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## PEN

Active South African Enterprise Architecture community collaborating through knowledge sharing and networking

The Open Group South Africa

The Open Group is a vendor-neutral and technology-neutral consortium with a foundation in its members - a diverse group that spans all sectors of the IT community - IT customers, systems and solutions suppliers, tool vendors, integrators and consultants, as well as academia and researchers. These members come from all over the world and include some of the largest IT buyers and vendors, representing both government and commercial enterprises.

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News: The Open Group Launches the TOGAF® Standard, Version 9.2

**TOGAF**

TOGAF® is an industry standard architecture framework that may be used freely by any organization wishing to develop an information systems architecture for use within that organization.

**EA Forum**

Real IRM, represents The Open Group in South Africa and brings local IT customers, vendors, consultants, governments and academics together through The Open Group's Enterprise Architecture Forum.

**EMMM**

The Open Group's Exploration, Mining, Metals and Minerals (EMMM) forum collaborates to create reference models (such as mining process and information models) for the exploration and mining industry.

**ArchiMate 3**

ArchiMate® is an open and independent modeling language for EA. The standard provides a notation to enable the unambiguous description, analysis, and visualisation of the relationships among business domains.

## eGovernment Architecture Framework - Romi Vidmar

Through e-Government initiatives, South Africa's Government seeks to provide improved services, greater public service efficiencies and cost containment. These endeavours meet and have met with varying levels of success since 1998.

In this month's EA Forum, Romi Vidmar, ESM Architect at SARS, will take us through a newly-proposed framework of twelve architectural artefacts which aims to facilitate the successful use of the Government Wide Enterprise Architecture (GWEA) framework and ICT governance.

Romi Vidmar began his career as a junior systems engineer with Siemens and has progressed through a number of roles and organisations to become Government CIO with national government, and then to his current position of ESM Architect with SARS. He holds BSc, BSc Hons and MSc degrees in computer science and information systems and is concluding a PhD in Information Systems. Romi is TOGAF 8 certified.

# **Towards the Development of an e-Government Theory and Reference Architecture for South Africa**

**Romi J. Vidmar  
PhD Thesis**

**UNISA**

**EA Forum, South Africa, 26, 27 June 2019**

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# 1. The thesis argument

South African e-Government efforts have been **regressing relative to other nations**. The Government Wide Enterprise Architecture (**GWEA**) and the Corporate Governance for ICT (**CGICT**) frameworks are insufficient to effectively support e-Government implementations. Worldwide there is a **gap in knowledge**, and a **desire for more e-Government theory**.

**Following the Design Science Research Methodology (DSRM)** Process framework, this research work has **designed and evaluated twelve proposed theory artefacts** including a reference architecture for GWEA, logically and empirically, within the limits of this research, **that offer a tentative theory and technology for better implementation**, by enterprise architects, of an e-Government programme in South Africa.

## 2. Problem relevance and gap in knowledge

The **goal of this study** is to **propose an improvement to the understanding of e-Government and its realisation in South Africa**. This is done by investigating the problem domain, designing and evaluating a proposed theory of e-Government consisting of a framework of 12 artefacts including a proposed reference architecture for e-Government within the existing GWEA framework, which is essentially a South African adaptation of the TOGAF standard for enterprise architecture. The TOGAF standard is used widely in the private and public sectors around the world.

## 2.1 Problem relevance and gap in knowledge

The goal of this study is **supported by the following research objectives:**

- RO1: To understand the nature of current e-Government research and its theoretical underpinning.
- RO2: To examine the history of e-Government progress in South Africa.
- RO3: To examine the role of EA in e-Government implementations.
- RO4: To analyse the progress in e-Government in South Africa.
- RO5: To analyse the impact of GWEA in South Africa.
- RO6: To propose a theory of e-Government and a GWEA reference architecture, for improved e-Government implementation. This includes the development of theoretical artefacts constituting the theoretical and technological elements in both instances.



## 2.2 Problem relevance and gap in knowledge

Based on the purpose of the research, the problem that has been identified and the objectives that have been set, **the research question of this study is:**

**RQ1: How can a theory of e-Government be designed and how can that be used to define a GWEA reference architecture to positively influence the implementation of e-Government in South Africa.**

In order to answer the research question, the following **sub-questions must be answered:**

SQ1: What progress has been made in e-Government since its inception?

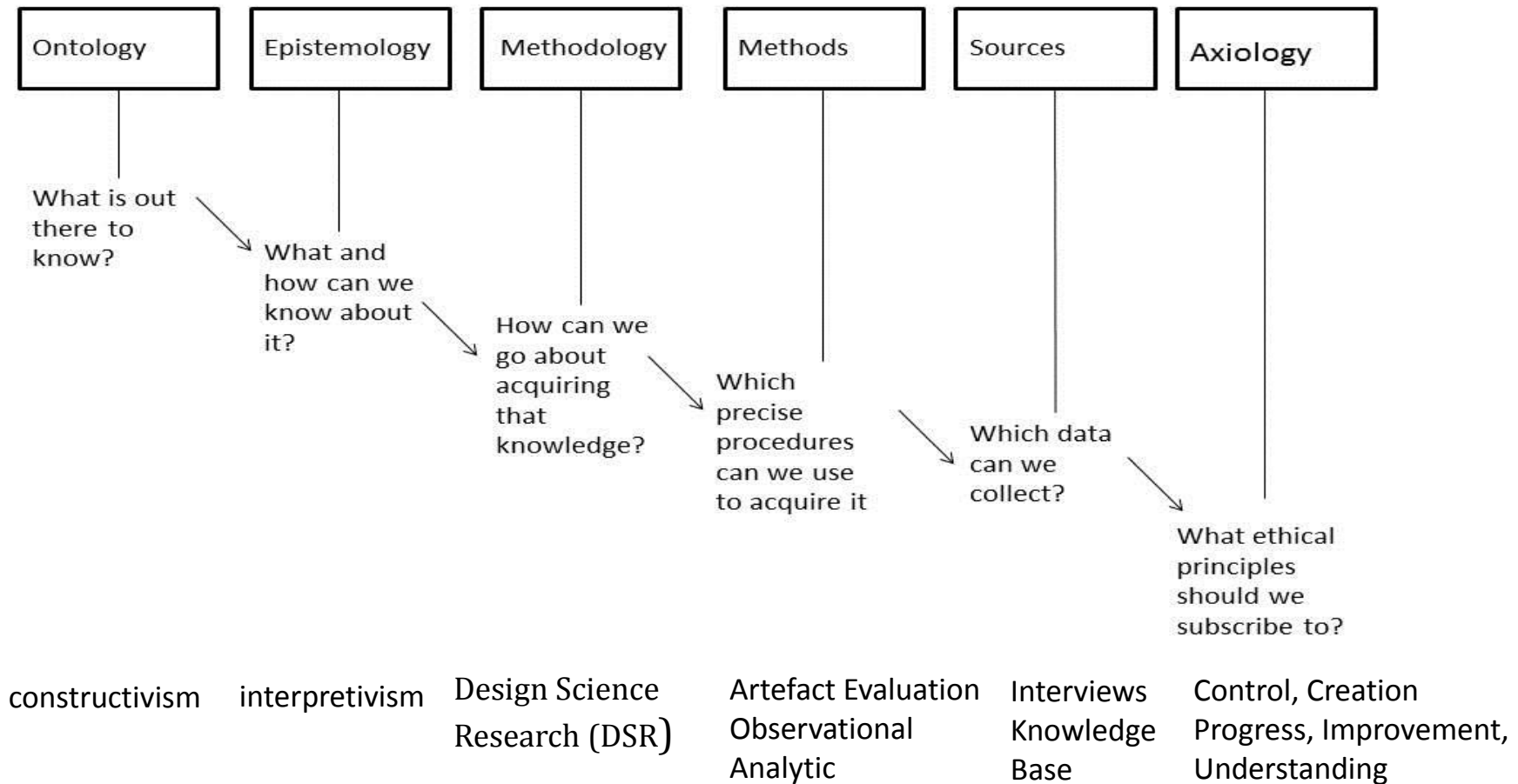
SQ2: How can the current state of e-Government be defined?

SQ3: How suitable are the proposed design artefacts to define a theory of e-Government?

SQ4: What is the current state of GWEA?

