

Assessing Readiness for e-Government Enterprise Architecture in a Developing Economy – Towards an Integrated Maturity Model

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Abstract— The practice of developing e-government enterprise architectures as a means for acquiring interoperable solutions is being embraced by several developing economies. However, for such efforts to be effective, a nation must assess its readiness for both e-government and enterprise architecture. Numerous studies discuss mechanisms for assessing e-government readiness or e-readiness, while some studies give insight into assessing readiness for enterprise architecture. There are hardly studies that provide perspective on readiness assessment that integrates both e-government and enterprise architecture perspectives. Yet architecture-driven e-government implementation is a key best practice in overcoming e-government interoperability issues in developing economies. Thus, adopting an architecture-driven e-government implementation without assessing readiness for both e-government and enterprise architecture, increases the risk of encountering an intertwined process-product problem. Process-related issues arise when the country does not effectively implement the architecture-driven change due to flaws in the procedure undertaken, while product-related issues arise when the desired changes are not achieved due to flaws in the product. This worsens the ‘design-reality’ gap that is already hindering successful implementation of e-government in developing economies. Thus, this paper presents initial results towards an integrated maturity model for assessing readiness for architecture-driven e-government implementations. The model synthesizes existing insights on assessing enterprise architecture readiness and e-government readiness. The applicability and feasibility of the model was evaluated using a field demo that was conducted in a Ugandan public entity.

Keywords: *enterprise architecture, e-government, readiness assessment*

I. INTRODUCTION

Enterprise architecture-driven e-government efforts in developed economies (e.g. [1–3]) report benefits such as sustainable alignment of business and IT functions and significant improvement in e-government performance. Thus, the practice of developing e-government enterprise architectures, as a means for achieving interoperability, is embraced by several developing economies, e.g. South Africa [4], Ghana [5], and Egypt [6]. However, undertaking an architecture-driven e-government implementation without assessing readiness for both e-government and enterprise architecture increases the risk of encountering an intertwined process-product problem. Process-related issues arise when the country does not effectively implement the architecture-

driven change due to flaws in the procedures undertaken, while product-related issues arise when the desired changes are not achieved due to flaws in the product. Since the ‘design-to-reality’ gap is already large enough to be a key hindrance to successful e-government in developing economies [7, 8] this intertwined process-product problem worsens it.

Enterprise architecture development often involves re-designing the product and service portfolio of an enterprise, its business processes, its information systems, and technology infrastructure [9]. Thus, the possible resultant changes imply the need to assess readiness for enterprise architecture prior to undertaking its development [2, 10–13]. Yet, also successful e-government demands comprehensive readiness assessment [2, 12, 14, 15]. Thus, for architecture-driven e-government implementations to be effective, a nation or government enterprise must assess its readiness for both e-government and enterprise architecture. There are numerous efforts on assessing e-government readiness in developing countries (e.g. [13–20]). Also, some efforts provide guidance on readiness assessment for enterprise architecture (e.g. [10, 21, 22]). However, there are hardly studies that provide an integrated perspective of readiness assessment in the context of implementing e-government enterprise architectures.

Thus, this paper presents initial results towards an integrated model for assessing readiness for architecture-driven e-government implementations in a government enterprise (at national, sector, and institutional levels). The model for Assessing Readiness to implement an e-Government Enterprise Architecture (ARGEA), comprises assessment dimensions that synthesize insights on enterprise architecture readiness and e-government readiness. The design, feasibility, and applicability of ARGEA was evaluated using a lab demo that was conducted in a Ugandan public entity. Section II presents related work, section III presents the design of ARGEA, section IV presents the field demo and key findings, and section V concludes the paper and indicates future work.

II. RELATED WORK AND GAP ANALYSIS

Literature provides various views on factors for assessing readiness for e-government and assessment tools for measuring such factors (see table I). Also, literature provides views on assessing readiness for enterprise architecture (table II). From the review, two key gaps were identified. First,

