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# Integrating E-Government through Enterprise Application Integration

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## ABSTRACT

Information Systems (IS) integration is considered to be highly significant in supporting organisations to be competitive and cost effective. This paper examines a potentially important area of information systems integration in the government sector through Enterprise Application Integration (EAI) technology. A review of the literature indicates that EAI has been a focal technology for several organisations in solving their integration problems. However, is relatively novice in the government sector; thus research literature around it is limited. Yet the impact of information systems integration remains under explored, as little research has been conducted to comprehend the governments' perception of integration that influences their decisions and actions. The author demonstrates that there is a need for an integrated architecture that facilitates reuse of existing applications and flexibly implementing business processes across the government sector. In attempting to explore information systems integration area, this paper focuses on EAI technology and presents factors that influence its adoption in an electronic Government (e-Government) environment. Thus, resulting in the development of a conceptual model that may be used to support decision-making in the government sector.

## Keywords

Electronic Government, Integration, Enterprise Application Integration, Adoption, Information Technology (IT).

## 1. INTRODUCTION

The rapid and continuous organisational transformation has become a common phenomenon, as governmental organisations have widely focused and embraced numerous information systems to automate their business processes and functions. Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Customer Relationship Management (CRM), and Electronic Commerce (EC) are an obvious manifestation of this transformation. However due to overwhelming extent of indispensable changes as well as sheer diversity in their IT infrastructure, government practitioners find it difficult to handle and share multitude of information held in their information systems across diverse departments. Erasala, (2002) reports that in most organisations, departments autonomously made their own IT operation decisions, and considered technologies and solutions based on their requirements. This individuality among the departments represents a disparate sight. Thus, organisations did not implement applications in a synchronised way and consequently comprised an assortment of autonomous applications and heterogeneous solutions. This situation rooted various departmental and technological problems, as applications could not co-operate and organisations ended up with a set of incompatible systems that led to integration problem.

The paper commences section 2 by exploring information systems integration issues in the government sector. Thereafter, in section 3 the role of EAI is examined in the government sector. Section 4 illustrates key factors influencing the adoption of EAI and new factors reported from the literature. In doing so, the author coalesce all these factors in section 5 to develop an extended conceptual model that focuses on EAI adoption in the government sector. In section 6, a research methodology and design is presented for future testing and empirical validation of the conceptual model and finally summarising the conclusions in section 7.

## 2. INFORMATION SYSTEMS INTEGRATION IN GOVERNMENT SECTOR

Since the commencement of Internet, the governmental organisations have confronted increase in pressures to perform efficiently and provide improved services to their citizenry. The use of Information and Communication Technology (ICT)

has provided the resources to do so through e-Government. Governments have widely invested in information technology and initiated diverse e-Government services with the hope of improving effectiveness in providing services to their constituents (Gefen *et al.*, 2002). This is due to e-Government possessing the potential for fundamentally changing the way public services are provided by increasing quality of services and offering an innovative approach to addressing problems of the government services.

Regardless of e-Government adoption and offering innovative approaches, there is a lack of common understanding and standards among the diverse legacy applications. This is because, governmental organisations implemented many diverse applications to support their business activities, but these individual applications were not developed in a coordinated way but in stead evolved as a result of the next latest technological innovation (Stonebraker, 1999). Likewise, Janssen *et al.*, (2003) reports that, currently each governmental organisation has developed its own information systems in isolation and for each product and services, there exists separate information system. In many organisations, the adoption of packaged applications like ERP systems could not provide a flexible, manageable and maintainable IT infrastructure. As a result, ERP systems co-exist along side other applications (Themistocleous *et al.*, 2001).

However, for the government initiatives to be successful, it is important that back-office applications and their streamlining have to be measured carefully. This contemplation will benefit the governments in realising the significance of back-office integration with front-office contemporary applications. Back-office applications and their operations are of high importance as they may require information exchange and knowledge sharing between various units, different departments and possibly with other organisations (Homburg and Bekkers, 2002). Nevertheless, the integration of the packaged applications is not cost effective (Puschmann and Alt, 2001). Thus, for the governments to acquire more cost-effective and efficient solutions that result in manageable and maintainable IT infrastructures there is a need for eliminating heterogeneity of legacies and proper use of information technology in the government sector. The author suggests that this may be achieved by employing EAI as a portfolio of technologies that establishes a flexible and powerful infrastructure that manages data across the organisation including legacy and custom applications.