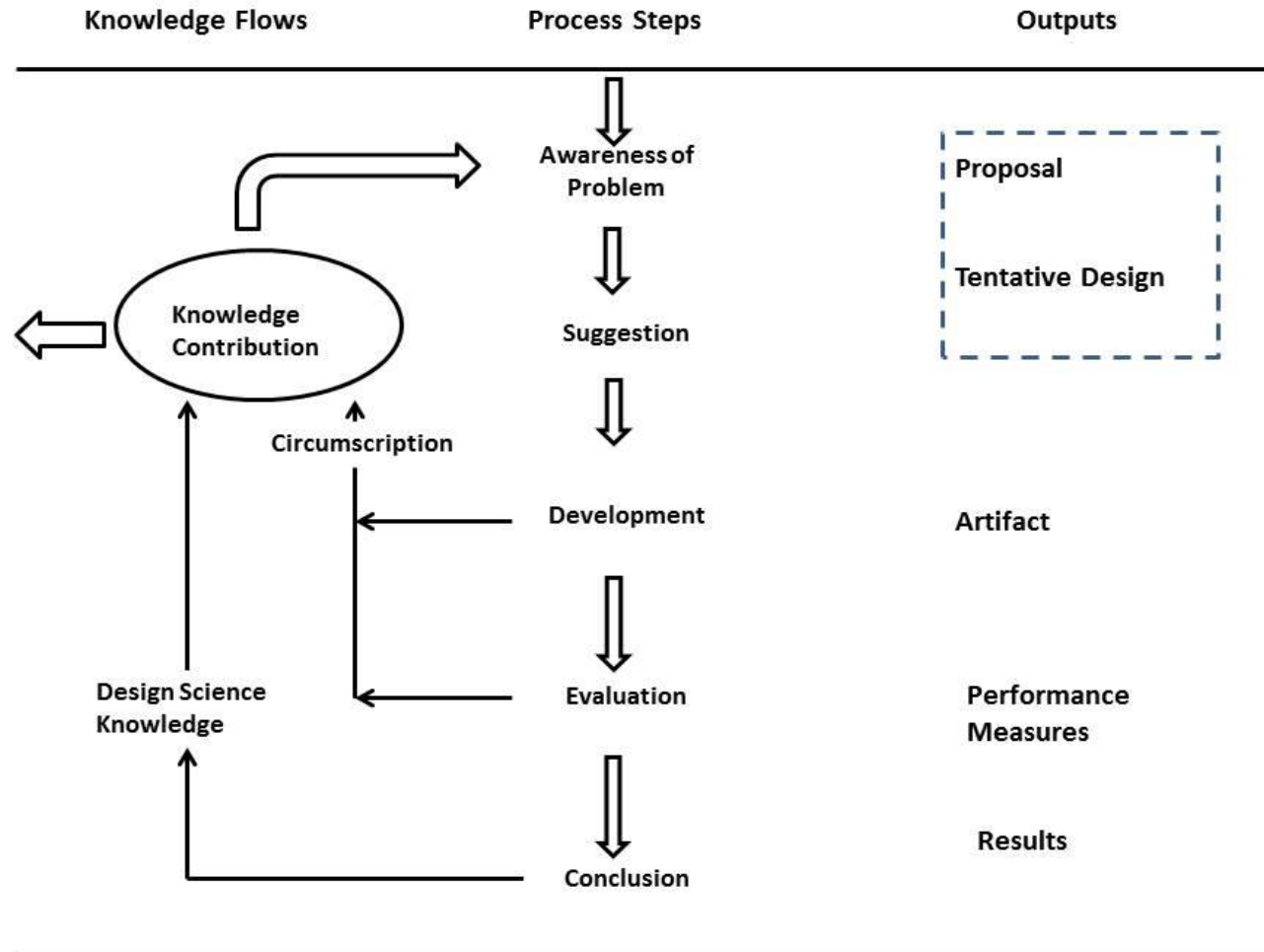
SQ5: How suitable is the proposed GWEA reference architecture artefact in support of e-Government solution design?

# 3. Appropriateness of the research framework



The interrelationship between the building blocks of research (Grix, 2002)

# 3.1 Appropriateness of the research framework



DESIGN SCIENCE RESEARCH PROCESS MODEL (DSR CYCLE) AFTER VAISHNAVI & KUECHLER (2016) ADAPTED FROM TAKEDA ET AL (1990)

## 4. Appropriateness of empirical situation for observing the phenomena

- The investigation of the problem statement suggested the need to use the **semi-structured interview method** to interview qualified enterprise architects with 10-20 year's experience in e-Government development in South Africa across national, Gauteng provincial and local government and in industry consulting.
- **Two design-evaluation cycles using the observational method of evaluation** were completed to evaluate the current context of e-Government and in particular the usefulness of the proposed theory artefacts designed by the researcher. In the first cycle 9 participants were interviewed; 6 from national government, 1 from Gauteng Province, 1 from local government, 1 from industry. In the second cycle 6 were interviewed; 4 from national government, 2 from industry. **The sample size was constrained by the difficulty of finding willing candidates, practical research constraints and saturation of data.**
- **Three further design-evaluation cycles were used to evaluate the artefacts analytically** against accepted definitions of theory.

## 5. Demonstrated command of literature of the research discipline

The literature review covers **two sub-disciplines of information systems**:

E-Government

Enterprise Architecture

Literature sources included local and international research publications and local e-Government and Enterprise Architecture government standards – CGICT, GWEA, PRC, IT Policy

## 6. Demonstrated command of literature of the research framework

Leading researchers have been consulted in research methodologies, in particular DSR.

Popper (1976)

Simon (1981)

March & Smith (1995)

Purao (2002)

Rossi & Sein (2003)

Hevner et al (2004)

Gregor (2006)

Hevner (2007)

Gregor & Jones (2007)

Ilari (2007)

Peppers et al (2008)

Hevner & Chatterjee (2010)

Gregor & Hevner (2013)

Mentz et al (2014)

Kotze et al (2015)

Bannister & Connolly (2015)

Goldkuhl (2016)

Viashnavi & Kuechler (2016)

Kotzé, & Goede (2016)

Paulin (2017)

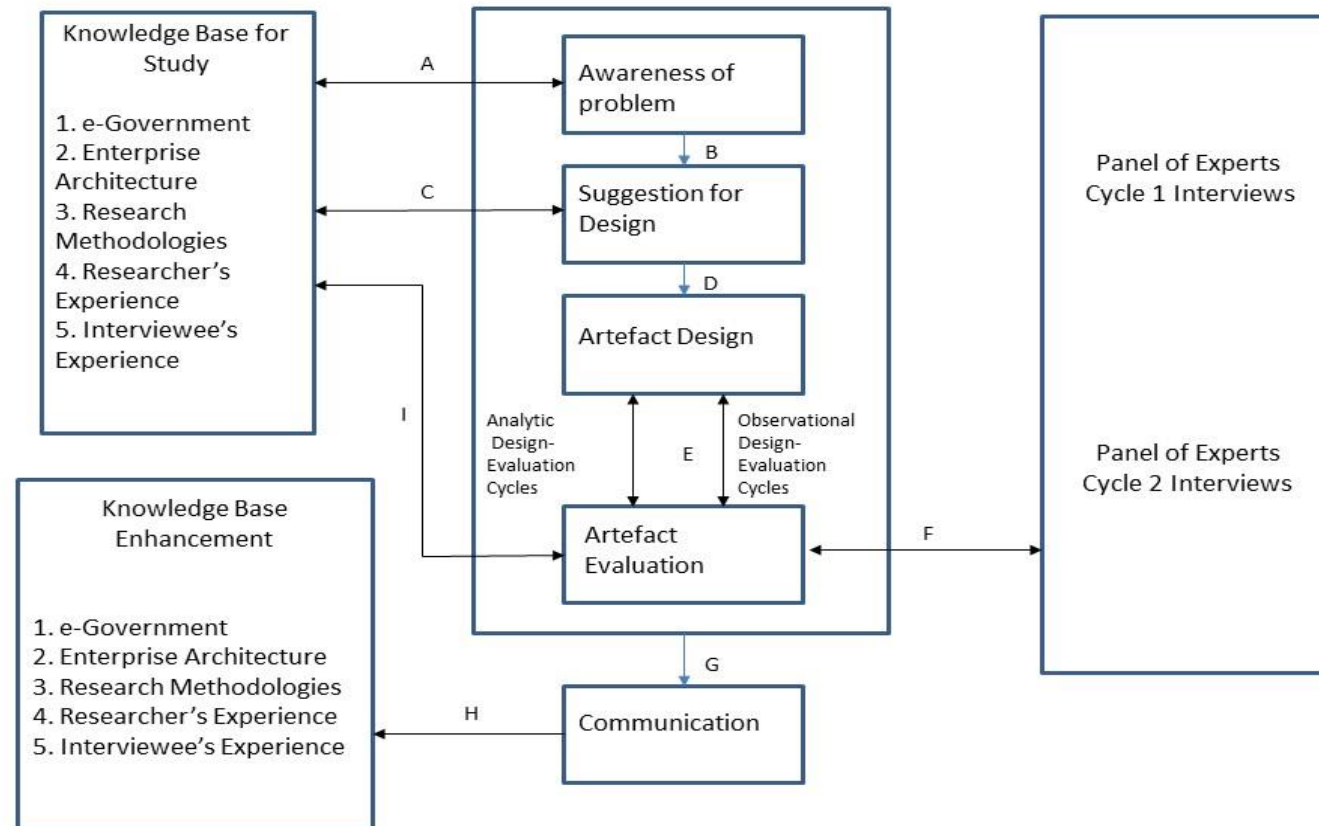
Van der Merwe et al (2017)