TABLE I. TAXONOMY OF FACTORS FOR E-GOVERNMENT READINESS ASSESSMENT

Categories of factors for assessing e-government readiness (based on Al-Omari & Al-Omari, 2006)	Sources
Organizational readiness	
Stakeholder/ Personal readiness: Professional growth (<i>the extent to which government values opportunities for skilled growth</i>); Efficacy (<i>stakeholder's ability to perform a task to a satisfactory degree</i>); Adaptability (<i>ability of stakeholders to rapidly learn new skills & behaviors in response to the changing environment</i>); Influence (<i>ability for government regulations to influence citizen/ stakeholder's behavior</i>)	[23–26]
Motivational readiness by leaders and other stakeholders: Skill development and training needs; Pressure for change from internal or external sources; Management support; Need for interaction; Desire for improvement	[23, 24]
Organizational climate factors and technology transfer: Exposure to new technology; Adoption of new technology; Clarity of mission and goals; Staff cohesion; E-communications via internet & emails; Openness to change	[19, 24, 27–30]
Institutional resources: Staffing levels (<i>number and quality of staff members available</i>); Physical resources; Training and development resources; Adequacy and use of computers; Adequacy of office and physical space available.	[24, 30, 31]
Governance and leadership readiness	
Government commitment: Trust in e-government on issues of security and privacy; Financial support and investment for the development of ICT; E-government system benefits; Trust in technology.	[13, 18, 25, 28, 29, 31–37]
Service quality: Trust in the reliability of enabling technology; Contributors' ability to enhance one's readiness in adopting technology; Inhibitors ability to lower readiness level for adoption & use; Policy discourse culture; Availability of intelligent & informed policies.	
Customer readiness (“ <i>condition or state in which a consumer is prepared and likely to use an innovation for the first time</i> ” [25])	
Culture readiness and Culture variables: People culture local language content; Economic costs to access online services; Customer trust in government; Social culture practices; Customer need for interaction; Customer organizational socialization; Customer perceived risk; Customer desire for control; Awareness and Motivation; Customer's ability to acquire necessary skills and confidence to perform a task; Cultural beliefs, values, and norms.	[18, 19, 30, 31, 33, 38]
Competency readiness (the existence of qualified personnel in the public sector)	
Demographics (<i>age, gender, education level</i>); Human capital (<i>citizens' education and knowledge on how to use computers and the internet</i>); User characteristics (<i>e.g. perceived risk, perceived control, internet etc.</i>); Citizen experience with internet & e-government websites	[25, 29, 34, 39]
Technology readiness (“ <i>people's propensity to embrace and use latest technologies for accomplishing goals in home life and at work</i> ” [35])	
ICT architecture: Availability of the portal; Service delivery objective (service oriented architecture); Focus on business process and information systems; Change management; Security and privacy.	[13, 19, 25, 28, 31, 34-37]
ICT services and support: Perceived system usefulness; Perceived system ease of use; Perceived system quality; Perceived information quality; Perceived service quality; Trust in medium; ICT infrastructure connectivity.	[13, 28, 29, 30, 34, 35,40]
Innovation characteristics: Technology complexity (<i>extent to which an innovation is perceived to be difficult to use and understand</i>); Observability (<i>extent to which results of an innovation are visible to others</i>); Trialability (<i>extent to which an innovation may be experimented with on a limited basis</i>); Perceived risk; Relative advantage (<i>extent to which an innovation is perceived advantageous</i>); Compatibility (<i>extent to which an innovation is perceived as being consistent with existing values, past experiences and needs of potential adopters</i>).	[13, 33, 40]
Legal readiness	
Legal and regulatory environment: Legal culture (<i>ability to accommodate the adoption of new paradigm of using the Internet, computer, and digital technologies in domestic & international governmental interactions</i>); rule of law; Level of censorship	[18, 19, 35]

TABLE II. TAXONOMY OF FACTORS FOR ASSESSING READINESS FOR ENTERPRISE ARCHITECTURE

Key aspects to consider when preparing for EA development [21]	Factors for assessing EA readiness – People, process, technology, & enterprise environment factors [10]	Factors for assessing EA readiness [22]
Existence of EA Governance framework or mechanisms	EA Management (<i>existence of a governance structure for change management</i>); EA Governance (<i>existence of structure & procedures for business-IT alignment</i>); Stakeholder support (<i>ability to sponsor & support EA tasks</i>); Management commitment (<i>ability to be involved in execution of EA tasks</i>)	Senior management support; executive management support
Existence of a reliable capability framework & resources	EA culture (<i>ability to embrace EA practice</i>); EA Resources (<i>availability of Human Resource & finances resources</i>); Competency & skills (<i>ability to execute tasks associated with EA development</i>)	Existence of: Change management measures; Human resource; & other Resources
Contents in enterprise continuum (<i>e.g. enterprise strategy, rules, principles, reference models</i>)	EA vision (<i>ability to articulate it</i>); Communication protocol (<i>existence of formal information sharing channels</i>); Policy & Rules (<i>existence of decision making guidelines for transparency & objectivity</i>); EA Repository (<i>mechanism for managing & structuring information assets</i>); EA Tools (<i>existence of tools for implementing EA practice</i>)	Existence of: an organization structure, organization strategy, organization culture
Capabilities in Business & Information Systems Domains	Business motivation (existence of business case & corresponding business requirements)	Available information technology resources
Capabilities in Technology & Security Domains	Security (existence of safety measures for all enterprise assets)	

there was need to derive a catalogue that can synthesize and holistically classify factors for e-government readiness and factors for assessing readiness for enterprise architecture, in a way that would allow integrated assessment of the latter with respect to the former. Second, in the context of the assessment approach, there was need to derive an architecture-based maturity assessment perspective for determining the extent to which e-government capabilities are developed across all levels of the government enterprise. Thus, section III presents ARGEA as a solution towards addressing these two gaps, and describes how its design addresses these gaps.

