focused on "State" (60%). The stages "Target", "Outcomes", "Impact" and "Process" are rarely observed (20%) since it is relatively harder to benchmark these areas.

	UN	EU	WEF	OECD	WU	Total out of 5 Studies
Efficiency						0
Coordination						0
Process					●	1
Impact			●			1
Outcomes				●		1
Target					●	1
Input			●		●	2
State	●		●		●	3
Usage		●	●	●	●	4
Output	●	●	●	●	●	5

Figure 4 Preferred Focus Stages for International e-Government Benchmarking Studies

RQ2 - Common Benchmarking Criteria: In order to identify the maturity of benchmarking studies, 12 basic criteria are defined such as openness in methodology, transparency, benchmarking data sharing, wide coverage, cooperation ecosystem, GDP consideration, regional evaluation, report history and frequency. According to this comparison shown in Figure 5, World Economic Forum (WEF) meets nearly all of the criteria and European Union (EU) follows it with nine positive criteria. It is seen that all institutions have a transparent methodology, a regional evaluation and perform cooperation with countries (but cooperation with international institutions is weak). All of them have a GDP consideration and published a report this year, except for the Organization for Economic Co-operation and Development (OECD). For countries to make improvements in their e-government development, open criteria list is important. Thus, a country with a low score will understand which criterion is insufficient and will have an opportunity to improve itself. For this perspective, only the UN does not share an all criteria list for benchmarking but all other institutions do. The weakest point resides in the open data approach (that provides powerful opportunity for researches in benchmarking) since only the OECD shares all benchmarking data freely with the public. The other institutions do not share their data openly.

RQ3 - Country Coverage of Studies: EU and OECD prepares reports for their member states (including candidate states) whereas other institutions (UN, WEF and Waseda University (WU)) cover wide range of countries as seen in Figure 6.

RQ4 – Most Preferred Collaboration Channels: For the governance and common mind perspective, it is seen in the Table 1 that, all studies cooperate the benchmarked country (in order to verify the data and results). Second most preferable channel is international organizations (as data source and experience Exchange). Cooperation with Academy and private sector are in third place.

COMMON BENCHMARKING CRITERIA	WEF	EU	UN	WU	OECD
Open Criteria List	✓	✓	✗	✓	✓
Open Benchmarking Data to Public	✗	✗	✗	✗	✓
Transparent Methodology	✓	✓	✓	✓	✓
Cover more than 100 Country	✓	✗	✓	✗	✗
15+ Years of Benchmarking Experience	✓	✓	✓	✗	✗
Coop. With Countries	✓	✓	✓	✓	✓
Coop. With Private sector	✓	✓	✓	✗	✗
Coop. With International Org.	✓	✗	✓	✗	✗
Regional Evaluation	✓	✓	✓	✓	✓
GDP Consideration	✓	✓	✓	✓	✗
Yearly Benchmarking	✓	✓	✗	✓	✗
Report on 2016	✓	✓	✓	✓	✗
<b>COMBINED POINT</b>	<b>11</b>	<b>9</b>	<b>9</b>	<b>7</b>	<b>5</b>

Figure 5 Common Benchmarking Criteria - Comparison of Institutions

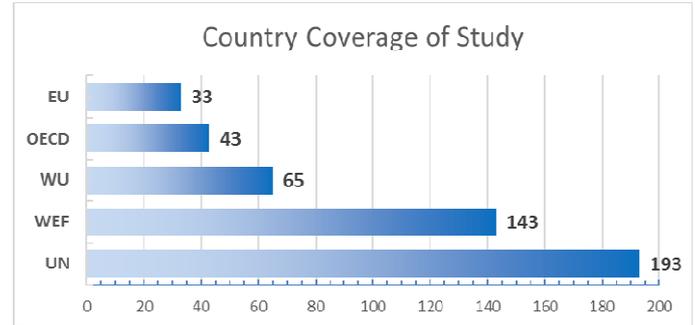


Figure 6 Country Coverage of the Benchmarking Studies

RQ5 – Preferred Methodologies (Index and Indicator Density): In order to sustain the comparability, none of institutions prefers to make changes in their benchmarking indicators dramatically but may add only a very few new indicators in order to reflect the trends. Even though each institution names differently, all of them have values for “index” and “indicator”. Currently UN has 16 indicators in three indexes, WEF has 10 indicators (namely category) on five indexes (namely main component), EU has 22 indicators on five indexes (namely benchmark level), WU has 35 sub indicators (namely indicator) on 10 indexes (namely indicator) and OECD has 10 sub-indexes (namely indicator) on four indexes (namely pillar). So those five institutions provide us total of 93 indicators and 27 indexes. In this research, the indexes were grouped to be listed under a general category as much as possible and as a result 14 categories are obtained (Figure 7). The most common index categories are “infrastructure” and “usage” that are shared nearly by all of the institutions. “Transparency” follows as the second most common index category, “efficiency-effectiveness, online services” and “human capital” is shared by only two institutions. Eight categories (impact, participation, performance, social media, ecosystem (environment), superstructure, privacy and security, user centricity) do not include more than one index, so they are unique (used only within the same institutions). The estimated reasons for some of them are benchmarking difficulty (for impact and performance) and lack of enough data (for participation, privacy and security, environment) or existence of other benchmarking studies focused on directly one index (user centricity on “Global e-Government Report” from Brown University et al 2007).

When a similar categorization was attempted for the indicators, it was determined that there were no common categories.

As seen in Figure 7, increased usage (by the benchmarking studies) indicate the areas that are more important of have more prioritized in an e-government. So by focusing into those areas (infrastructure, usage and transparency), it is possible to use the limited government resources to the more critical areas. In addition this approach will also provide better benchmarking results for those governments. This approach will also provide better benchmarking results for those governments.

Common Indexes	Usage	Organizations					
Infrastructure	6	UN	EU	WU	WU	WEF	WU
e-Service Usage	4	EU	WU	WEF	OECD		
Transparency	3	EU	WU	OECD			
Efficiency-Effectiveness	2	EU	WU				
Online Services	2	UN	WU				
Human Capital	2	UN	WEF				
Impact	1	WEF					
Participation	1	WU					
Performance	1	OECD					
Social Media	1	OECD					
Ecosystem	1	WEF					
Superstructure	1	WU					
Privacy and Security	1	WU					
User Centricity	1	EU					

Figure 7 Common Index Categories

## 5. Conclusions

It is obvious that, output of benchmarking studies provides many opportunities for improving the e-government maturity in countries and enable for comparisons between countries for government services maturity. The identification of common aspects of different measurement studies is crucial for spending the limited public resources on common goals and lets us focus on the e-government topic in the mostly researched areas. In this research, active five out of 16 well-known e-government benchmarking studies (UN, EU, OECD, WEF and WU) have been analysed in detail.

From this, it is found that, those studies focused mainly on “output” and “usage” of benchmarking framework for E-government. Second finding is that; “cooperation with countries”, “regional evaluation”, “transparent methodology”, “GDP consideration” are the common benchmarking criteria. On the other hand, weakest point is “openness” on benchmarking data.

Another result in the common index categories show that “Infrastructure” and “e-Service Usage” are the most important and preferred categories but it is striking that human-focused categories such as “human capital” and “user centricity” are involved in a very small number of studies. Also privacy and security are very important common point between e-government and cyber security but those categories are included in one study only.

It is observed that none of the studies measures the “usage of e-services by citizens”, “governance model of e-government”, “benefits of e-services” and “satisfaction”. It is possible to carry out studies in the future on preparing an improved e-government framework in the scope of the results of this research.

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