

# E-Government Portals Maturity Models: A Best Practices' Coverage Perspective

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**Abstract:** E-government is a field where oriented practice is considered crucial for its prosperity. Therefore, best practices are considered among the success factors of e-government portals. To this end, e-government maturity models can be used to provide guidance and guidelines to identify those best practices. After an extensive literature review, we have collected both; the e-government portals' best practices and organized them according to their purposes in an e-Government Portals' Best Practice Model (eGPBPM), and the set of 25 maturity models best practices in two separated previous published studies. The eGPBPM is composed of four best practice categories including: back-end, Web design, Web content and external. Moreover, each maturity model has several stages of maturity and each stage include a set of best practices used to rank the maturity of e-government portals. The goal of this paper is to identify the extent to which e-government maturity models are covering the best practices of the eGPBPM. To achieve this goal, a mapping between the maturity models' best practices for each maturity stage and the best practices of the eGPBPM has been performed. Our findings show that although this set of maturity models are used in practice, they include only some of the e-government portals' best practices and none of them have a full coverage of those best practices.

**Key words:** E-Government, maturity model, best practices, e-government portal.

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## 1. Introduction

E-government can be defined as the use of internet to deliver online services to the citizens. E-government portals can be used to deliver those services. The success of an e-government portal depends on its implementation, design and the services offered to the users [1]. However, there is no textbook or theory for e-government [2], since it is considered as an emerging field of interdisciplinary research in which practical recommendations are important features [3]. This is why, practical recommendations, case studies and best practices are considered important in building e-government portals. To this end, e-government maturity models can serve as a guide for agencies to enhance their portals' quality. Furthermore, they can also be used to determine the missing best practices at any given stage of maturity and provide recommendations to move to higher stages.

To this end, we have conducted an extensive literature review to identify the e-government portals' best practices in [1]. However, after collecting those best practices it has been noticed that they are not logically grouped. Besides that, some best practices was raised by some authors with the same meaning, but with

different wordings such as customer centricity that can be named as user focus or customer-centric [4], user-centric [5] or customer intention [6]. For this purpose, the best practices' wordings have been unified and grouped in a logical way, which is composed of four best practice categories (back-end, Web design, Web content and external). This can help practitioners and researchers to build e-government portals' easily.

An e-government portal's maturity model is a set of evolutionary stages that determines the maturity of the e-government portals. The maturity models offer a way to rank e-government portals and guide agencies to enhance their portals' quality [7]. In fact, many e-government maturity models exist in the literature and for a practitioner choosing one among the others should be done based on a strong basis, such as, the practitioner purposes and the maturity model best practices or features that will satisfy the stakeholders. For example, Lee and Kwak maturity model focuses on open government and e-participation, however other maturity models such as Layne and Lee [8] and United Nations [9] focus on e-government best practices from a global perspective. To this end, we have conducted an extensive literature review to identify the e-government portals' best practices of 25 maturity models in [7]. The purpose of this paper is to identify to which extent this set of 25 e-government maturity models are covering the best practices presented in the e-Government Portals' Best Practices Model (eGPBPM).

This paper is structured as follow: Section 2 and Section 3 provide respectively an overview on the implemented best practices in the e-government portals maturity models and the best practices of the eGPBPM, whereas, Section 4 provides the mapping conducted between the e-government portals' best practices (as in the eGPBPM) and the 25 e-government maturity models' best practices. Section 5 synthetize and discuss the result of the mapping. Finally, Section 6 concludes the paper and gives directions for future work.

## **2. E-Government Portal Maturity Models**

E-government best practices from 25 maturity models were collected during an extensive literature review in a previous study [7]. The 25 maturity models are: Layne and Lee [8], Andersen and Henriksen [10], United Nations [9], Alhomod et al. [11], Hiller and Belanger [12], Almazan and Gil-Garcia [13], Cisco [14], Karokola et Yngström [15], West [16], Moon [17], World Bank [18], Deloitte and Touche [19], Howard [20], Shahkooh et al. [21], Lee and Kwak [22], Siau and Long [23], Wescott [24], Chandler and Emanuel [25], Kim and Grant [26], Chen [27], Windley [28], Reddick [29], Accenture [30], UK National Audit Office [31] and Netchaeva [32].

These maturity models have different stages varying from 2 to 6. Table I through IV in the Appendix summarize the best practices of the maturity models with 2 and 3 stages, 4 stages, 5 stages and 6 stages respectively.

From those tables, it can be concluded that the focus of the maturity models differs from a maturity model to another. Besides that, they focus on different aspects and perspectives of e-government (such as G2C, G2G and Open government). Furthermore, while some maturity models are introducing new best practices, it seems that others are just ignoring them, such as: measuring performance and analytics for decision making introduced only by the Lee and Kwak model and ignored by all the others [7]. This can be explained by the fact that all the maturity models have been built without any input of the existing models or best practices, with the exception of Almazan and Gil-Garcia, Shahkooh et al, Siau and Long, and Kim and Grant maturity models [7]. This may result in the absence of some best practices already raised by other authors. Besides that, it can be noticed that the most important stages of maturity can be summarized into 4 different stages as the following: presence, interaction, transaction and integration.

### 3. E-Government Portal Best Practice Model

We have collected e-government portals' best practices from literature to build a best practice model in [1]. The model is composed of four best practice categories, each category contains subcategories. Fig. 1 summarizes the model, and Tables V to VIII in the Appendix provide details, advantages and examples for each best practice subcategory. The best practice categories are explained below.

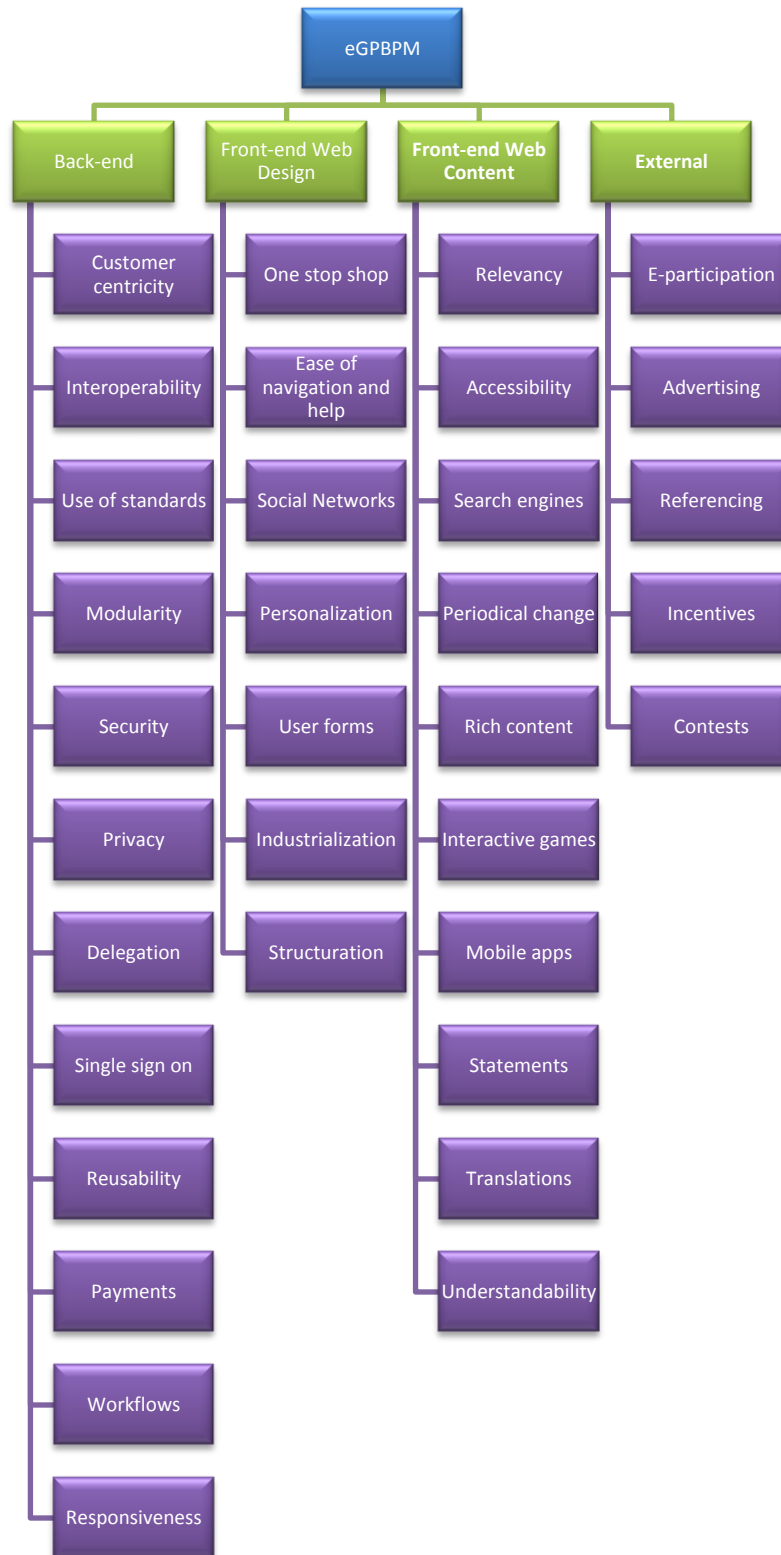


Fig. 1. Best practice model [1].