III. DESIGN OF ARGEA

The purpose of ARGEA is to assess the readiness of using an enterprise-architecture driven approach to achieve e-government interoperability across the government enterprise. Thus, this section first gives contextual perspectives that shape the design of ARGEA, and then presents its design.

From [41] e-government interoperability issues are classified using 3 dimensions: legal issues that are concerned with defining and implementing laws and regulations; policy and political issues that are concerned with financing and alignment of stakeholder interests; social and cultural issues that are concerned with accommodating heterogeneous aspects of e-government implementation and adoption. These dimensions are then adopted to derive three strategic requirements for implementing interoperable e-government solutions – Legal and Governance framework, Sustainability and Capacity building framework, and Innovation and Adaptation framework [42]. Accordingly, in this paper we take the position that assessing readiness for architecture-driven e-government implementations needs to be done in line with: (a) the strategic requirements for e-government interoperability; and the (b) core elements of developing an enterprise architecture. The benefits of this position is two-fold. First, it helps to determine the extent to which a specific e-government enterprise has gone towards achieving the strategic requirements for e-government interoperability. Second, it demonstrates the scope and volume of remaining work towards achieving the desired state of e-government implementation at national, sector, and institutional levels. Thus, the design of ARGEA is derived by synthesizing views from 5 perspectives, so as to form assessment dimensions A to E (as described below).

- Dimension A draws from the perspective of the 3 strategic requirements for e-government interoperability – legal & governance, sustainability & capacity building, and innovation & adaptation frameworks.

- Dimension B draws from the perspective of the various factors of assessing e-government readiness as catalogued in section II (table I). Where the main categories of factors for e-government readiness assessment (shaded in grey color) are integrated with the three strategic requirements in dimension 1 as follows: the strategic requirement of a sustainability and capacity building framework incorporates the factors under Organizational readiness, Governance and leadership readiness, and Competency readiness in table I. The strategic requirement of an innovation and adaptation framework accommodates factors under Customer readiness and Technology readiness. Also, the strategic requirement of a legal and governance framework accommodates factors under legal readiness in table I.
- Dimension C draws from the perspective of existing views on core elements for architecture development and existing views on factors for assessing readiness for enterprise architecture, as synthesized in table II).
- Dimension D draws from the perspective of the three tiers or levels that constitute the government enterprise. The government enterprise is three-tiered – comprising national level, sector level, and institutional level [43]. The critical challenge in developing countries is to achieve interoperability of e-government solutions at each level and across all levels.
- Dimension E draws from the perspective of encouraging an architecture-oriented thinking when assessing the extent of growth or existence of specific e-government capabilities, so as to determine extent of required efforts when developing an government enterprise architecture.

Dimensions A to E and their underlying perspectives are holistically represented using Fig. 1 and table III. To synthesize these perspectives and dimensions, the following five tasks were executed.

Task 1 involved classifying and synthesizing concepts in dimension B according to the broad categories in dimension A, thereby combining dimensions A and B into one (A x B) as shown in Fig. 1. **Task 2** involved classifying and synthesizing concepts in dimension C to form the broad categories presented on the left side of Fig. I. **Task 3** involved prompting or indicating that the readiness of each level of the government enterprise in dimension D is scrutinized with respect to the categories and sub-categories of concepts in dimensions A x B and C. Thus, dimensions C and D are combined into one (C x D). This forms a cube in Fig. 1 with sides: A x B, C x D, and E.