### 3. ENTERPRISE APPLICATION INTEGRATION AND E-GOVERNMENT

EAI emerged as integration software in the mid 1990s and attempted to overcome several organisational problems i.e. integration issues and provided substantial benefits to organisations. EAI combines a variety of integration technologies such as message brokers, adapters and application servers, to build a centralised integration infrastructure (Linthicum, 1999). Such an evolution has dramatically reduced the time for integration, as developers prefer EAI packages to individual integration technologies (Themistocleous, 2004). In addition, EAI specifically addresses the integration issues from technical and business perspectives (Themistocleous *et al.*, 2004).

The organisations have extensively adopted EAI but today, there are very few published case studies in the normative literature that discuss EAI adoption in the government sector. The author explains that the lack of published case studies in this domain can be attributed to many interpretations. Some reasons could be that, (a) Governmental organisations adopt new technologies reactively as compared to private organisations and wait for the outcome of EAI adoption in the private sector (Themistocleous, 2004); (b) EAI is not mature enough as a technology; (c) EAI has not been adopted extensively in the public/private sector; (d) private sector adopts integration technologies due to competition (Themistocleous and Irani, 2001). Themistocleous *et al.*, (2004) claims that there is a similarity between electronic data interchange (EDI) and EAI in terms of competition. According to Chwelos *et al.*, (2001), competition is a major factor in EDI adoption. In addition, Themistocleous and Irani, (2001) empirically validated that competition is an influential factor in EAI adoption, whereas (Themistocleous *et al.*, 2004) draw parallels between EDI and EAI and claims both as integration technologies that are (a) based on the same concepts i.e. extract, translate, transmit and (b) aim at automating business processes. However, there are disparities between these two technologies as (a) EAI can achieve business process integration whether EDI does or does not and (b) EAI produces more flexible and maintainable solutions (Themistocleous *et al.*, 2004).

The author reports that although the governmental organisations turned to adopt EDI technology to (a) enhance transactions and communication; (b) speed up their business processes and (c) provide better services. Nevertheless, there are limitations of EDI technology (complexity and lack of integration with internal systems) that encouraged the governmental organisations to turn to Internet technologies. The author suggests that all such evidences support that EAI can play a significant role in aligning the applications of governmental organisation to their business processes as such information systems, require an adequate methodological support so that well structured and easily understandable models can be constructed (Puschmann and Alt, 2001). Thus, in the near future the governmental organisations may turn to employ EAI to create an integrated infrastructure, and further speed up and integrate business processes, and provide better services to their citizenry.

**4. KEY FACTORS INFLUENCING EAI ADOPTION IN GOVERNMENT SECTOR**

A critical dilemma for the e-Government projects is the interoperability of heterogeneous legacy government systems (Tam and Wong, 2003). To address the government problems there is a need for adopting effective technologies and methodologies to provide ease and seamless connections between their information systems. The author reports that there have been a number of integration technologies developed by different software vendors and standard bodies, no one has received sufficient acceptance to ensure that e-Government systems building upon which can ensure universal interoperability. In addition, today, to the best of author’s knowledge there is no EAI adoption model that exists to provide support to decision makers in the government sector. However, Linthicum (1999), Pushmann and Alt (2001), Zahavi (1999), and Kalakota (1999) identified key factors related to EAI adoption. Themistocleous, (2002) presented an EAI adoption model by incorporating all the key factors. These factors are summarised in Table 1.