### 3.1. Back end Category

Back-end best practices can be defined as the best practices that run in background and usually the users do not see them (such as: system, data processing and business logic best practices). This includes: customer centricity, interoperability, use of standards, modularity, security, privacy, delegation, single sign on, reusability, payments, workflows and responsiveness (see Table V in the Appendix).

### 3.2. Front-end Web Design Category

Front-end - Web design best practices can be defined as the best practices that the user usually interacts with and sees, and are related to the interface or design of the portal. This includes: one stop shop, ease of navigation and help, social networks, personalization, user forms, industrialization and structuration (see Table VI in the Appendix).

### 3.3. Front-end Web Content Category

Front-end - Web content best practices can be defined as the best practices that the user usually interacts with and sees and are related to the information and content of the portal. This includes: relevancy, accessibility, search engines, periodical change, rich content, interactive games, mobile apps, statements, translations and understandability (see Table VII in the Appendix).

### 3.4. External Category

External best practices can be defined as the best practices that are loosely coupled with the technical aspects of the portal and are mostly related to the marketing of the portal and to the inclusion of the citizen in the e-government process. This includes: e-participation, advertising, referencing, incentives and contests (see Table VIII in the Appendix).

## 4. Mapping between the Maturity Models and the Best Practice Model

This section presents the mapping conducted between the maturity models' best practices and the best practice subcategories of the best practice model. The purpose is to identify to which extent the maturity models are covering the e-government portals' best practices.

Table 1. Mapping between Maturity Stages and Back-end Best Practice Subcategories

| BP subcategories \ Stage    | Stage 1 | Stage 2                | Stage 3                                                   | Stage 4                                                         | Stage 5 and above            |
|-----------------------------|---------|------------------------|-----------------------------------------------------------|-----------------------------------------------------------------|------------------------------|
| Customer Centricity         | NA      | NA                     | [19], [30]                                                | [10], [9], [13], [28]                                           | [30]                         |
| Vertical Interoperability   | [10]    | NA                     | [8], [14], [27], [30]                                     | [9], [11], [12], [33], [17], [21], [22], [23], [25], [26], [28] | [13], [19], [22], [24], [31] |
| Horizontal Interoperability | [10]    | NA                     | [14], [30]                                                | [8], [9], [11], [12], [33], [17], [21], [23], [25], [28]        | [13], [19], [22], [24], [31] |
| Use of standards            | NA      | NA                     | NA                                                        | NA                                                              | NA                           |
| Modularity                  | NA      | NA                     | NA                                                        | NA                                                              | NA                           |
| Security                    | NA      | [19], [30]             | [9], [14], [33], [18], [21], [22]                         | [13], [24], [28], [31]                                          | NA                           |
| Privacy                     | NA      | [19]                   | [33], [22], [25]                                          | NA                                                              | [12]                         |
| Delegation                  | NA      | NA                     | NA                                                        | NA                                                              | NA                           |
| Single Sign on              | NA      | NA                     | NA                                                        | NA                                                              | [22]                         |
| Reusability                 | NA      | NA                     | NA                                                        | NA                                                              | NA                           |
| Payments                    | NA      | [14], [19], [28], [29] | [9], [11], [12], [33], [17], [20], [21], [23], [19], [26] | [13], [24], [28], [31], [32]                                    | [24]                         |
| Workflows                   | NA      | [24]                   | NA                                                        | [28], [31]                                                      | NA                           |
| Responsiveness              | NA      | NA                     | NA                                                        | NA                                                              | NA                           |

The criteria used for the mapping are the best practice subcategories (as described in Tables V to VIII in the Appendix) and the stages of the maturity models. Since those stages include the best practices, in the mapping we identify for each stage of maturity, the maturity models that included the best practice subcategories. It is important to note that in this mapping, if a maturity model contains just a feature of the best practice subcategory then the whole subcategory is marked as existing.

#### 4.1. Mapping between the Maturity Models and Back-end Best Practices

Table 1 summarizes the mapping conducted between the stages of each maturity model among the 25 models and the back-end best practice subcategories. The 'Stage' column represents the stages of the maturity models and the 'BP subcategories' column represents the back-end best practice subcategories described in Table V in the Appendix. If the best practice subcategory is not covered by the maturity model, it is marked as not available 'NA'.

It can be noticed from Table 1 that all the maturity models address only some of the back-end best practice subcategories. While none of them address all the back-end subcategories. Furthermore, there are some best practice subcategories that are not covered by any maturity models such as: use of standards, modularity, delegation, reusability and responsiveness.

#### 4.2. Mapping between the Maturity Models and Web Design Best Practices

Table 2 shows the mapping between the maturity stages of each maturity model and the Web design best practice subcategories. The 'BP subcategories' column represents the Web design best practice subcategories described in Table VI in the Appendix.

Table 2. Mapping between Maturity Stages and Design Best Practice Subcategories

| BP subcategories \ Stage | Stage 1 | Stage 2         | Stage 3                                             | Stage 4                      | Stage 5 and above      |
|--------------------------|---------|-----------------|-----------------------------------------------------|------------------------------|------------------------|
| One stop shop            | NA      | [29]            | [16], [19]                                          | [8], [12], [21], [23]        | [13], [24], [31], [32] |
| Ease of navigation       | NA      | [28], [32]      | NA                                                  | NA                           | [22], [24]             |
| Social Networks          | NA      | [22]            | [22]                                                | [9]                          | NA                     |
| Personalization          | [14]    | [10]            | [10], [13], [14], [23], [31]                        | [13], [33], [16], [19], [31] | [19]                   |
| User forms               | [14]    | [8], [27], [28] | [9], [11], [12], [33], [17], [18], [21], [23], [20] | [28]                         | NA                     |
| Industrialization        | NA      | NA              | NA                                                  | NA                           | NA                     |
| Structuration            | NA      | NA              | NA                                                  | NA                           | NA                     |

From the above, it can be deduced that all the maturity models address only some of the design best practice subcategories and no maturity model is covering all of them. Moreover, two best practice subcategories (including industrialization and structuration) are not covered by any maturity model. Furthermore, it can be noticed that some authors raise the same best practice in different stages; but it is more sophisticated in higher stages.

#### 4.3. Mapping between the Maturity Models and Web Content Best Practices

Table 3 displays the mapping between the maturity stages of each maturity model and the content best practice subcategories. The 'BP subcategories' column represents the Web content best practice subcategories described in Table VII in the Appendix.

Table 3. Mapping between Maturity Stages and External Best Practice Subcategories

| BP subcategories \ Stage | Stage 1         | Stage 2                | Stage 3    | Stage 4         | Stage 5 and above |
|--------------------------|-----------------|------------------------|------------|-----------------|-------------------|
| Relevancy                | NA              | [22]                   | [10]       | [9], [28], [30] | [19]              |
| Accessibility            | NA              | NA                     | [16]       | NA              | [22]              |
| Search engines           | NA              | [33], [16], [23], [26] | [13], [31] | NA              | NA                |
| Periodical change        | [12], [23]      | [13], [22]             | NA         | NA              | NA                |
| Rich content             | [9], [16], [18] | [9]                    | [24]       | NA              | NA                |
| Interactive Games        | NA              | NA                     | NA         | NA              | NA                |
| Mobile Apps              | NA              | NA                     | NA         | NA              | NA                |
| Statements               | [28]            | [16], [22]             | [16]       | NA              | NA                |
| Translation              | NA              | [9]                    | [16]       | NA              | NA                |
| Understandability        | NA              | NA                     | NA         | NA              | NA                |

From Table 3, it can be noticed that no maturity model is covering all the best practice subcategories. Furthermore, all the maturity models address only few content best practice subcategories. Besides that, there are some best practice subcategories that are not covered by any maturity models including: interactive games, mobile apps and understandability. Moreover, some authors address the same best practice in different stages with a difference in sophistication.