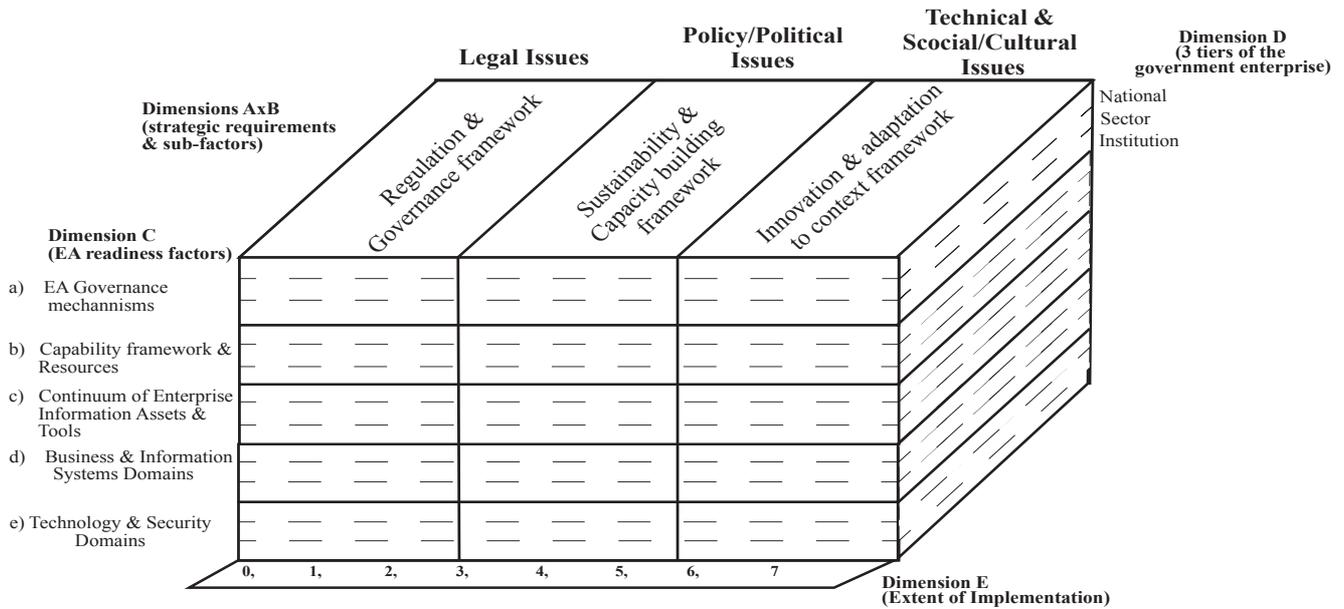


Fig. 1. ERGEA – High Level View

TABLE III. ARGEA – DISAGGREGATED QUESTION AND RESPONSE VIEW

	<i>Legal & governance factors</i>	<i>Policy/political factors</i>	<i>Technical/ Social/cultural factors</i>	
eGov't readiness	Regulation & Governance framework/ plan	Sustainability & Capacity building framework/ plan	Innovation & Adaptation to context framework/ plan	Tiers in government enterprise (Cascaded row totals)
EA readiness				
a) EA Governance mechanisms	<i>Q1.1 = (X, Y) for 3 tiers of government</i>	<i>Q1.2</i>	<i>Q1.3</i>	<i>National: Avg. (X, Y)</i> <i>Sector: Avg. (X, Y)</i> <i>Institutional: Avg. (X, Y)</i>
b) Capability framework & resources	<i>Q2.1</i>	<i>Q2.2</i>	<i>Q2.3</i>	
c) Continuum of Enterprise Information Assets & Tools	<i>Q3.1</i>	<i>Q3.2</i>	<i>Q3.3</i>	
d) Baseline & Information Systems Domains	<i>Q4.1</i>	<i>Q4.2</i>	<i>Q4.3</i>	
e) Technology & Security Domains	<i>Q5.1</i>	<i>Q5.2</i>	<i>Q5.3</i>	
Dimension E – Response key for X, Y responses: 0 = Not applicable; 1 = Applicable but not existing, not documented; 2 = Not documented, but existing informally; 3 = Plan is available to guide implementation, but implementation is yet to begin; 4 = Implementation at preliminary stage; 5 = Implementation in advanced stage; 6 = Fully functional/acquired; and 7 = Monitored and evaluated.				

Task 4 involved translating concepts in dimension E into a Likert scale to allow assessment of particular entities that constitute specific levels of the government enterprise in dimension D. In this step we adapt the six-step maturity model for enterprise architecture by [44] to the e-government context and derive 7 levels of readiness assessment. According to Op 't Land et al [44], architecture maturity can be measured as follows: level 0 for entities that have no architecture in place; level 1 for entities with ad hoc efforts towards adopting the practice of standardization; level 2 for entities implementing their enterprise architecture; level 3 for entities that have a fully established architecture; level 4 for entities that are maintaining their architectures; and level 5 for entities that are continuously improving their architectures.