Deng et al (2017)

Baskerville et al (2018)

# 7. Systematic approach to research allowing replication or corroboration

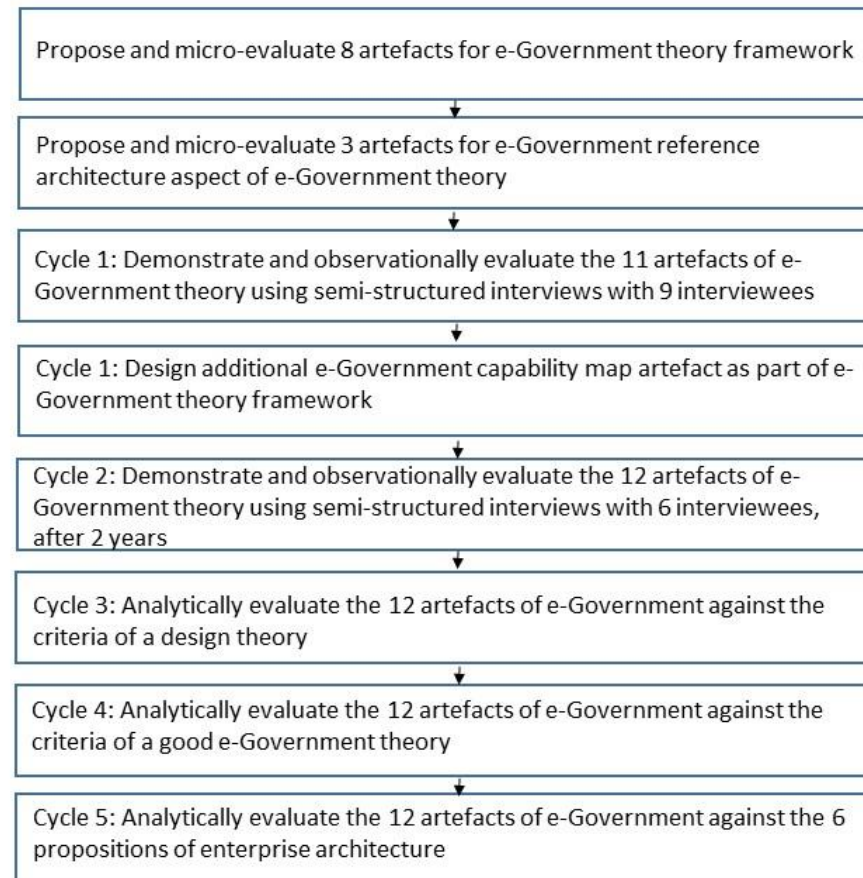
DSR methodology framework was followed systematically



Researcher's DSR Process Followed in this Study

# 7.1. Systematic approach to research allowing replication or corroboration

## Flow of DSR design-evaluation steps





## 7.2. Systematic approach to research allowing replication or corroboration

Qualitative data analysis was conducted in design-evaluation cycles 1 and 2 with the following **participant sample**.

Design-Evaluation Cycle	Number of Interview Participants	National Government	Gauteng Province	Local Government	Industry	Men	Women	E	A	I
Cycle 1 2015	9	6	1	1	1	8	1	5	3	1
Cycle 2 2018	6	4			2	5	1	4	2	

The sample size was constrained by the **difficulty of finding willing candidates, practical research constraints, and saturation of data.**

## 7.3. Systematic approach to research allowing replication or corroboration

**Qualitative data analysis** was conducted in design-evaluation cycles 1 and 2 using **thematic process approach** which is defined and is considered repeatable

Nine Transcripts	Number of codes assigned per transcript	Number of memos per transcript	Number of consolidated memos across 9 transcripts	Number of sub-themes across 9 transcripts	Number of themes across 9 transcripts
1	103	37	37	17	3
2	66	37			
3	93	37			
4	128	37			
5	74	37			
6	91	37			
7	101	37			
8	104	37			
9	102	37			
<b>Total</b>	862	333	37	17	3
<b>Total Data Size</b> 421 pages, 157,822 words	<b>Total Data Size</b> 83 pages 20,412 words	<b>Total Data Size</b> 51 pages, 13,225 words	<b>Total Data Size</b> 8 pages, 4125 words	<b>Total Data Size</b> 14 pages 7316 words	<b>Total Data Size</b> 23 pages 12,148 words

Data Deconstruction and Reconstruction – Cycle 1

Six Transcripts	Number of codes assigned per transcript	Number of consolidated answer files across 6 transcripts	Number of sub-themes across 6 transcripts	Number of themes across 6 transcripts
1	45	12	17	2
2	50			
3	68			
4	41			
5	75			
6	64			
<b>Total</b>	343	12	17	2
<b>Total Data Size</b> 56 pages, 23,045 words		<b>Total Data Size</b> 64 pages 23,944 words	<b>Total Data Size</b> 13 pages 6897 words	

Data Deconstruction and Reconstruction – Cycle 2

## 7.4. Systematic approach to research allowing replication or corroboration

**Thematic analysis is subjective and is based on a arguably low sample.** An **abductive argument can be used to evaluate its conclusion.** The following abductive statement from Timmermans & Tavory (2012) might be appropriate to be used in this evaluation.

Surprising fact F is observed

But if A would be true; F would be a matter of course

Therefore there is **reason to suspect** the truth of A

The complete abductive statement in the context of this research then might be:

**Evidence of support for the researcher's proposed theoretical framework for e-Government has been observed.**

But if a **e-Government theory acceptable to practitioners has been demonstrated by the researcher**; Evidence of support for the researcher's proposed theoretical framework for e-Government is observable, **would be a matter of course.**

Therefore **there is reason to suspect the truth of, A e-Government theory, thought to be useful to e-Government practitioners, was demonstrated.** The suspected truth of A is enhanced inductively as the observations remained fairly consistent in terms of artefact utility in two succeeding sets of interviews.

# 7.5. Systematic approach to research allowing replication or corroboration

## Cycle 3 and cycle 4 analytical evaluations

Cycle 3 Analytical Evaluation against Design Theory Criteria		Cycle 4 Analytical Evaluation against Good Theory Criteria	
Component	Description	Virtue	Description
Component 1: Scope and Purpose	Provides a clear description of the purpose and scope of the new theory.	Uniqueness	The uniqueness virtue means that one theory must be differentiated from another.
Component 2: Constructs	Describes all the existing or new entities or concepts relevant to the description of the theory.	Conservatism	A current theory cannot be replaced unless the new theory is superior in its virtues.
Component 3: Knowledge of Form and Function	Includes the full description of models, frameworks, methods and/or other abstract artefacts that form the body of the design science knowledge contribution.	Generalisability	The more areas that a theory can be applied to makes the theory a better theory.
Component 4: Abstraction and Generalisability	Is at such an abstract and general level that the artefacts resulting from the theory can change or be changed without affecting the theory.	Fecundity	A theory which is more fertile in generating new models and hypothesis is better than a theory that has fewer hypothesis.
Component 5: Evaluation and Validation Propositions	Has been evaluated for its truthfulness, i.e. assertions made based on the theory have been tested in an appropriate manner.	Theory parsimony theory simplicity, theory efficiency Occam's razor	The parsimony virtue states, other things being equal, the fewer the assumptions the better.
Component 6: Justificatory Knowledge	The search for an effective artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment	Internal consistency	Internal consistency means the theory has identified all relationships and gives adequate explanation.
Component 7: Communication of Research	DSR must be presented effectively both to technology-oriented as well as management-oriented audiences.	Empirical riskiness	Any empirical test of a theory should be risky. Refutation must be very possible if theory is to be considered a 'good' theory.
		Abstraction	The abstraction level of theory means it is independent of time and space. It achieves this independence by including more relationships.