#### 4.4. Mapping between the Maturity Models and External Best Practices

Table 4 summarizes the mapping between the maturity stages of each maturity model and the external best practice subcategories. The 'BP subcategories' column represents the external best practice subcategories described in Table VIII in the Appendix.

Table 4. Mapping between Maturity Stages and External Best Practice Subcategories

| BP subcategories \ Stage | Stage 1 | Stage 2                                 | Stage 3                           | Stage 4               | Stage 5 and above                                    |
|--------------------------|---------|-----------------------------------------|-----------------------------------|-----------------------|------------------------------------------------------|
| E-participation          | NA      | [8], [12], [17], [18], [20], [22], [28] | [9], [13], [14], [22], [24], [32] | [9], [16], [22], [30] | [12], [13], [17], [21], [23], [22], [24], [26], [32] |
| Advertising              | NA      | NA                                      | NA                                | [30]                  | NA                                                   |
| Referencing              | NA      | NA                                      | NA                                | NA                    | NA                                                   |
| Incentives               | NA      | NA                                      | NA                                | NA                    | NA                                                   |
| Contests                 | NA      | NA                                      | NA                                | [22]                  | NA                                                   |

From the above it can be concluded that the maturity models address only some of the external best practice subcategories and no model is covering all these subcategories. Moreover, two best practice subcategories are not covered by any maturity model, this includes: referencing and incentives. Besides that, some authors raise the same best practice in different stages with more sophistication in higher stages.

## 5. Synthesis and Discussion of the Mapping

From the mapping conducted in the previous section, a set of findings has been raised. Fig. 2 shows the total number of the covered best practice subcategories (including back-end, Web design, Web content and external subcategories) for each maturity model. As shown in the Figure, out of 35 best practice subcategories of the best practice model, Lee and Kwak maturity model covers the greatest number of

subcategories with 13 subcategories, followed by United Nations and Windley with 11 subcategories. Almazan and Garcia maturity model covers 10 subcategories. Besides, Wescott, Deloitte and Touche, and Siau and Long maturity models cover 9 subcategories. Moreover, UK, West, Gartner and Hiller and Belanger maturity models cover 8 subcategories. In addition, Accenture, Shahkooh and Cisco maturity models cover 7 subcategories. Furthermore, Kim and Grant, Moon, Andersen and Henriksen and Layne and Lee maturity models cover 5 subcategories. Besides that, Netchaeva, World Bank and Alhomod maturity models cover 4 subcategories. Then, Chandler and Emanuel along with Howard cover 3 subcategories. Finally, Reddick and Chen are in the last position with 2 covered subcategories.

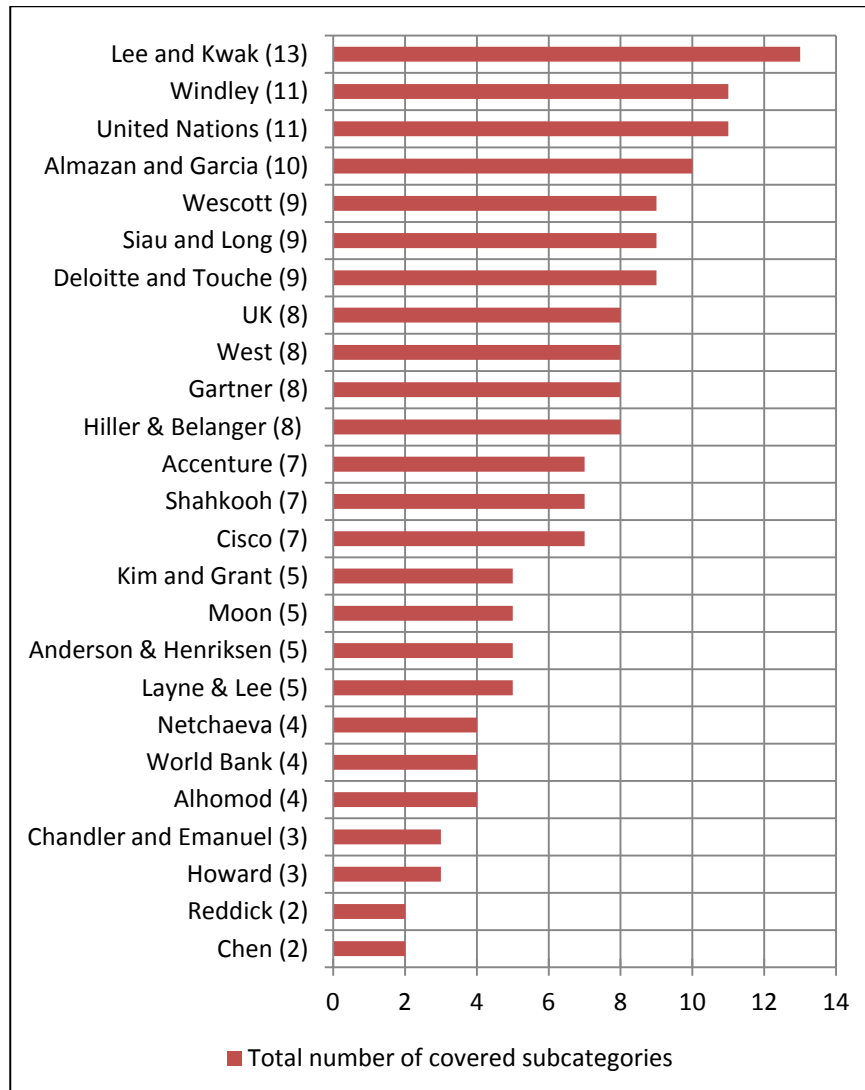


Fig. 2. Number of covered subcategories for each maturity models.

Fig. 3 shows the number of covered subcategories for each category type (back-end, front-end and external) with respect to each maturity model. From Fig. 3, it can be noticed that for:

- “Back-end subcategories”; Windley and Deloitte and Touche maturity models are covering the greatest number of back-end subcategories which is 6 subcategories. On the other hand, West maturity model does not cover any back-end subcategory.
- “Design subcategories”; Siau and Long maturity model covers the greatest number of design subcategories which is 3 subcategories. On the other hand, Accenture, Kim and Grant, and Chandler

and Emanuel maturity models are not covering any design subcategory.

- “Content subcategories”; although West maturity model is not covering many back-end subcategories, it is the model that covers the greatest number of content subcategories which is 5 subcategories. On the other hand, Netchaeva, Accenture, Reddick, Chen, Chandler and Emanuel, Shahkooh, Howard, Moon, Cisco, Alhomod and Layne and Lee maturity models do not cover any content subcategory.
- “External subcategories”; Lee and Kwak and Accenture maturity models cover the greatest number of external subcategories which is 2 subcategories. On the other hand, UK, Reddick, Chen, Chandler and Emanuel, Deloitte and Touche, Gartner, Alhomod and Andersen and Henriksen maturity models do not cover any external subcategory.