In the context of assessing readiness for architecture-driven e-government efforts, we adapt and extend the above

levels into the following 8 levels: 0 for 'not applicable'; 1 for 'applicable but not existing, not documented'; 2 for 'not documented, but existing informally'; 3 for 'plan is available to guide implementation, but implementation is yet to begin'; 4 for 'implementation at preliminary stage'; 5 for 'implementation in advanced stage'; 6 for 'fully functional/acquired'; and 7 for 'monitored and evaluated'. This forms the bottom side of the ARGEA cube – dimension E in Fig. 1.

Task 5 involved using each cell of the cube in Fig. 1 to prompt assessors to determine the extent to which a specific architecture-related element/factor (from dimension C) is (or can be) accommodated under a particular e-government element/factor (in dimension A x B), at each of the 3 levels of the government enterprise (dimension D). This forms the front side of the ARGEA cube in Fig. 1. However, conducting the assessment and recording results thereof can be done using the

disaggregated view of cells (containing codes Q1.1 to Q5.3) in table III.

In each cell of table III, the line of questioning follows the following two-step pattern: (A) To what extent is an e-government element (or requirement, readiness factor or sub factor) developed?; and (B) To what extent does the specific e-government element accommodate specific elements or sub elements for enterprise architecture? Appendix I instantiates this pattern by generating questions with codes [Q1.1a, Q1.1b] to [Q5.3a, Q5.3b]. This order of questioning is adopted because in most developing countries, there is some level of already ongoing work on e-government development, and efforts for architecture-driven e-government are being adopted or considered for adoption to streamline e-government development. Thus, this line of questioning helps to determine the extent to which particular e-government elements have been developed, and to determine the entry point of enterprise architecture in specific contexts.

The alternative line of questioning is to first find out the extent to which an enterprise architecture element is developed within a given government enterprise, and then determine the extent to which that architecture element addresses particular concerns or emerging issues in an e-government effort. However, this alternative line may be suitable in settings where a (reference) e-government enterprise architecture from a developed economy is being adapted for use in a developing economy, or if a developed economy is exploring ways of 'maintaining' its enterprise architecture to address emerging issues in e-government.

Column 1 of table III shows elements for assessing architecture readiness, and columns 2 to 4 show elements for assessing e-government readiness. Sub-elements or sub-factors under architecture-related elements in column 1 and sub-elements or sub-factors under e-government-related elements in columns 2 to 4 are used in the formulation of questions that assessors use during the readiness assessment. The assessment is done at each of the 3 tiers of the government enterprise. This is indicated by: (a) disaggregating each cell into 3 sub-cells to depict the national, sector, and institutional levels; and (b) prompting for cascaded row totals in the last column of table III. After each cell is filled with an assessment response/value [X, Y], we generate averages for each full row using the format: [Average X, Average Y]. Row averages are then graphically presented (using a radar chart or bar/line graph) to aid decision making on the readiness to develop an e-government enterprise architecture.

The questions in appendix 1 have sub-questions that accommodate specific sub elements or sub-factors for e-government and for enterprise architecture (that are based on taxonomies presented in tables I and II in section II). However, due to space limitations, all questions and sub-questions that assessors can use or follow to generate response values for all cells in Fig. 1 and table III, can not be presented in this paper. Thus, an extract of high level questions is provided in appendix 1. The questions can be used to generate response values for major cells marked Q1.1 to Q5.3 in table III.

IV. INITIAL VALIDATION OF ARGEA

As suggested by Hevner et al [45] and Wieringa [46], the design of artifacts in information systems can be evaluated using: experiment methods (field or lab experiments, lab demo); observational methods (case study, action research, field study, field demo); descriptive methods (bench marking and illustration scenarios); functional and structural testing

methods; and analytical methods. The selection of the appropriate design evaluation method depends on the desired or intended application context of the artifact and the resources available.

Thus, in this study it was considered appropriate and economical to first evaluate the design, feasibility, and applicability of ARGEA in a setting where researchers use the artifact in a real enterprise (that has a relatively smaller scope of coverage). This implies that it was vital to choose an entity/organization that is considered to be at institutional level of the government enterprise, instead of choosing an entity that is at national or sector levels of the government enterprise.

Experiment methods require the researcher or other people to use an artifact in a controlled environment and simulate it with artificial data, while observational methods require the researcher or other people to use an artifact in a real enterprise environment [45, 46]. For example, using a field demo, a researcher uses an artifact in a real enterprise to demonstrate its usability [46]. Thus, it was appropriate to first use a field demo to evaluate ARGEA prior to employing other observational design evaluation methods.