No.	Factors	References from Integration Area
1	Cost	Linthicum (1999), Themistocleous (2002)
2	Competition	Themistocleous and Irani (2002)
3	Barriers	Themistocleous (2002)
4	Benefits	Pushmann and Alt (2001), Themistocleous (2002)
5	IT Infrastructure	Zahavi (1999), Themistocleous (2002)
6	IT Sophistications	Kalakota (1999), Themistocleous (2002)
7	Evaluation Framework	Themistocleous (2001b)
8	Support	Themistocleous (2002)
9	Internal Pressures	Themistocleous (2001b)
10	External Pressures	Themistocleous (2002)
11	Managerial Motivation	Kalakota (2000), Themistocleous (2002)
12	Technical Motivation	Kalakota (2000), Themistocleous (2002)
13	Trading Partners	Themistocleous (2002)

**Table 1: Factors that Influence EAI Adoption**

Apart from the factors reported in Table 1 the author, takes into consideration the following new factors derived from the literature for the development an EAI adoption model in the government sector, listed in Table 2.

No.	Factors	References from Integration Area	References from e-Government Area
1	Better Evaluation of Work Processes	Losavio <i>et al.</i> , (2002)	—
2	Increase in Efficiency of Processes	—	Csetenyi, (2001)
3	Improved Inter-organisational Relations	Lee <i>et al.</i> , (2003)	Homburg and Bekkers, (2002)
4	Privacy of Citizen data	Boudriga, (2002)	Boudriga, (2002)
5	Common Information Standards	Atherton (2002)	Atherton (2002)
6	Standardisation of Data	—	Homburg and Bekkers, (2002)
7	Fault Tolerance	Losavio <i>et al.</i> , (2002)	—
8	Security of Citizen Data	Boudriga, (2002)	Boudriga, (2002)
9	Championship	—	—

**Table 2: Proposing New Factors Influencing EAI Adoption in the Government Sector**

The author reports that all the former factors/sub factors presented in (Themistocleous, 2004), can also be taken into consideration for EAI adoption in the government sector. Nevertheless, these former factors were used for EAI adoption in multinational organisations and yet to be empirically tested and validated for their effects in the government sector.