# 7.6. Systematic approach to research allowing replication or corroboration

## Cycle 5 analytical evaluation

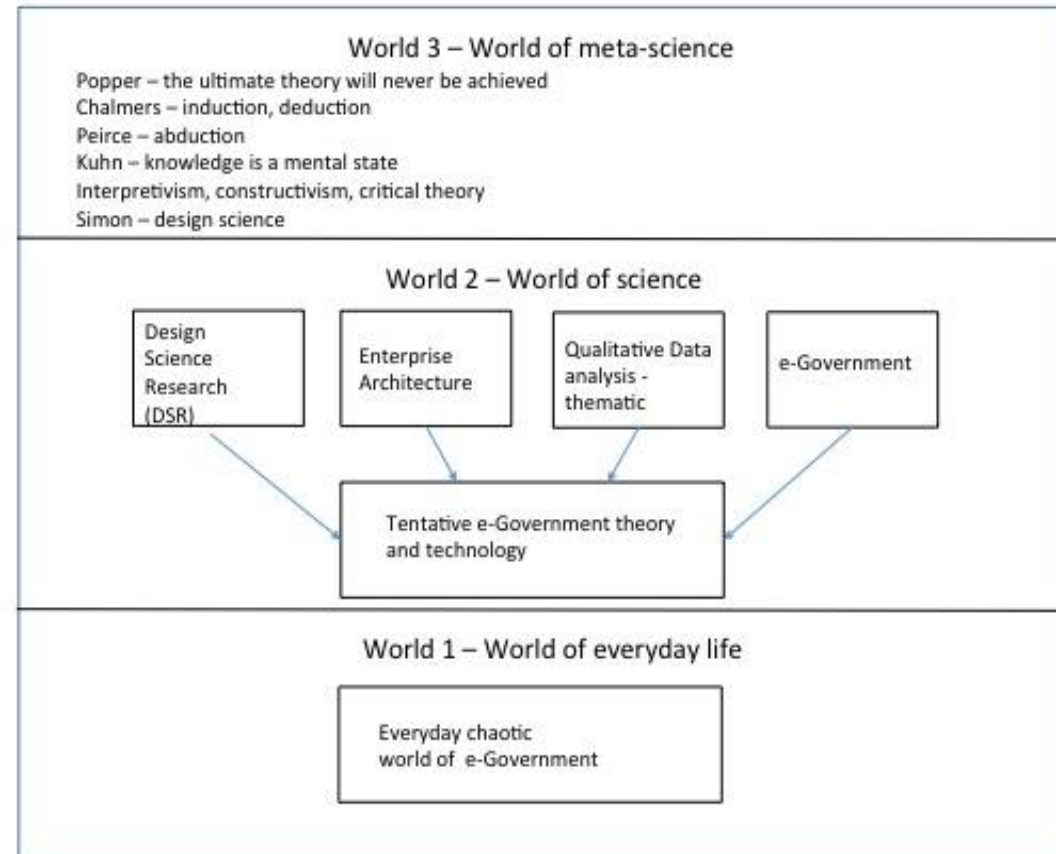
EA Proposition	Proposition Statement	Evaluation
Proposition 1	EA is a description of the structure of the systems of an enterprise in terms of components and their relationships.	The proposed theory supports the use of EA in the form of GWEA. The artefact in Figure 5-1 and Figure 5-2 support Proposition 1 by the form they take describing the structures of e-Government applications.
Proposition 2	The current view of the enterprise is captured in an as-is model	The artefact in Figure 4-3 depicts the As-Is state of government information systems and is therefore in support of Proposition 2.
Proposition 3	The future view of the enterprise is captured in a to-be model.	The artefact in Figure 4-3 showing the To-Be state of e-Government directly supports Proposition 3.
Proposition 4	EA translates the values/strategy of the enterprise into operational IT/IS systems	Proposition 4 is supported by artefacts in Figures 4-4, 4-5, 4-6 as they illustrate the realisation of IT and IS systems and implementation issues and concerns.
Proposition 5	EA relates the actions/behaviour that relates to the information technology (IT) and information systems (IS) management and implementation of the enterprise.	The design artefacts in Figures 4-5, 4-6, 4-9, 5-1, 5-2, 5-3 and 5-4 find application in support of the management and implementation of e-Government by means of enterprise architecture.
Proposition 6	EA captures a representation of the enterprise in the form of a model or set of models.	The theory framework in Figure 4-1 supports Proposition 6 as it represents the different structural views of the current and future e-government in South Africa.

## 8. Contribution to the field of study

- The research makes a **scientific and technological contribution** in e-Government
- A **tentative theory of e-Government** has been proposed and found **valid** within the limits of the research
- **12 artefacts were designed and evaluated**
- The artefacts have a **technological application as they appear useful to enterprise architects for the purpose of e-Government implementation**

# 8.1 Contribution to the field of study

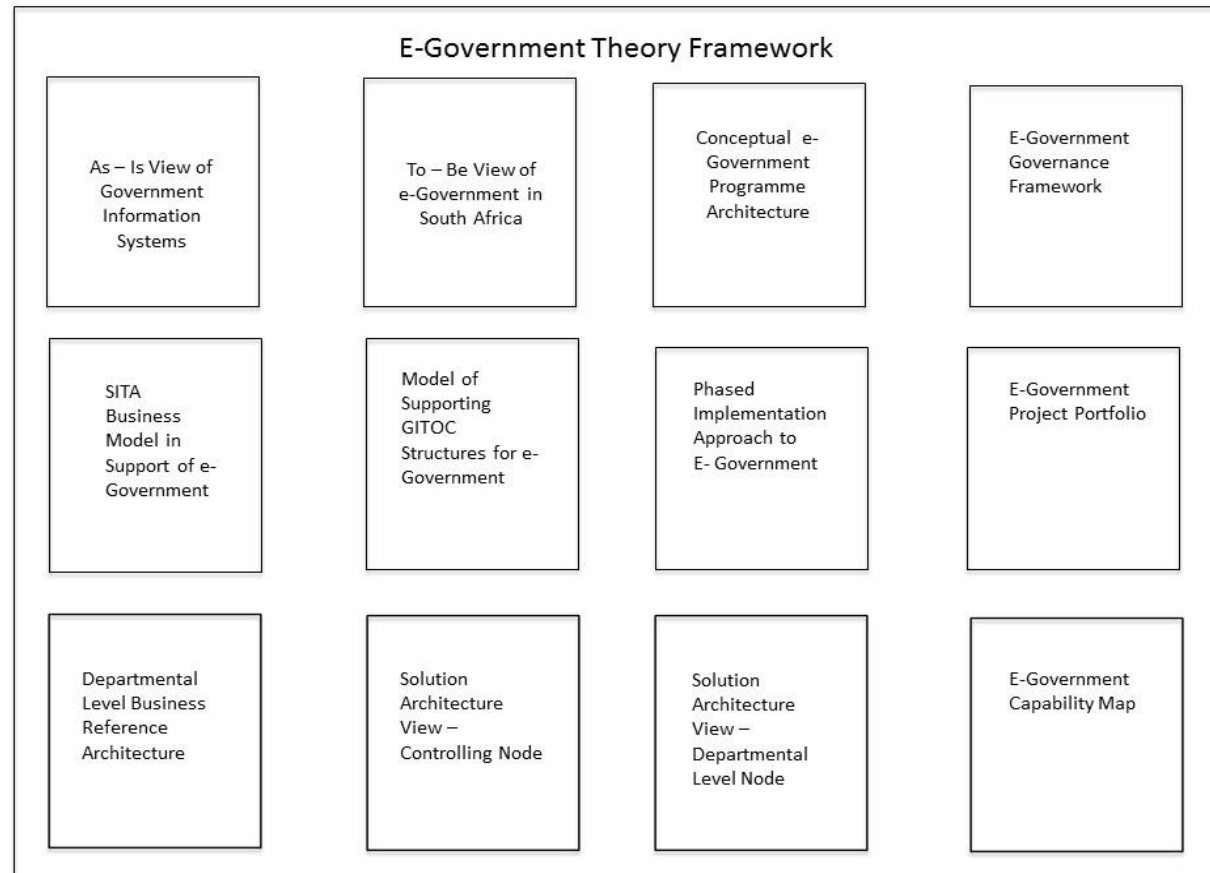
The contribution is to the worlds of science and everyday life