Context of chosen entity: The institution that was chosen was a Public University in Uganda. To make the scope manageable, one College within the Public University was chosen. The College was facing a service delivery problem in the coordination of the research programme for its students. The performance of its student research programme was low, characterized by: low number of graduating students due to inefficiencies in the coordination of the research examination process; delays in completion and submission of research reports or dissertations/theses; high level of frustration among students executing their research projects; high level of frustration among academic staff who supervise and examine student research projects.

To address these issues, an e-government solution was required. e-Government solutions can take three forms, i.e.: i) e-administration solutions – those that align internal processes of a public entity with digital technologies; ii) e-citizen and e-service solutions – those that align external processes that support citizen engagements with digital technologies; and iii) e-society solutions – those that align external processes that support private and other public entities with digital technologies [47]. Thus, a business case was developed for the desired e-government solution of the College's research programme.

The business case indicated that it was vital to develop an e-government solution that would have at least 4 modules.

- Module 1 was to be an e-administration solution for supporting effective management and coordination of the research programme. This module would have to be interoperable with: the university-wide students results management system; and the human resource system that manages promotions of academic staff, who are involved in the supervision and examination of student research projects.
- Module 2 was to be an e-service solution for supporting the College to effectively interact with students to execute and complete their research projects on time. It would support student-programme interactions from the start of the research project to the end, and subsequent followups associated with alumni management.
- Module 3 was to be an e-society solution for supporting the College to interact with its public and private partner agencies through dissemination of research innovations

of students and academic staff, and management of issues from agencies that sponsor student research projects.

- Module 4 was to be an e-administration solution that integrates data from modules 1 to 3 to support predictive analysis for organizational learning in the context of the research programme. It would require the College to collect data on students' performance and research contexts, so as to measure improvements over time in student supervision and assess effectiveness of learning during research (learning analytics).

The business case was accompanied with an architecture vision of the desired e-government solution, and a rapid prototype for modules 1 to 4. Prior to fully implementing the desired e-government solution (as documented in the business case), it was vital to assess readiness of the College to undertake an architecture-driven e-government implementation at unit level. This is because the College (perceived as a unit in this case) is governed by the Public University, which is an institutional-level entity in the context of ARGEA.

Setup of the evaluation: ARGEA was used as the readiness assessment approach. Its question log in appendix 1 was used to engage two key stakeholders. The coordinator and administrator of the research programme were engaged as the two key stakeholders/respondents in the readiness assessment exercise. From the question log, only institutional level questions asked due to the nature of entity that was chosen. One of the researchers was the interviewer, and was able to explain concepts in the question log to the respondents during the readiness assessment exercise. Quantitative responses from the interview were documented using MS EXCEL,

which was also used to generate row averages (as the final assessment values in table III)

Results from Readiness Assessment: For confidentiality reasons and space limitations, the qualitative responses from the readiness assessment in the selected entity can not be disclosed here. Since only institutional level questions were asked, averages were generated for only the institutional level of the e-government enterprise. The row averages of the quantitative responses/values (as explained in section III) are presented using the bar graph in Fig. 2. The Y-axis of the graph represents the points in the assessment scale provided in Dimension E of Fig. 3 and table III. The bars represent the extent to which particular elements for e-government and enterprise architecture are developed or exist within the research programme. Thus, the bar graph shows that the research programme lacked documentation of aspects that constitute key elements in developing both e-government and enterprise architecture.

Readiness assessment results also indicate that the College was not yet ready to undertake the effort of developing the desired architecture-driven e-government solution that would address the problems faced by its research programme. From the qualitative responses that underly/justify the scores in Fig. 2, the major two reasons for lack of readiness were: *the absence of a sustainability plan; and a legal and governance plan* for supporting and guiding the development, implementation, and maintenance of the desired e-government solution. Thus, the College had to first embark on addressing these gaps.