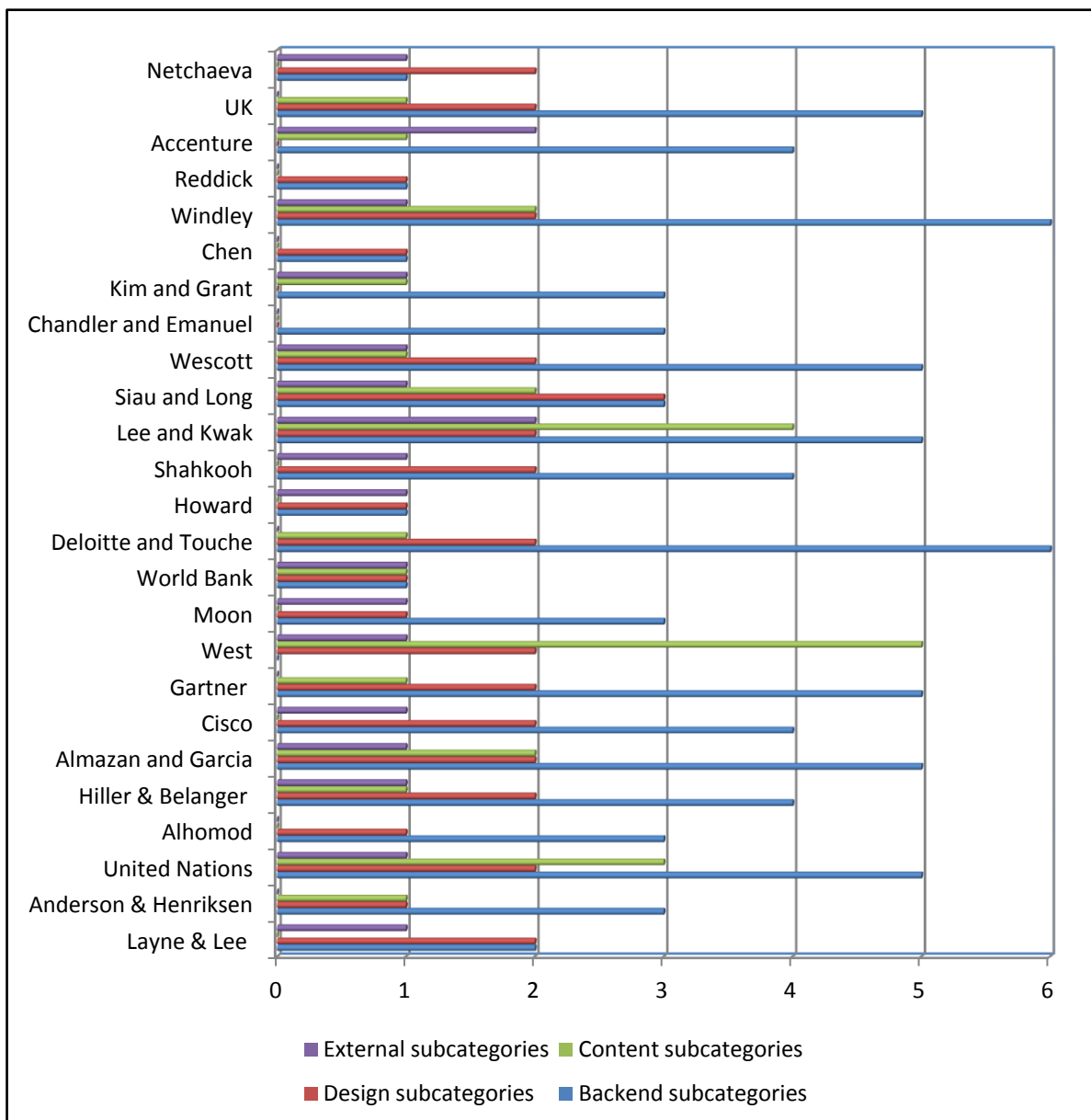


Fig. 3. Covered best practice subcategories of each maturity model.

To sum up, although the maturity models were proposed for different purposes, they are all composed of a set of stages that contain best practices in order to rank the portals' maturity. However, regarding the maturity models' best practices coverage, it is clear from the mapping performed in the previous section



that none of the maturity models are covering all the e-government portals' best practices of the eGPBPM. Table 5 provides a summary of the 12 best practice subcategories that are not covered by any maturity model among the 25 models. Besides that, some of the e-government maturity models are covering only few e-government portals' best practices. Furthermore, the focus of the maturity models is not balanced and does not include all the pillars of e-government portals' best practices (back-end, Web design, Web content and external). For instance, many maturity models focus on one best practice category such as back-end or Web content and ignore other categories. Therefore, the output of the mapping will be an important input to give guidelines to build a new maturity model that should cover all the e-government portals' best practices from the literature. Besides that, it allows us to figure out the most appropriate stage of maturity for each best practice subcategory.

Table 5. The best Practice Subcategories not Covered by any Maturity Model

| Best practice category | Best Practice subcategory                                                     |
|------------------------|-------------------------------------------------------------------------------|
| Back-end               | Use of standards<br>Modularity<br>Delegation<br>Reusability<br>Responsiveness |
| Web design             | Industrialization<br>Structuration                                            |
| Web content            | Interactive games<br>Mobile apps<br>Understandability                         |
| External               | Referencing<br>Incentives                                                     |

## 6. Conclusion

In this paper, we have identified to which extent the e-government maturity models are covering the best practices of the eGPBPM. To achieve this goal, a detailed mapping between the eGPBPM [1] and the best practices of the 25 maturity models has been completed.

To perform this mapping, the best practices of 25 maturity models were collected after an extensive literature review in [7]. Although, the maturity models present large similarities between them in terms of stage names, it seems that their features differ widely. Second, we have collected e-government portals' best practices to build a best practice model after an extensive literature review in [1]. The model is composed of four best practice categories, including: back-end, Web design, Web content and external. Each best practice category contains subcategories, and each subcategory contains best practices.

After the mapping, it was noticed that none of the maturity models is covering all the best practice subcategories of the eGPBPM. Moreover, all the maturity models miss at least half of the best practices of the eGPBPM. Besides that, some maturity models are covering only few e-government portals' best practices such as: Chandler and Emanuel, and Howard that cover 3 subcategories and Reddick and Chen that cover 2 subcategories. Furthermore, the focus of the maturity models in terms of best practice categories is not balanced and does not include all the pillars of e-government portals' (back-end, Web design, Web content and external). For instance, some maturity models focus on one best practice category, while they ignore the other categories such as: West (ignores all the back-end subcategories), Accenture, Kim and Grant, Chandler and Emanuel (ignore all the Web design subcategories), Netchaeva, Accenture, Reddick, Chen, Chandler and Emanuel, Shahkooh, Howard, Moon, Cisco, Alhomod, Layne and Lee (ignore all the Web content subcategories), UK, Reddick, Chen, Chandler and Emanuel, Deloitte and Touche, Gartner, Alhomod, and Andersen and Henriksen maturity models (ignore all the external subcategories).

As a future work, the output of this mapping triggers recommendations and guidelines in order to build an e-government portals maturity model that includes all the e-government portals' best practices of the eGPBPM [1]. Besides that, the mapping between the maturity models and the best practice model will allow us to build the new maturity model, since it allows us to figure out the most appropriate stage of maturity for each best practice subcategory.

## Appendix

Table I. Summary of the Maturity Models best Practices with 2 and 3 Stages

| Stage MM   | Stage 1                                                                                                                                                                         | Stage 2                                                                                                                                                      | Stage 3                                                                                                                                                                                                                                                 |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cisco      | <ul style="list-style-type: none"> <li>- Legislative posting</li> <li>- Public notices</li> <li>- Online forms</li> <li>- Webcasting</li> <li>- Personalized portals</li> </ul> | <ul style="list-style-type: none"> <li>- Citizen self-service portal</li> <li>- Electronic payments</li> </ul>                                               | <ul style="list-style-type: none"> <li>- Services consolidated and shared across various government jurisdictions</li> <li>- Personalization</li> <li>- Interactive communication</li> <li>- Identity management</li> <li>- Content security</li> </ul> |
| World Bank | <ul style="list-style-type: none"> <li>- Variety of information</li> <li>- Rules, regulations, documents and forms</li> </ul>                                                   | <ul style="list-style-type: none"> <li>- Feedback and comments on legislatives or policy proposals</li> <li>- E-mail contacts of officials</li> </ul>        | <ul style="list-style-type: none"> <li>- Users can complete transactions online</li> <li>- Security</li> </ul>                                                                                                                                          |
| Howard     | <ul style="list-style-type: none"> <li>- Information about government its activities</li> </ul>                                                                                 | <ul style="list-style-type: none"> <li>- Interaction</li> <li>- E-mails</li> <li>- Chat rooms</li> </ul>                                                     | <ul style="list-style-type: none"> <li>- Users can complete transactions</li> <li>- Payments</li> </ul>                                                                                                                                                 |
| Chen       | <ul style="list-style-type: none"> <li>- Presentation catalogue</li> <li>- Downloadable forms</li> </ul>                                                                        | <ul style="list-style-type: none"> <li>- Working databases</li> <li>- Online transactions</li> <li>- Online forms</li> </ul>                                 | <ul style="list-style-type: none"> <li>- Vertical integration</li> </ul>                                                                                                                                                                                |
| Reddick    | <ul style="list-style-type: none"> <li>- Information available online</li> </ul>                                                                                                | <ul style="list-style-type: none"> <li>- Online transactions</li> <li>- Electronic payments</li> <li>- Online databases</li> <li>- One stop shops</li> </ul> | NA                                                                                                                                                                                                                                                      |