RESEARCH CONTRIBUTION FROM THE THREE WORLD PERSPECTIVE

## 8.2 Contribution to the field of study

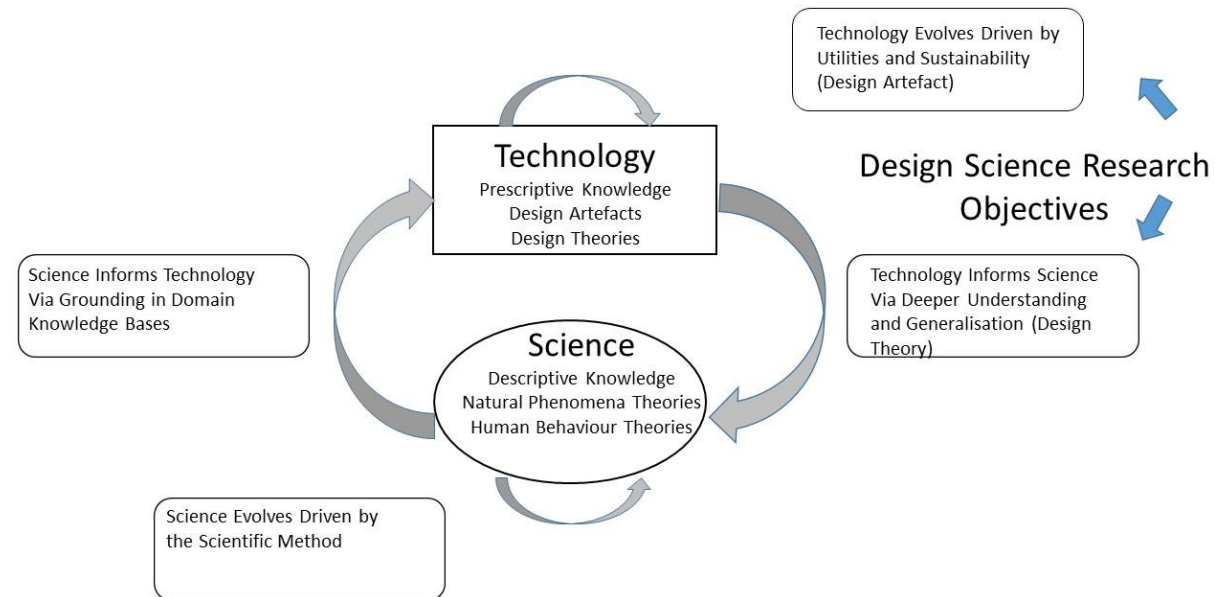
The following 12 artefacts emerged from the initial process of suggestion and design and the first observational evaluation cycle, and they together form the e-Government framework. Each represents a distinct view of e-Government stakeholder concerns.





## 8.3 Contribution to the field of study

The research appears to make a scientific and technological contribution in e-Government



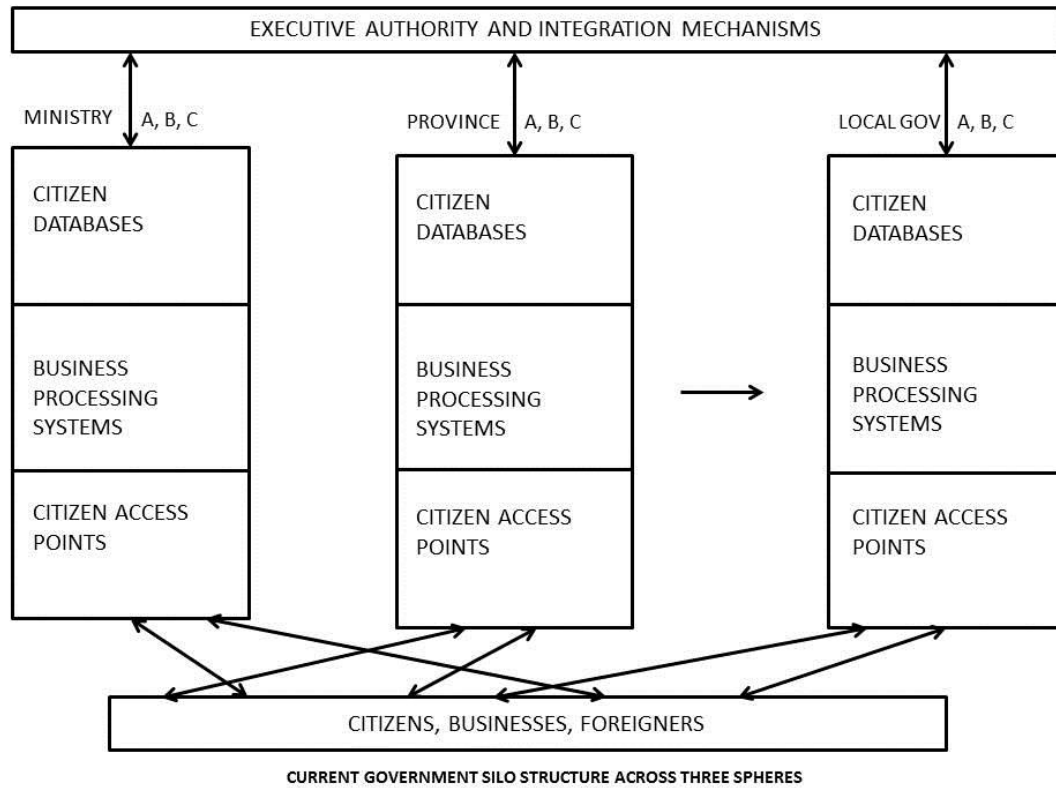
DSR Technology and Science Contributions (Baskerville et al, 2018)

## 8.4 Contribution to the field of study

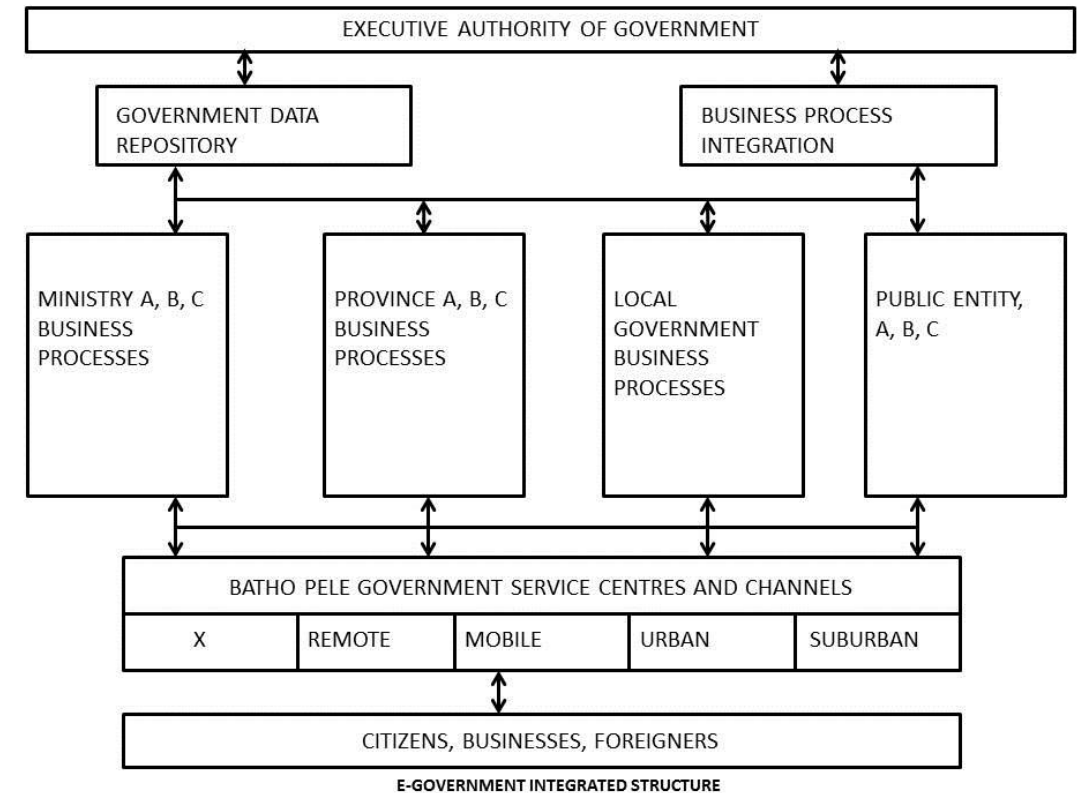
A tentative theory of e-Government has been proposed and found valid within the limits of the research.