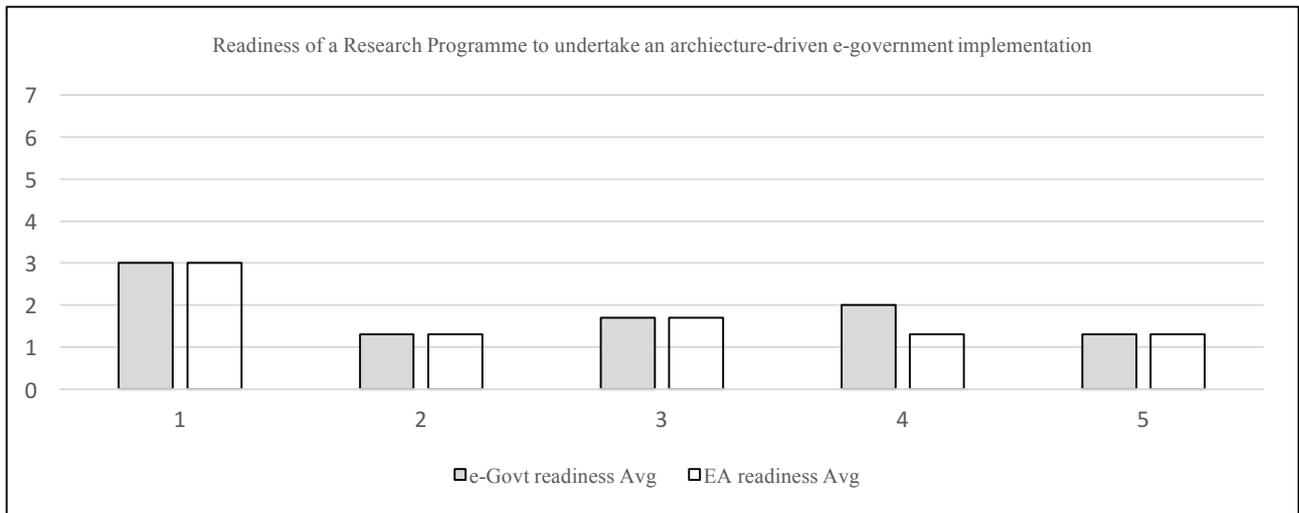


Fig. 2. Graph of Averages from the Readiness Assessment

Findings on the design and feasibility of ARGEA: from the assessment exercise, the following were the key issues and how they were addressed.

First, there was need to add a 'not applicable' option on the response scale in dimension E. This has been rectified in the ARGEA model presented in Fig. 1 and table III. Also, the wording used in some questions had to be amended for better understanding. For example, questions on 'laws/ regulations/ rules' were first presented as 'laws & regulations'. Then 'rules' was amended to make the sentences easier to respond to especially in terms of internal governing principles of an entity.

Second, in the question log, there was need to first inquire whether a given element or readiness factor of e-government exists prior to asking the extent to which it accommodates an element or sub element in the enterprise architecture dimension. For example, in Q1.1b, before asking whether existing governance mechanisms for the enterprise support management and control roles of architecture development, one would have asked whether a governance mechanism for e-government actually exists. However, this would increase the number of questions in the question log. To avoid increasing the number of questions, the assessor records information on the existence of an e-government element using the X response value. Also, information on the extent to

which an element for enterprise architecture is or can be accommodated in an existing element of e-government is recorded using the Y response value.

Third, there is need to ensure that the response key (dimension E) accommodates responses associated with both the 'hard' or tangible and 'soft' or intangible aspects in relation to the assessment questions. Also, the current response scale does not cater for option of a 'plan being available, but not operationalized or adopted for a long time'.

Findings on the applicability of ARGEA: It was successfully applied in an entity at institutional level. Findings indicate that if questions are provided with the lowest level of granularity (where they are disaggregated to reflect sub-sub factors under the broad elements of e-government and enterprise architecture), then the usability of ARGEA will improve.

V. CONCLUSION AND FUTURE WORK

The aim of this paper was to provide initial results regarding the development of an integrated maturity model for the mutual assessment of readiness to undertake or implement an architecture-driven e-government solution. The focus of the paper was not to 're-invent the wheel' in terms of readiness assessment factors for e-government and for enterprise architecture. However, since several factors and sub-factors are involved in assessing readiness for both e-government and enterprise architecture, we focused on deriving a model that can provide a holistic and integrated perspective of assessing readiness for architecture-driven e-government implementations. We perceive such a model as an attempt towards having a synthesized catalog of existing views on factors for assessing readiness for e-government and for enterprise architecture. Future work will involve evaluating ARGEA using other design evaluation methods such as case studies, so that all questions are validated with entities at sector level and national level.

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APPENDIX 1. HIGH LEVEL QUESTIONS OF ARGEA

Note: From [42], we adopt sub elements of the three e-government core elements or strategic requirements (i.e. *legal & governance framework, sustainability & capacity building, innovation & adaptation framework*), and we use them to formulate questions coded Q1.1 to Q5.3 in the following question log.

Response key for X, Y responses: 0 = Not applicable; 1 = Applicable but not existing, not documented; 2 = Not documented, but existing informally; 3 = Plan is available to guide implementation, but implementation is yet to begin; 4 = Implementation at preliminary stage; 5 = Implementation in advanced stage; 6 = Fully functional/acquired; and 7 = Monitored and evaluated.

Assessing the extent to which elements in the **legal & governance framework for e-government** address the core elements of **enterprise architecture** development.