Table II. Summary of the Maturity Models Best Practices with 4 Stages

| Stage MM               | Stage 1                                                                                                                                                                                                        | Stage 2                                                                                                                                                                                                                                         | Stage 3                                                                                                                                                                                                                                                                                                                                        | Stage 4                                                                                                                                                                                                                                                   |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Layne and Lee          | <ul style="list-style-type: none"> <li>- Present on the web</li> <li>- Download forms</li> <li>- Consult presentation catalog</li> </ul>                                                                       | <ul style="list-style-type: none"> <li>- Make transactions</li> <li>- Fill forms with a confirmation of receipt</li> <li>- Online working databases</li> <li>- Talk to officials</li> <li>- Online forums</li> <li>- E-participation</li> </ul> | <ul style="list-style-type: none"> <li>- Integration to higher stage systems</li> <li>- Within similar functionalities</li> </ul>                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>- Systems integrated across various jurisdictions</li> <li>- Portals are real one stop shops</li> </ul>                                                                                                            |
| Andersen and Henriksen | <ul style="list-style-type: none"> <li>- Horizontal and vertical integration</li> <li>- Use of intranet</li> <li>- Limited use of front-end systems</li> <li>- Self-service like downloadable files</li> </ul> | <ul style="list-style-type: none"> <li>- Extensive use of intranet</li> <li>- Personalized Web interfaces according to users' needs</li> <li>- Extensive use of intranet.</li> </ul>                                                            | <ul style="list-style-type: none"> <li>- Abandoning of intranet</li> <li>- Transparent processes</li> <li>- Personalized Web interfaces</li> <li>- The Web site is fed by information from other institutions.</li> <li>- Information is not organization oriented</li> <li>- The Web site is organized to solve citizens' problems</li> </ul> | <ul style="list-style-type: none"> <li>- Data mobility, data can be shared between organizations</li> <li>- Application mobility</li> <li>- Ownership to data is transferred to the customers</li> <li>- Customer centricity is widely applied</li> </ul> |
| UN                     | <ul style="list-style-type: none"> <li>- Web sites contain Static information</li> <li>- Web sites contain links to ministries</li> </ul>                                                                      | <ul style="list-style-type: none"> <li>- One way communication</li> <li>- Downloadable forms</li> </ul>                                                                                                                                         | <ul style="list-style-type: none"> <li>- Two way interaction with citizen</li> <li>- E-voting</li> <li>- Citizen identity</li> </ul>                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>- Web sites are proactive</li> <li>- Citizen feedback</li> <li>- Web 2.0</li> <li>- Agencies are citizen centric</li> </ul>                                                                                        |

| Stage<br>MM          | Stage 1                                                                                                       | Stage 2                                                                                                        | Stage 3                                                                                                                                                                       | Stage 4                                                                                                                                                                                                                  |
|----------------------|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | and other government branches<br>- Laws, regulations, relevant documentation and information on public policy | - The portal features audio and video clips and are multilingual                                               | - Applying for certificates, licenses and permits<br>- Secure online payments                                                                                                 | - Services organized in a through life events or segmented groups<br>- Citizens involved activities and decision making (e-participation)<br>- Data is transferred through integrated applications                       |
| Alhomod              | - Portal provides only information                                                                            | - Citizen can download forms and email them                                                                    | - Users can complete entire tasks<br>- Possibility of payments                                                                                                                | - Various departments shares information                                                                                                                                                                                 |
| Gartner              | - Web site is static<br>- Basic information                                                                   | - Search engines<br>- Document downloading<br>- Emails                                                         | - Complete transaction online<br>- Payment<br>- Security<br>- Privacy                                                                                                         | - Integration<br>- Personalization                                                                                                                                                                                       |
| West                 | - Web sites used for posting information<br>- Publications, databases, reports and legislations               | - Search engines<br>- Privacy and security statements are few                                                  | - One stop shop portal<br>- Variety of services are available<br>- Privacy and security policies<br>- Translations<br>- The portal is accessible for people with disabilities | - Personalization<br>- Push technology (email subscriptions and newsletters)<br>- Feedback and comments                                                                                                                  |
| Chandler and Emanuel | - Online information                                                                                          | - Basic interaction<br>- Email systems                                                                         | - Online transaction                                                                                                                                                          | - Integrated services across various departments and agencies.                                                                                                                                                           |
| Windley              | - Static pages<br>- Downloadable forms<br>- Policy statements<br>- Contact information<br>- Phone numbers     | - Interactions mechanisms<br>- Emails<br>- Web forms<br>- Help<br>- FAQs<br>- Electronic payments<br>- Surveys | - End to end transactions<br>- Information is shared between organizations                                                                                                    | - Services are customer centric<br>- Services are segmented according to population groups and life events<br>- Web forms<br>- Workflows<br>- Security<br>- Electronic payments<br>- Vertical and horizontal integration |

Table III. Summary of the Maturity Models Best Practices with 5 Stages

| Stage<br>MM         | Stage 1                                                     | Stage 2                                                                                                                   | Stage 3                                                                                 | Stage 4                                                                                                                                      | Stage 5                                                                                                    |
|---------------------|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Hiller and Belanger | - Posting information<br>- Information accurate and timely. | - Communication between the citizens and the government<br>- E-mail systems<br>- Citizens can fill in information request | - Online services<br>- Financial transactions<br>- Transactions can be completed online | - Services are connected internally and externally<br>- A single portal can be used to access all e-government services                      | - Political participation<br>- Online voting<br>- Posting comments online<br>- Privacy should be supported |
| Moon                | - Posting data and information                              | - Interactive mode between the governments and the stakeholders<br>- Email systems                                        | - Self-services like renewing licenses<br>- Payments                                    | - Horizontal and vertical integration<br>- Data sharing between various departments enhances effectiveness, user-friendliness and efficiency | - Surveys<br>- Forums<br>- Online voting                                                                   |
| Shahkooh            | - Information is                                            | - Emailing officials                                                                                                      | - Users can conduct secure                                                              | - Single point of                                                                                                                            | - Online                                                                                                   |

| Stage<br>MM   | Stage 1                                                                                                               | Stage 2                                                                                                                                                                                                                                                                                                                                               | Stage 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Stage 4                                                                                                                                                                                                      | Stage 5                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| et al         | published online                                                                                                      | - Downloading forms                                                                                                                                                                                                                                                                                                                                   | transactions<br>- Security<br>- Payments<br>- Digital signatures                                                                                                                                                                                                                                                                                                                                                                                                                      | contact                                                                                                                                                                                                      | voting,<br>- Public forums<br>- Opinion surveys                                                                                                                                                                                                                                                                                                                                                                                                              |
| Lee and Kwak  | - Broadcasting information<br>- Governments measure the number of visitors and pages viewed to assess the performance | - Use of social media is limited<br>- Feedback is get from the public<br>- Publishing relevant data online in a timely manner<br>- Data quality and accuracy is increased<br>- Privacy standards<br>- Governments measure the number of published datasets, the number of data downloads, and the number of visitors to evaluate Web site performance | - Social media tools<br>- Input from the public is welcomed<br>- Feedback used in policy decisions which helps governments make reliable decisions<br>- Respond to public's feedback<br>- E-Voting and e-Petitioning<br>- Social media: Facebook, Twitter, YouTube, and Flickr<br>- Web 2.0 tools to share comments, stories and ideas<br>- Data privacy<br>- Security<br>- Governments measure the stage of public participation using process centered metrics to asses performance | - Interagency collaboration by sharing data and public input<br>- Public contests<br>- Shared repositories are made available<br>- Data is analyzed for obtaining new insights and improving decision-making | - Data is easily accessed by mobile devices and tablets<br>- Portals and social media sites are compatible with various platforms<br>- Data is vertically and horizontally integrated<br>- Data, social media tools and services are integrated<br>- Ease of navigation, Single sign on<br>- Data analytics is used for decision making processes<br>- Agencies are focused on enabling continuous improvements and innovation of public engagement programs |
| Siau and Long | - Static information<br>- Information regularly updated                                                               | - Form download<br>- Search engines<br>- Email systems                                                                                                                                                                                                                                                                                                | - Users can perform complete transactions<br>- Payments<br>- Personal information updates                                                                                                                                                                                                                                                                                                                                                                                             | - Vertical and horizontal integration<br>- Single unified portal                                                                                                                                             | - Online voting<br>- Polling<br>- Surveys<br>- Contribution on political decisions                                                                                                                                                                                                                                                                                                                                                                           |
| Kim and Grant | - Limited information available on the web                                                                            | - Search engines<br>- Downloadable forms                                                                                                                                                                                                                                                                                                              | - Online transactions<br>- Electronic payments                                                                                                                                                                                                                                                                                                                                                                                                                                        | - Horizontal and vertical integration<br>- Measurement of performance                                                                                                                                        | - Political activities<br>- Continuous improvements                                                                                                                                                                                                                                                                                                                                                                                                          |
| Accenture     | - Information is published online                                                                                     | - Security<br>- Online presence is broad                                                                                                                                                                                                                                                                                                              | - Many services are available<br>- Cross agency cooperation<br>- Services are customer centric                                                                                                                                                                                                                                                                                                                                                                                        | - Services are clustered<br>- Clear ownership and authority<br>- CIO or central                                                                                                                              | - Improved customer service delivery<br>- Multichannel                                                                                                                                                                                                                                                                                                                                                                                                       |