The theoretical conjecture which this research study has shown to be valid, within the limitations of the study, is that **a theoretical view of e-Government, expressed as a series of design artefacts is vital to engage the enterprise architecture practitioners and e-Government decision makers in following the mission of e-Government as expressed in the ICT policy and strategy statements and the ICT governance framework.** Together with effective governance structure, a more effectively managed implementation agency, SITA, and appropriate investment and an e-Government reference architecture as part of GWEA, South African **e-Government efforts may prove more effective by providing some improved guidance to those charged with their planning and implementation.**

# 8.5 Contribution to the field of study

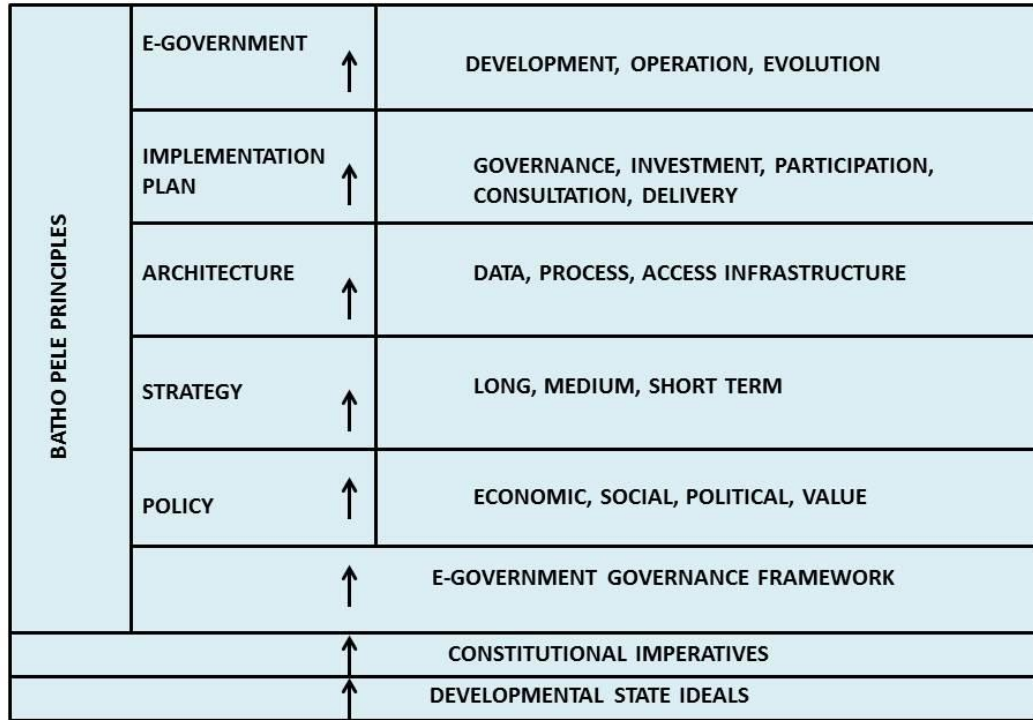


PROPOSED AS-IS VIEW OF GOVERNMENT INFORMATION SYSTEMS