Q1.1a. To what extent do laws/regulations/rules support development of an e-government enterprise architecture (or standardization/ integration of e-government implementation) at national/ sector/ institutional levels?
Q1.1b. To what extent do existing governance mechanisms accommodate the management & control responsibilities that are associated with e-government development and architecture development, at national/ sector/ institutional levels?
Q2.1a. To what extent do laws/regulations/rules support building skills & competences (of all stakeholder groups) that are required for developing both e-government & enterprise architecture at national/ sector/ institutional levels?
Q2.1b. To what extent is the governance or decision making processes for accessing resources (required to develop an e-government enterprise architecture) streamlined at national/ sector/ institutional levels?
Q3.1a. To what extent do laws/regulations/rules support the establishment & sharing of a repository for all information assets & tools relevant for building an e-government enterprise architecture at national/ sector/ institutional levels?
Q3.1b. To what extent do existing governance mechanisms support the management and control of a repository for all information assets & tools for the e-government enterprise architecture at national/ sector/ institutional levels?
Q4.1 & Q5.1. To what extent do laws/regulations/rules support or enforce the development of architectures for the business, information systems, technology and security domains (associated with the existing & planned e-government capabilities)?
Assessing the extent to which elements in the sustainability & capacity building framework for e-government address the core elements of enterprise architecture development
Q1.2a. To what extent have Public Private Partnerships (PPPs) for establishing infrastructure for an e-government enterprise architecture (or for realizing integrated e-government) been developed at national/ sector/ institutional levels?
Q1.2b. To what extent have the PPPs for the e-government infrastructure accommodated the management & control responsibilities that are associated with architecture development at national/ sector/ institutional levels?
Q2.2a. To what extent has a capacity building framework for e-government stakeholders been developed at national/ sector/ institutional levels?
Q2.2b. To what extent has the capacity building framework for e-government stakeholders accommodate the skilling needs for enterprise architecture development at national/ sector/ institutional levels?
Q3.2a. To what extent has an ICT or e-government strategic management framework or plan been developed at national/ sector/ institutional levels?
Q3.2b. To what extent does the ICT or e-government strategic management framework or plan include the key information assets that are useful as inputs for developing enterprise architecture at national/ sector/ institutional levels?
Q4.2a & Q5.2a. To what extent has a risk assessment & cost benefit analysis mechanism for e-government been developed to cater for issues in the business, information systems, technology, & security domains domains of existing solutions at national/ sector/ institutional levels?
Q4.2b & Q5.2b. To what extent does the risk assessment & cost benefit analysis mechanism accommodate issues associated with planned e-government capabilities in the business, information systems, technology, & security domains at national/ sector/ institutional levels?
Assessing the extent to which elements in the innovation & adaptation framework for e-government address the core elements of enterprise architecture development

<p>Q1.3a. To what extent has a team been established to innovate e-government solutions & adapt them to context? To what extent is the development & adaptation of e-government innovations managed and controlled at national/ sector/ institutional levels?</p>
<p>Q1.3b. To what extent has a monitoring & evaluation framework for an e-government enterprise architecture (or for realizing integrated e-government) been developed at national/ sector/ institutional levels? To what extent does management at each government level accommodate or support modifications to include all key performance indicators for enterprise architecture and for e-government?</p>
<p>Q2.3a. To what extent has a public participatory framework or plan for supporting e-government implementations been developed at national/ sector/ institutional levels?</p>
<p>Q2.3b. To what extent does the public participatory framework or plan for e-government accommodate skilling needs of citizens or customers & other end-users as key stakeholders of an e-government enterprise architecture at national/ sector/ institutional levels?</p>
<p>Q2.3c. To what extent is the resource acquisition process for innovations & adaptations for e-government solutions streamlined at national/ sector/ institutional levels?</p>
<p>Q3.3a. To what extent have interoperability principles or guidelines (& specifications for integrating heterogeneous applications) for e-government solutions been developed or customized and shared at national/ sector/ institutional levels?</p>
<p>Q3.3b. To what extent do the existing e-government interoperability principles or guidelines (& specifications for integrating heterogeneous applications) accommodate principles for all architecture domains in an e-government enterprise architecture at national/ sector/ institutional levels?</p>
<p>Q4.3a & Q5.3a. To what extent have the business, information systems, technology, and security domains for existing & planned e-government capabilities been documented at national/ sector/ institutional levels? Or To what extent have domain architectures for existing & planned e-government capabilities exist?</p>
<p>Q4.3b & Q5.3b. To what extent are interoperability issues associated with the business, information systems, technology and security domains of existing & planned e-government innovations been documented at national/ sector/ institutional levels?</p>