FACTOR	DESCRIPTION
Cost	Cost is considered as a significant factor and many organisations perform a cost benefit analysis before taking any important decision regarding the investment in the adoption of innovation. Lee <i>et al.</i> , 2003 reports that the basic concept of EAI is mainly in its externality of enterprise integration with lower cost and less programming using existing applications, whereas Pushmann and Alt, (2001) stated that a significant benefit of application integration is the reduction of overall integration cost.
Competition	Organisations have to cope with rapidly changing customer demands, stiffening competition and innovation in information technology. Those organisations that can act swiftly in this dynamic environment will have a major advantage over their competitors. Themistocleous and Irani, (2001) report that private sector adopts integration technologies due to competition. Thus, Themistocleous and Irani (2001) empirically validated that competition is an influential factor for EAI adoption.
Barriers	The introduction of EAI presents few barriers and organisations need to consider these barriers before proceeding to EAI adoption. Themistocleous, (2004) presented some barriers at the operational, managerial, strategic, technical and organisational levels such as cultural issues, political issues, resistance to change etc. Thus, the author suggests that EAI barriers consist of an influential factor for EAI adoption in the government sector.
Benefits	Published case studies (Pushmann and Alt, 2001) suggest that EAI provides various types of integrations. In addition, EAI provides benefits such as reusing business processes, easier migration to new technologies, reducing integration cost, increasing performance etc. Themistocleous, (2004) reports a number of EAI benefits derived from EAI pilot projects. These benefits from the pilot projects led the organisation to EAI adoption.
IT Infrastructure	The non-integrated nature of most IT infrastructure causes numerous problems to organisations, which need to unify their information systems and fully automate their business processes. There is therefore a need for a technology that results in a flexible, manageable and maintainable integrated IT infrastructure (Themistocleous, 2004). Such an infrastructure can lead to differentiation and therefore competitive advantage. Existing IT infrastructure of an organisation is a factor that affects the introduction of EAI, as the needs of the infrastructure often stimulate the process for adopting application integration (Pushmann and Alt, 2001).
IT Sophistication	IT Sophistication refers to the technical expertise in the organisation such as the limitations of the existing information systems and their dependencies. For instance, an organisation reported by Themistocleous and Irani (2002) had multiple ERP implementations with redundancy in data and functionality. The organisation took the decision to phase out all the redundant ERP solutions only when it realised the real capabilities of ERP systems. IT sophistication is related to the level of understanding and addressing of technical problems at enterprise and cross enterprise level (Themistocleous, 2004).
Evaluation Framework	Themistocleous (2002) proposed a framework that contributes to the selection of integration technologies and tools. This framework highlights a combination of integration technologies that can be used to integrate an IT infrastructure. Such a framework can be considered as a tool that supports decision making for EAI adoption and consists of an influential factor.
Support	Support is another influential factor that affects the decision making process. This factor is related to vendors', consultants and management support. According to Themistocleous and Irani, (2001) organisations have limited knowledge on EAI technology. This might lead to government sector seeking support from other sources when taking EAI adoption decision.
Internal Pressures	The author considers this factor as an essential in initiating the adoption of EAI in government sector. Quality of customer services, data redundancy, and data integrity are some of the various drivers that motivate the adoption of innovation.
External Pressures	Increased competition often pushes organisations to search for new ways to increase their productivity and seek a competitive advantage. Organisations are turning to EAI to support the achievement of a competitive advantage through IT infrastructure differentiation (Themistocleous, 2004). Trading partners are another form of external pressures as customers and suppliers often demand closer collaboration. Therefore, organisations are looking for new practices to better co-ordination cross enterprise business processes, which translates into a factor that influences the adoption of EAI.
Managerial Motivation	This factor relates to the issues that influence the management decisions i.e. increase in response to citizen and competitive advantage. There is a need for government sector to improve their decision-making process and support management with real-time data in developing integrated IT infrastructures.
Technical Motivation	Technical motivation is another factor that relates to the issues that influence the management decisions i.e. offering customisation of applications, reducing development risks, resulting in reliable data. Thus, this factor might have significant effects on EAI adoption in the government sector.
Trading Partners	The pressures from suppliers and stakeholders often demand closer collaboration with governmental organisations. Thus, there is a need for better coordination in efficiently supporting the business processes. The author considers trading partners as an important factor leading to EAI adoption in the government sector.

**Table 3: Former Factors Influencing EAI Adoption**

### 5. CONCEPTUAL MODEL FOR EAI ADOPTION IN AN E-GOVERNMENT ENVIRONMENT

The literature illustrates that there exist few models such as extension to Brown’s Model of integration (Losavio *et al.*, 2002) and (Themistocleous, 2002) that discuss EAI adoption. However, these models discuss different factors that influence EAI adoption. Themistocleous, (2004) categorised a number of factors and sub factors for EAI adoption model such as operational, managerial, strategic, technical, and organisational etc. Thus, the author incorporates the former factors summarised in Table 1 and new sub factors in Table 2 to propose an extended conceptual model that may be employed as a decision making tool for EAI adoption in the government sector.