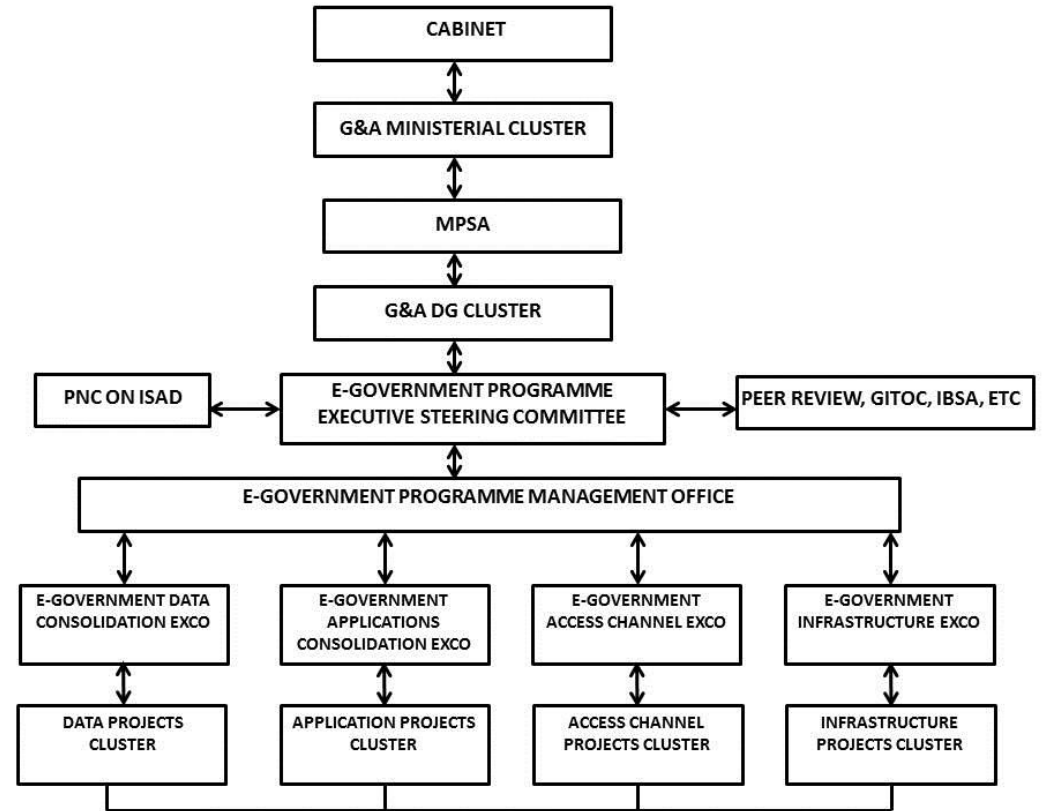
PROPOSED TO-BE VIEW OF E-GOVERNMENT IN SOUTH AFRICA

# 8.6 Contribution to the field of study



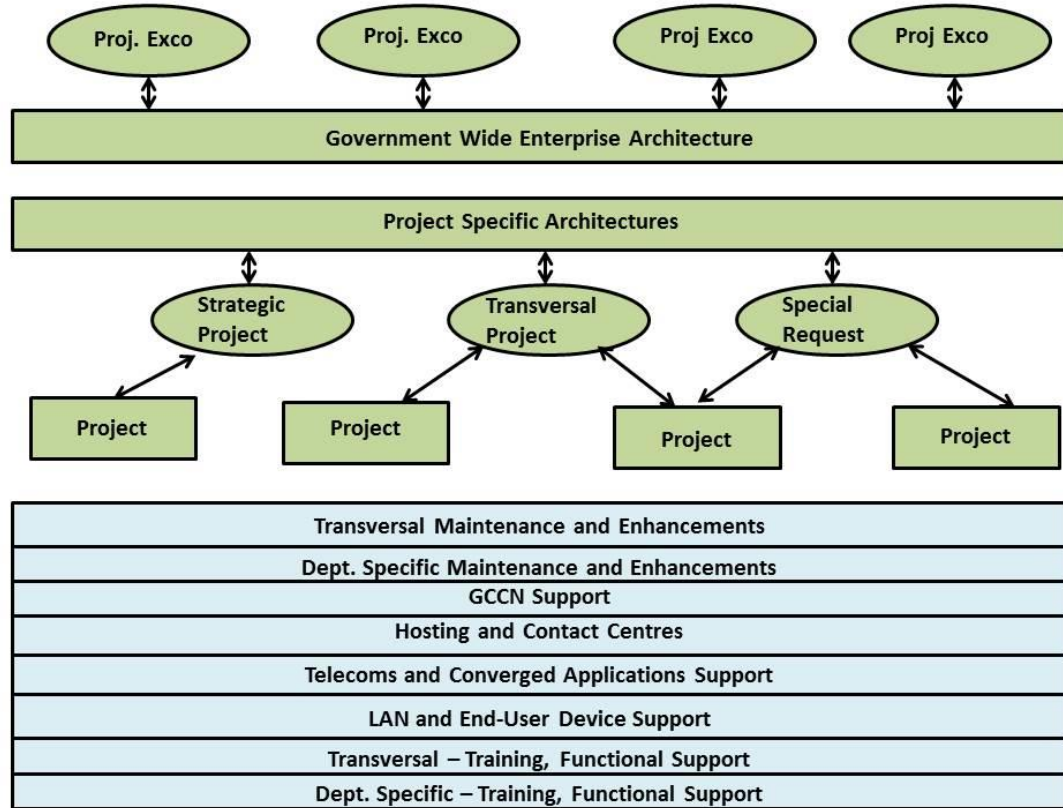
CONCEPTUAL E-GOVERNMENT PROGRAMME ARCHITECTURE

PROPOSED PROGRAMME ARCHITECTURE FOR E-GOVERNMENT IN SOUTH AFRICA

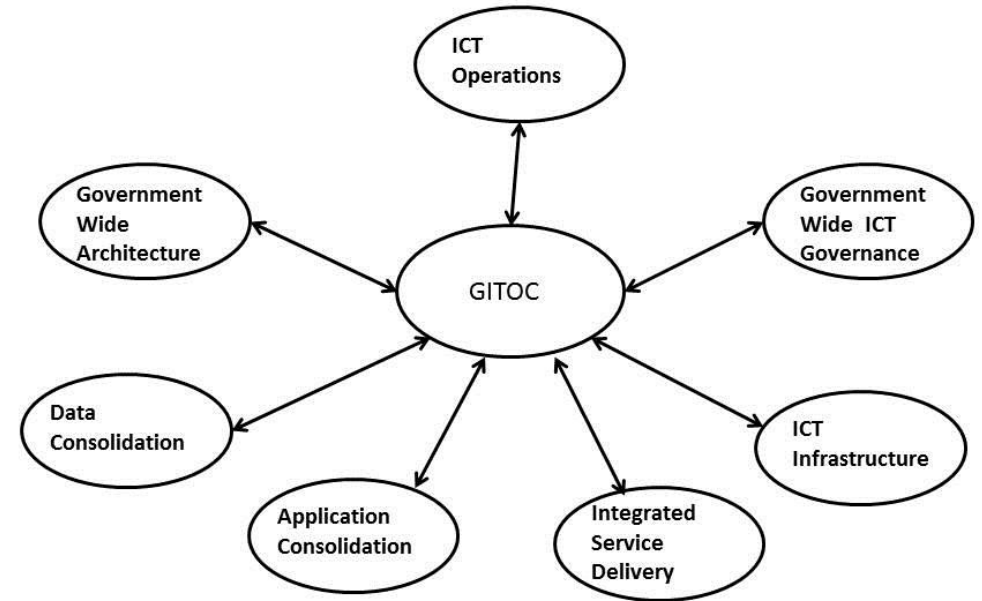


PROPOSED E-GOVERNMENT GOVERNANCE FRAMEWORK FOR SOUTH AFRICA

# 8.7 Contribution to the field of study



PROPOSED SITA BUSINESS MODEL IN SUPPORT OF E-GOVERNMENT IN SOUTH AFRICA



PROPOSED MODEL OF SUPPORTING GITOC STRUCTURES FOR E-GOVERNMENT

## 8.8 Contribution to the field of study

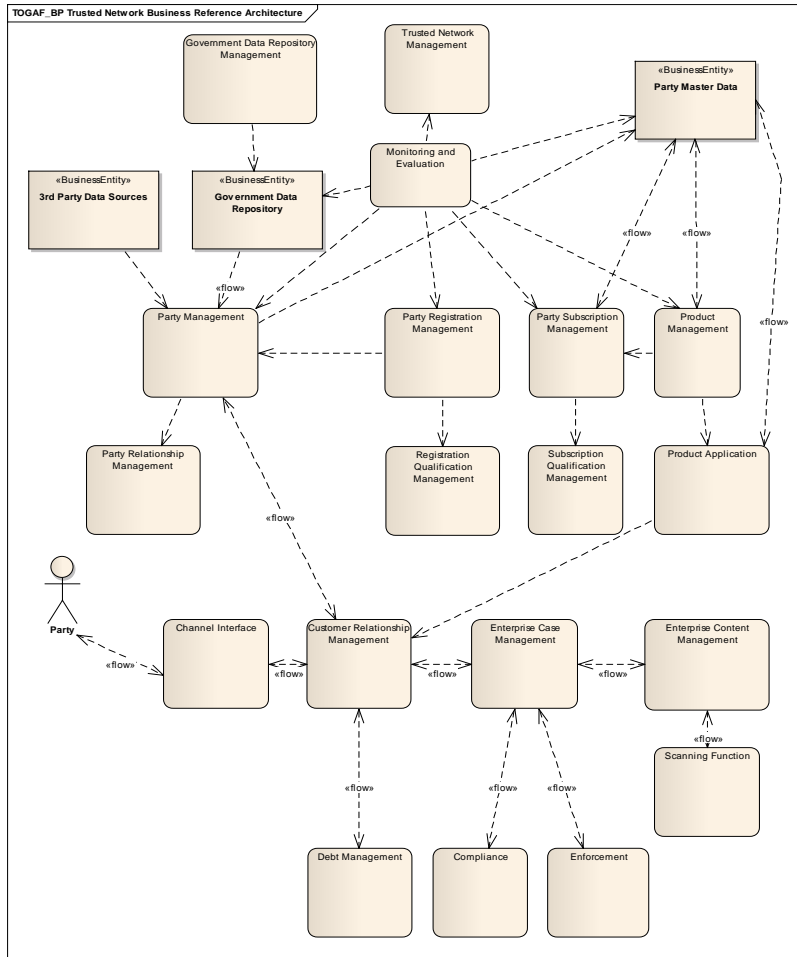
Phase 1	Multilingual information portal and call centre
Phase 2	Catalytic projects with some secure transaction based services
Phase 3	Clustering of related services, process optimisation
Phase 4	Personalisation and proactive services
Phase 5	Maintenance and opportunistic reengineering