| Stage<br>MM | Stage 1                                                           | Stage 2                                                | Stage 3                                                                                                                                | Stage 4                                                                                                                                                        | Stage 5                                                                                                            |
|-------------|-------------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
|             |                                                                   |                                                        |                                                                                                                                        | agency<br>- Customer is involved in the process of e-government<br>- The services are marketed                                                                 | integration                                                                                                        |
| UK          | - Few pages are available<br>- Basic information about the agency | - Web site contains many pages<br>- Downloadable forms | - Personalization options<br>- Customizable search tools<br>- Extensive use of emails<br>- Timely responses of mails<br>- Email alerts | - Secure transactions<br>- Payments<br>- Users can authenticate<br>- Users can track the status of their applications<br>- Users can manage their own accounts | - One stop shops<br>- Vertical and Horizontal integration<br>- Agency anticipate the needs of users and alert them |
| Netchaeva   | - Online Web sites<br>- Department information                    | - FAQs<br>- Email systems                              | - Forums<br>- Opinion surveys                                                                                                          | - Online services<br>- Electronic payments                                                                                                                     | - One stop shop<br>- Votes<br>- Online discussion<br>- Comment on policy and legislation proposals                 |

Table IV. Summary of the Maturity Models Best Practices with 6 Stages

| Stage<br>MM            | Stage 1                                           | Stage 2                                                                                                                       | Stage 3                                                                                                                                                | Stage 4                                                                                                                      | Stage 5                                                                                                                                                      | Stage 6                                                                 |
|------------------------|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Almazan and Gil-Garcia | - Web site contain static and limited information | - Information is frequently updated<br>- More pages available                                                                 | - Download forms<br>- Communicate with the government by mail<br>- Customization according to user profiles<br>- Forums<br>- Chats<br>- Search engines | - Secure online Web services<br>- Payments<br>- User centric approach<br>- Advanced customization according to user profiles | - One stop shop<br>- One entry portal of different - Jurisdiction agencies                                                                                   | - Voting<br>- Opinion surveys<br>Public forums                          |
| Deloitte and Touche    | - Static information<br>- Electronic encyclopedia | - Transaction<br>- Exchange of information<br>- Digital signatures<br>- Citizens' records are kept confidential<br>- Payments | - Single point of entry portal<br>- Portals are citizen centric<br>- Payments                                                                          | - Portal can be personalized<br>- Interfaces at this stage can be manipulated by users                                       | - Services are clustered to provide unified services to the customer<br>- Services are considered as a group of transactions rather than a group of agencies | - Portal is integrated<br>- Services are personalized to customer needs |
| Wescott                | - E-mail systems<br>- G2G systems                 | - Workflow systems<br>- Information is department centric<br>- Public can                                                     | - Online services<br>- Laws and regulations<br>- Emails, telephone and                                                                                 | - Secure payments<br>- License renewals                                                                                      | - Votes<br>- Opinions<br>- Feedback                                                                                                                          | - Vertical and horizontal integration<br>- FAQs<br>- Payments           |

| Stage<br>MM | Stage 1 | Stage 2               | Stage 3                                                                                               | Stage 4 | Stage 5 | Stage 6                                                                   |
|-------------|---------|-----------------------|-------------------------------------------------------------------------------------------------------|---------|---------|---------------------------------------------------------------------------|
|             |         | access<br>information | fax numbers<br>- Suggestions<br>using email<br>- Forums to ask<br>questions and<br>receive<br>answers |         |         | - One stop<br>shops<br>- Sharing of<br>information<br>between<br>agencies |

Table V. Summary of Back-end Best Practices

| Subcategory                                | Details                                                                                                                                                                                             | Advantages                                                                                                                                                                                                                                                         | Examples                                                                                                              |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Customer Centricity                        | - Make services customer-centric, tailor-made and designed with "its users in mind"                                                                                                                 | - User does not need to be aware of all existing organizations<br>- Enable the ease of use and usefulness<br>- Enable efficiency                                                                                                                                   | - One stop shops and one agency feel portals<br>- Observatory methods or ethnographic work<br>- Living labs           |
| Interoperability (Vertical and Horizontal) | - Vertical integration: between different departments; federal, provincial and municipal within the same jurisdiction<br>- Horizontal integration: between various jurisdictions of the government. | - Help making services customer centric<br>- Enable one stop access<br>- Absence of delays                                                                                                                                                                         | - X-Road in Estonia<br>- The electronic file system in Austria                                                        |
| Use of standards                           | - Use of standards and open source standards                                                                                                                                                        | - Enable cross platform interoperability and facilitate interoperability efforts<br>- Can achieve flexibility and ease of change in requirements and technology<br>- Helps preventing the fact of "re-architecting" as problems arise<br>- Reinforces coordination | - XML<br>- SOAP                                                                                                       |
| Modularity                                 | - Implement the modules one by one                                                                                                                                                                  | - Helps in reusing services or components<br>- Achieve flexibility and interoperability<br>- Changing small functionalities does not break the whole functionality                                                                                                 | - SOA                                                                                                                 |
| Security                                   | - Allow citizens to make transactions securely<br>- Disaster recovery and real time backup                                                                                                          | - Increase adoption and trust<br>- Text-based signatures, can be printed<br>- Digital signature will allow complex transactions to be done electronically                                                                                                          | - Digital signatures for identification, authentication and security                                                  |
| Privacy                                    | - keep citizens' records confidential                                                                                                                                                               | - Increase adoption and trust                                                                                                                                                                                                                                      | - Role based access of e-government employees<br>- P3P compliance<br>- Avoid Cookies<br>- Avoid use of HTML get forms |
| Delegation                                 | - Allow someone to act on behalf of a person or company                                                                                                                                             | - Allows more flexibility for citizens                                                                                                                                                                                                                             | - Austria have mechanisms supporting delegation                                                                       |
| Single Sign on                             | - Single authentication                                                                                                                                                                             | - Users can log in to many application only one time                                                                                                                                                                                                               | - The Seychelles's integrated portal in eastern Africa offers a single sign on to its users                           |

|                |                                                                                                                                       |                                                                                                |                                                                                              |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Reusability    | - Before starting the development of a new module, one should check the possibility of Web 2.0 to see if the component already exists | - Saves time and cost                                                                          | - Google calendar<br>- WordPress                                                             |
| Payments       | - Offer Payments in the portal                                                                                                        | - Possibility for the citizen to pay with a credit card or with internet banking in the portal | - Official Web portal of Dubai's police which allows citizens to pay for traffic violations  |
| Workflows      | - Workflow enabled systems                                                                                                            | - Possibility for the citizen to track the status of his application online                    | - The portal of e-submission of annual accounts in the former Yugoslav Republic of Macedonia |
| Responsiveness | - Short response time for executing general services                                                                                  | - Efficiency                                                                                   | N/A                                                                                          |

Table VI. Summary of Web Design Best Practices

| Subcategory        | Details                                                                                                                                                                                                                                                                 | Advantages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Examples                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| One Stop Shop      | - Single point of entry for all services                                                                                                                                                                                                                                | - Preferred model of service delivery<br>- Citizens don't have to know each government is responsible for which service<br>- Citizens should be able to go to a one point of access to access all e-government services<br>- Easy to use by citizens<br>- The services of the one stop shops are heavily used<br>- Increase customer satisfaction                                                                                                                                                                                | - In Singapore, the eCitizen portal that provides more than 1600 services is positioned as a one stop portal for all government services<br>- The Austrian initiative HELPg.v.at covers 12 federal ministries, 9 federal provinces, 80 local authorities and 2,359 municipalities                                                                                                                |
| Ease of Navigation | - Ease of navigation and ease of use<br>- Intuitive<br>- User friendly<br>- Visually pleasing<br>- Appropriate visual design<br>- Clear menu structure<br>- Grouping frequently accessed services in a list<br>- FAQs<br>- Help<br>- Common look<br>- Uniform Web pages | - Clear structure help the users know where exactly (level) they are in the portal and what other services are available for them<br>- Citizens can find pages they are looking for easily<br>- Influencing customer satisfaction and adoption<br>- Ease of access to services grouped in a list<br>- FAQs produce relief to the user<br>- Common look increases accessibility and ease of use<br>- Common look makes it easier for citizens to access e-government<br>- Common look reduce some boundaries to access the portal | - The US portal FirstGov is user friendly and easy to navigate (the portal's services are highlighted in a list in the home page)<br>- The eCitizen portal in Singapore is easy to navigate and aesthetically pleasing<br>- The Tunisian national portal group most used services in a section in the home page<br>- Government of Canada is aiming to provide common look & feel to its portals |
| Social Networks    | - Use of Web 2.0 technologies and platforms<br>- Social networking, Blogs, wikis, RSS.                                                                                                                                                                                  | - Strengthens the relationship with the citizen<br>- Enables the user to engage with government<br>- Help improve the quality of online public services<br>- Great adoption of services by citizens<br>- Better coordination between citizen's expectation and public services<br>- Exploit the problem solving skills of the internet users<br>- Increase participation<br>- Improvements in service usage                                                                                                                      | - Use of social networking such as Facebook, Twitter, WordPress, YouTube and Flickr.                                                                                                                                                                                                                                                                                                             |
| Personalization    | - Personalization or customization for citizens<br>- Targetisation                                                                                                                                                                                                      | - Services can be tailored and customized according to user profiles and requirements (age, education level, occupation..)                                                                                                                                                                                                                                                                                                                                                                                                       | - In Austria and France, citizens are able to customize their driving licenses and passports                                                                                                                                                                                                                                                                                                     |



| Subcategory       | Details                                                                                                                                                                                                                                                                                                                                                | Advantages                                                                                                       | Examples                                                                                                                                                                                                                            |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   |                                                                                                                                                                                                                                                                                                                                                        | - Adapt Web site ergonomics to user profiles                                                                     | online.<br>- 'My messages' area customized to user profiles in the My CPF portal in Singapore<br>- Korea's national portal offers the possibility to enter age and gender to customize the users' channels and services of interest |
| User Forms        | <ul style="list-style-type: none"> <li>- Indicate the mandatory fields</li> <li>- Use drop down menus</li> <li>- Possibility of a preview before submitting the form</li> <li>- Possibility of printing the accepted form</li> <li>- Online help when filling the form</li> <li>- Information regarding the stage of completion of the form</li> </ul> | <ul style="list-style-type: none"> <li>- User friendly</li> <li>- Ease of use</li> </ul>                         | N/A                                                                                                                                                                                                                                 |
| Industrialization | <ul style="list-style-type: none"> <li>- Following industry guidelines</li> </ul>                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>- Increases usability</li> </ul>                                          | <ul style="list-style-type: none"> <li>- CSS</li> <li>- ISO/TR 16982 (ergonomics of human system interaction)</li> <li>- usability methods supporting human centered design)</li> </ul>                                             |
| Structuration     | <ul style="list-style-type: none"> <li>- Before starting writing pages of the portal, one should spent time writing the structure of the Web site</li> <li>- Use of site maps</li> </ul>                                                                                                                                                               | <ul style="list-style-type: none"> <li>- Clear structure</li> <li>- Users stay oriented in the portal</li> </ul> | <ul style="list-style-type: none"> <li>- Most sites in Taiwan have site maps</li> </ul>                                                                                                                                             |

Table VII. Summary of Web Content Best Practices

| Subcategory    | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Advantages                                                                                                                                                                                                                                                                                                                                                                                                    | Examples                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relevancy      | <ul style="list-style-type: none"> <li>- Content should be citizen centric, written according to citizens' needs and designed with 'its users in mind'</li> <li>- Grouping information by theme and target groups</li> </ul>                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>- Helps the citizen find information easily</li> <li>- Citizen should not know for each type of information which e-government organization is responsible for</li> </ul>                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>- One stop shops</li> <li>- The Brazilian national portal is organized by themes and target groups</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Accessibility  | <ul style="list-style-type: none"> <li>- Make the site accessible for everyone, including people with disabilities.</li> <li>- Pictures and background should not be overdone</li> <li>- Avoid inline multimedia elements</li> <li>- Avoid server side image</li> <li>- Monitor HTML broken links</li> <li>- Support mobile devices</li> <li>- Following industry guidelines in Web content</li> <li>- Audio CAPTCHAs</li> <li>- Possibility to hear text of pages</li> </ul> | <ul style="list-style-type: none"> <li>- Accessibility influence the success of the portal</li> <li>- The Web sites become accessible for people with disabilities</li> <li>- Helps reduce the digital divide among people with disabilities</li> <li>- Good download time by not overdoing pictures</li> <li>- No accessibility problem with missing plugins to access inline multimedia elements</li> </ul> | <ul style="list-style-type: none"> <li>- Web Content Accessibility guidelines (WCAG)</li> <li>- WebXact tool can be used to measure the compliance with the accessibility standards</li> <li>- e-Accessibility checker used by the UN</li> <li>- The Austrian HELP.gv.at portal employs a group of Web experts on Web design suitable for disabled people to make information and services accessible to a wider range of people including the ones with disabilities</li> <li>- Bahraini portal has the possibility to hear text of pages for people with vision deficiencies</li> </ul> |
| Search engines | <ul style="list-style-type: none"> <li>- Provides the ability for users to perform search on</li> </ul>                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>- Search engines make information and services</li> </ul>                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>- Used as a metric by Brown University to benchmark e-government portals</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |



| Subcategory         | Details                                                                                                                                                                                   | Advantages                                                                                                                                               | Examples                                                                                                                                                                                                                                                                                                           |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | information or services                                                                                                                                                                   | easier to find and can be used with metadata to achieve this<br>- Metadata helps search engines find e-government information easily                     |                                                                                                                                                                                                                                                                                                                    |
| Periodical change   | - Having expiry dates or review dates is important so that the Web team can update certain pages automatically                                                                            | - Users won't be disappointed with non-updated information<br>- Updated information and current information are among the dimensions of Web site quality | - The Austrian portal HELPg.v.at is empowered by a team of editors working in parallel with federal ministries to guarantee that information is up to date and updated regularly                                                                                                                                   |
| Rich content        | - Rich information ranging from video clips, publications, press releases, databases, Webcasts, interactive maps, news, laws and regulations etc...                                       | - Improves citizen engagement                                                                                                                            | - Web sites in Singapore are content rich ( they contain video clips, publications, press releases and databases)<br>- The official portal of Dubai's Police contains a broad range of information, news, laws and regulation<br>- The Swiss national portal contains many cartoon videos organized by life events |
| Interactive games   | - Interactive games                                                                                                                                                                       | - Allowed citizens to learn in a fun and educational way<br>- Increases citizens' knowledge                                                              | - My CPF portal in Singapore included games about retirement planning<br>- The e-learning NBPortal in Poland is also using decision games in economics                                                                                                                                                             |
| Mobile Applications | - Downloadable mobile applications                                                                                                                                                        | - Increases service mobility                                                                                                                             | - The Korean portal offers mobile applications                                                                                                                                                                                                                                                                     |
| Statements          | - Disclaimers, copyrights and privacy and security statements<br>- Government should be transparent with the flow of information                                                          | - Detailed information concerning security, privacy and data protection could enhance the trust of the citizen                                           | - Web sites in Singapore have privacy statements<br>- In US Web sites feature privacy and security statements                                                                                                                                                                                                      |
| Translations        | - Having an English version and translations of the portal                                                                                                                                | - Helps foreign people access the portal                                                                                                                 | - All sites in Taiwan have a fully featured English version<br>- Sites in the US can be translated into over 30 languages                                                                                                                                                                                          |
| Understandability   | - Links and texts used in the portal must be easily comprehended<br>- The information of the Web site should be clear and understandable<br>- Content should be written in plain language | - Guarantee equal e-government opportunity<br>- Audience can understand first time they hear or read                                                     | - US plain language initiative                                                                                                                                                                                                                                                                                     |