PROPOSED PHASED IMPLEMENTATION APPROACH TO E-GOVERNMENT

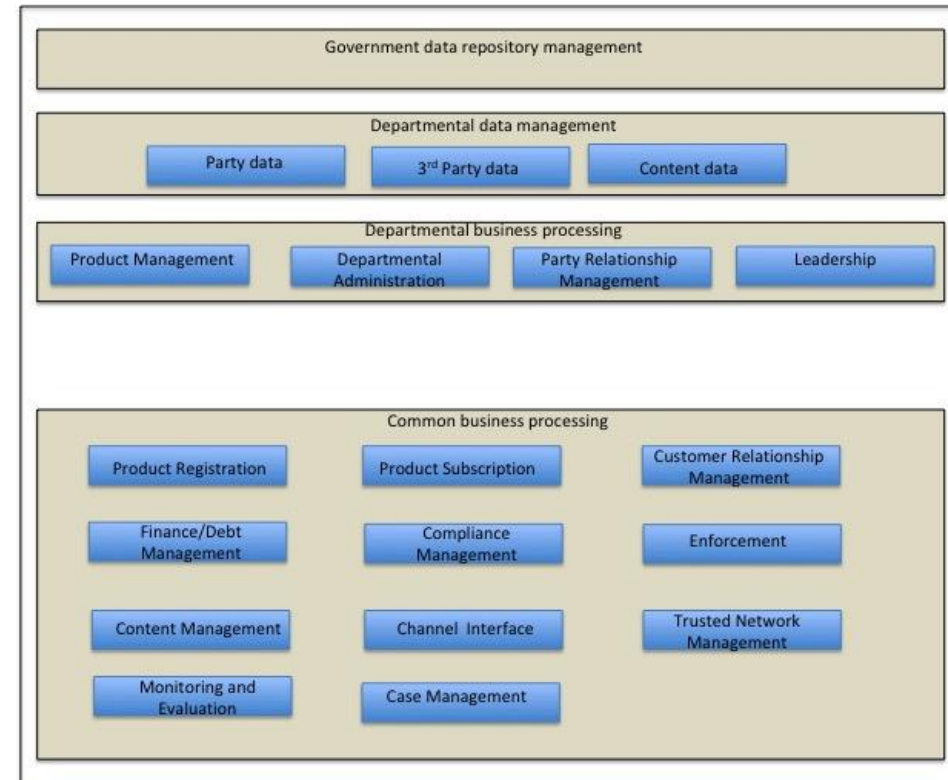
	G2G	G2C	G2B	IEE
Phase 1	Website eMail	GW Portal, Website, MPCC,	GW Portal, Website, MPCC	E-Mail Website
Phase 2	IFMS, HANIS Website	GW Portal, CDW Website, MPCC, eHealth	eProcure, SARS Website	eGIS, eMail, CABENET
Phase 3	IFMS	eHealth eEducation, HANIS SARS, NATIS	eProcure eServices eFiling	eRecords, NATIS, eMail
Phase 4	IFMS			
Phase 5	IFMS	GW Portal	IFMS	

PROPOSED E-GOVERNMENT PROJECT PORTFOLIO MODEL

# 8.9 Contribution to the field of study

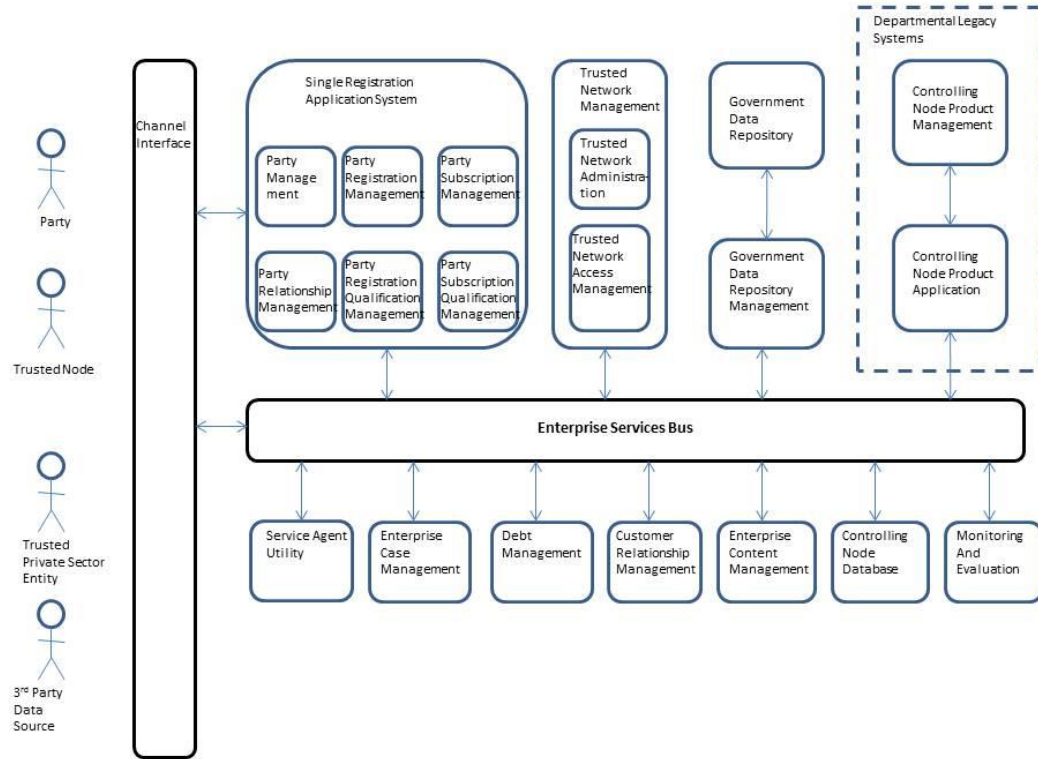


PROPOSED DEPARTMENTAL LEVEL BUSINESS REFERENCE ARCHITECTURE

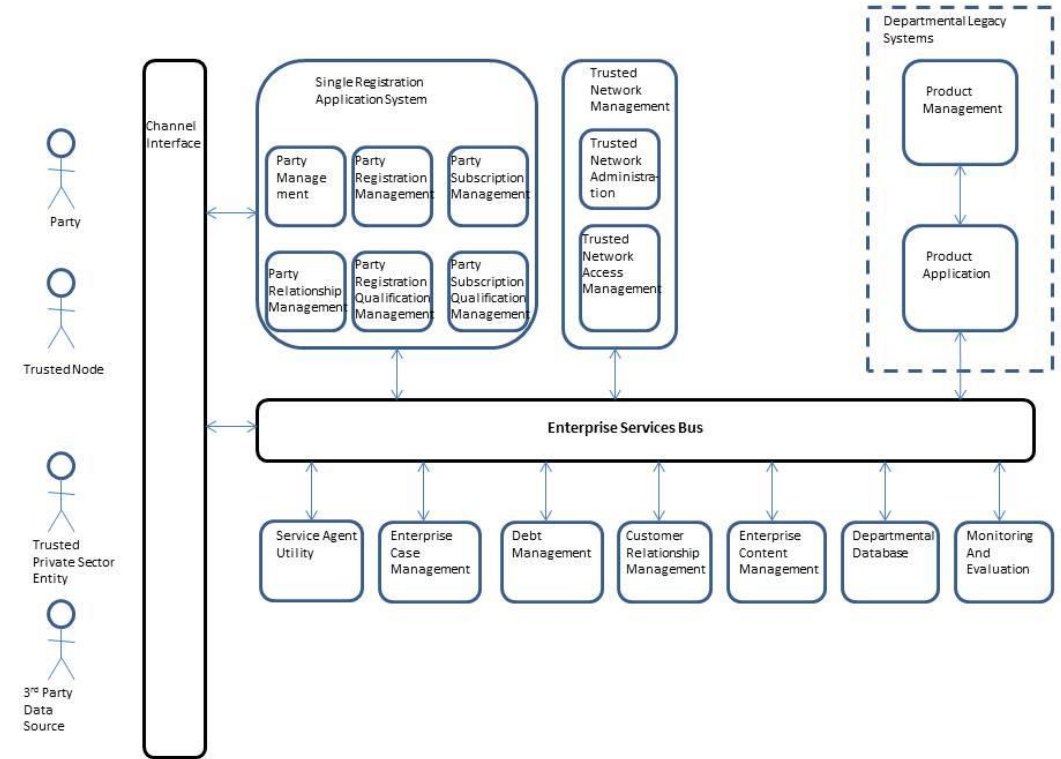


PROPOSED E-GOVERNMENT CAPABILITY MAP

# 8.10 Contribution to the field of study



PROPOSED SOLUTION ARCHITECTURE VIEW – CONTROLLING NODE



PROPOSED SOLUTION ARCHITECTURE VIEW – DEPARTMENTAL LEVEL NODE



# 9. Communicative competence

Structure of thesis follows the logic of the DSR methodology

Chapter 1: Introduction

Chapter 2: Research Design and Methodology

Chapter 3: Literature Review

Chapter 4: Suggestion and Development of e-Government Theoretical Artefacts

Chapter 5: Suggestion and Development of e-Government Reference Architecture Artefacts

Chapter 6: Artefact Evaluation and Findings

Chapter 7: Significance, Limitations and Further Research

## 9.1 Communicative competence

The research **objectives and questions posed in this study were resolved as follows:**

RO1-RO4: Chapter 3: Literature Review

RO5-RO6: Chapter 6: Artefact Evaluation and Findings

RQ1 and

SQ1-SQ5: Chapter 6: Artefact Evaluation and Findings

## 10. Ethical approach to research

1. Sources of information and inspiration are stated and all references given
2. Ethical clearance for research was obtained from UNISA
3. Interviewee anonymity is preserved
4. Interview data is stored for inspection