Table VIII. Summary of External Best Practices

| Subcategory     | Details                                                                                                                                                                                                           | Advantages                                                                                                                                                                                           | Examples                                                                                                                                                                |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E-Participation | - Seeking feedback from the users<br>- Possibility to rate services<br>- Web site assessments<br>- Surveys for users and non-users<br>- Possibility to ask an expert<br>- Tracing hard data ( frequently accessed | - Contribute in the policy making process<br>- Feedback can be user to launch newer versions of the portal<br>- Improves public services and interaction with the citizen<br>- Encourage and promote | - Surveys and polls to identify citizens' need<br>- Computerized surveys<br>- Online forums<br>- Chat room<br>- Comment forms<br>- Suggestion programs<br>- e-Petitions |

| Subcategory | Details                                                                         | Advantages                                                                                                                                                       | Examples                                                                                                                                                    |
|-------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | products, the length of time spent on each page )                               | e-participation<br>- Increase satisfaction<br>- Provide help and answers to users<br>- Tracking data can be used to enhance the Web site                         |                                                                                                                                                             |
| Advertising | - Ads and advertisements<br>- Promote and increase awareness of public services | - Help citizens to be aware of the services and information available to them                                                                                    | - Canada advertises its Web sites in printed brochures, TV and Radio<br>- The Belgian government is using digital television for job advertisement          |
| Referencing | - Search Engine Optimization                                                    | - Help citizens find services and information                                                                                                                    | - The Web site "http://marketing.grader.com/" can be used to grade and enhance SEO practices.                                                               |
| Incentives  | - Offering incentives to users to promote the Web channel                       | - Promote and increase service usage                                                                                                                             | - France, Ireland and Singapore offer an extended period for filling taxes<br>- In the United States, online users profit from filling their taxes for free |
| Contests    | - Making public data available for public<br>- Organizing contests              | - Encourage participation and collaboration<br>- Create innovative services in order to help solve problems expressed by citizens<br>- Citizens become producers | - The district of Columbia in Washington Apps contest                                                                                                       |

## References

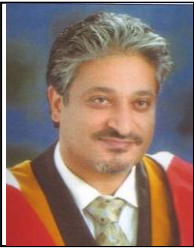
- [1] Allah, A. F., Cheikhi, L., Qutaish, R. A., & Idri, A. (2014). E-government portals best practices: A comprehensive survey. *Electronic Government, An International Journal*, 11(1-2), 101-132.
- [2] Halachmi, A. (2004). E-government theory and practice: The evidence from Tennessee (USA). *Front. Public Adm.*
- [3] Assar, S. (2011). *Practical Studies in E-Government*.
- [4] Forfás, *eGovernment: International Best Practices*. 2008.
- [5] World Bank, *Designing and Implementing E-Government: Key Issues, Best Practices and Lessons Learned*.
- [6] Berntzen, L., & Olsen, M. G. (2009). Benchmarking e-government-a comparative review of three international benchmarking studies. *Proceedings of the Third International Conference on Digital Society*, (pp. 77-82).
- [7] Allah, A. F., Cheikhi, L., Qutaish, R. A., & Idri, A. (2014). E-government maturity models: A comparative study. *International Journal of Software Engineering and Applications*, 5(3), 71-91.
- [8] Layne, K., & Lee, J. (2001). Developing fully functional e-government: A four stage model. *Gov. Inf. Q.*, 18(2), 122-136.
- [9] United Nations Department of Economic and Social Affairs. *UN E-Government Survey 2012: E-Government for the People*, United Nations. New York, United States, 2012.
- [10] Andersen, K. V., & Henriksen, H. Z. (2006). E-government maturity models: Extension of the Layne and Lee model. *Gov. Inf. Q.*, 23(2), 236-248.
- [11] Alhomod, S. M., Shafi, M. M., Kousarrizi, M. N., Seiti, F., Teshnehlal, M., Susanto, H., Almunawar, M. N., Tuan, Y. C., Aksoy, M. S., & Batawi, Y. A. (2012). Best practices in E government: A review of some

- Innovative models proposed in different countries. *International Journal Electr. Computer. Science*, 12(1), 1–6.
- [12] Hiller, J. S., & Belanger, F. (2001). Privacy strategies for electronic government. *E-Gov.*, 162–198.
- [13] Almazan, R. S., & Garcia, J. R. G. (2008). E-government portals in Mexico.
- [14] Cisco IBSG, E-Government Best Practices Learning from Success, Avoiding the Pitfalls.
- [15] Karokola, G., & Yngström, L. (2009). Discussing e-government maturity models for developing world-security view. *Proceedings of the Conference on Information Security South Africa* (pp. 81–98).
- [16] West, D. M. (2004). E-government and the transformation of service delivery and citizen attitudes. *Public Adm. Rev.*, 64(1), 15–27.
- [17] Moon, M. J. (2002). The evolution of e-government among municipalities: Rhetoric or reality?. *Public Adm. Rev.*, 62(4), 424–433.
- [18] Toasaki, Y. (2003). E-government from A user's perspective. *APEC Telecommunication and Information Working Group*.
- [19] Deloitte Consulting and Deloitte & Touche, Deloitte & Touche. (2000). At the dawn of e-government: The citizen as customer. *N. Y. Deloitte Res.*
- [20] Howard, M. (2001). E-government across the globe: How will'e'change government. *E-Gov.*
- [21] Shahkooh, K. A., Saghafi, F., & Abdollahi, A. (2008). A proposed model for e-government maturity. *Information and Communication Technologies: From Theory to Applications*.
- [22] Lee, G., & Kwak, Y. H. (2012). An open government maturity model for social media-based public engagement. *Gov. Inf. Q.*
- [23] Siau, K., & Long, Y. (2005). Synthesizing e-government stage models—a meta-synthesis based on meta-ethnography approach. *Ind. Manag. Data Syst.*, 105(4), 443–458.
- [24] Wescott, C. G. (2001). E-government in the Asia-pacific region. *Asian Journal Polit. Sci.*, 9(2), 1–24.
- [25] Chandler, S., & Emanuels, S. (2002), Transformation not automation. *Proceedings of 2nd European Conference on E-government* (pp. 91–102).
- [26] Kim, D. Y., & Grant, G. (2010). E-government maturity model using the capability maturity model integration. *Journal Syst. Information Technol.*, 12(3), 230–244.
- [27] Chen, J., Yan, Y., & Mingins, C. (2011). A three-dimensional model for e-government development with cases in China's regional e-government practice and experience. *Proceedings of the 2011 Fifth International Conference on Management of e-Commerce and e-Government* (pp. 113–120).
- [28] Windley, P. J. (2002). eGovernment maturity. *USA Wind. Technolometria*.
- [29] Reddick, C. G. (2004). A two-stage model of e-government growth: Theories and empirical evidence for US cities. *Gov. Inf. Q.*, 21(1), 51–64.
- [30] Rohleder, S. J., & Jupp, V. (2002). E-government leadership: Engaging the customer. *Accenture*.
- [31] *Government on the Web II*.
- [32] Netchaeva, I. (2002). E-government and e-democracy a comparison of opportunities in the north and south. *Int. Commun. Gaz.*, 64(5), 467–477.
- [33] Baum, C., & Maio, A. D. (2000). Gartner's four phases of e-government model. *Gart. Group*.



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