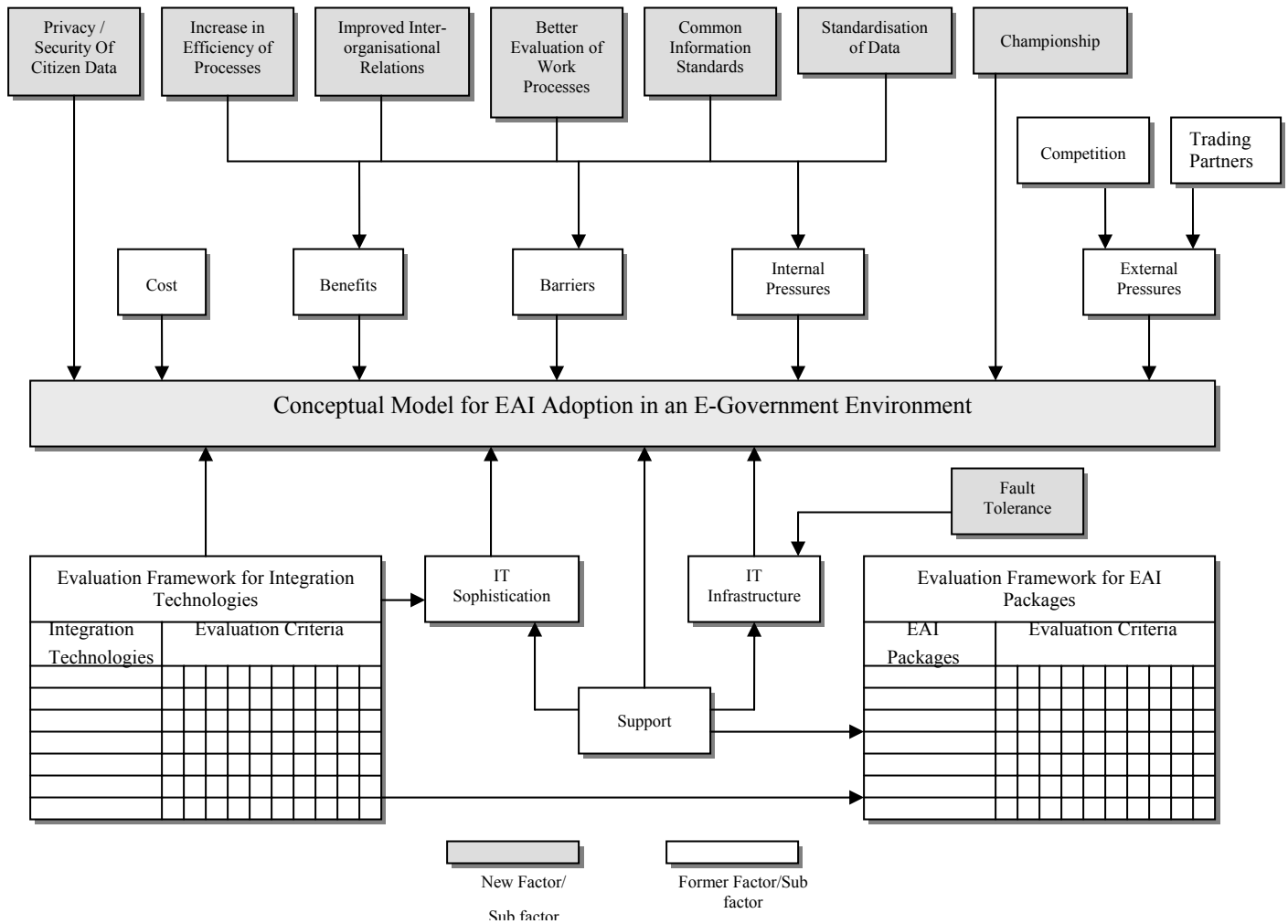


Figure 1: Proposed Conceptual Model for EAI Adoption in an E-Government Environment

### 6. RESEARCH METHODOLOGY

An interpretive and qualitative multiple case study approach will be selected to empirically test and validate the conceptual model. The author opted interpretivism viewpoint in the context of this research to understand how governmental organisations adopt and implement new technologies and support their decisions and actions. Interpretive research methodology is related to data gathering and generating solid descriptions and interpretations and further allows theory building therefore, the author deems an interpretivism stance would allow better explaining of this phenomenon in the organisational backdrop. In addition, the author considers qualitative research method an appropriate approach, as it will assist in,

- Examining EAI adoption phenomenon in the governmental organisations.

- Understanding the individuals in the social and cultural contexts within which they perform (governmental organisations).
- For describing and analysing the data and complex processes.
- Understanding the environment of the governmental organisations and their capacity of innovation adoption.

Through a multiple case study strategy, factors influencing EAI adoption in the government sector will be investigated. In doing so, various data collection methods such as interviews, documentation, and observation are opted. The bias that is considered a danger in using qualitative research approach will be dealt in this research through data triangulation. The use of multiple data collection methods makes the triangulation possible, which provides stronger substantiation of theory (Themistocleous, 2004). The following figure 2 illustrates the research design,

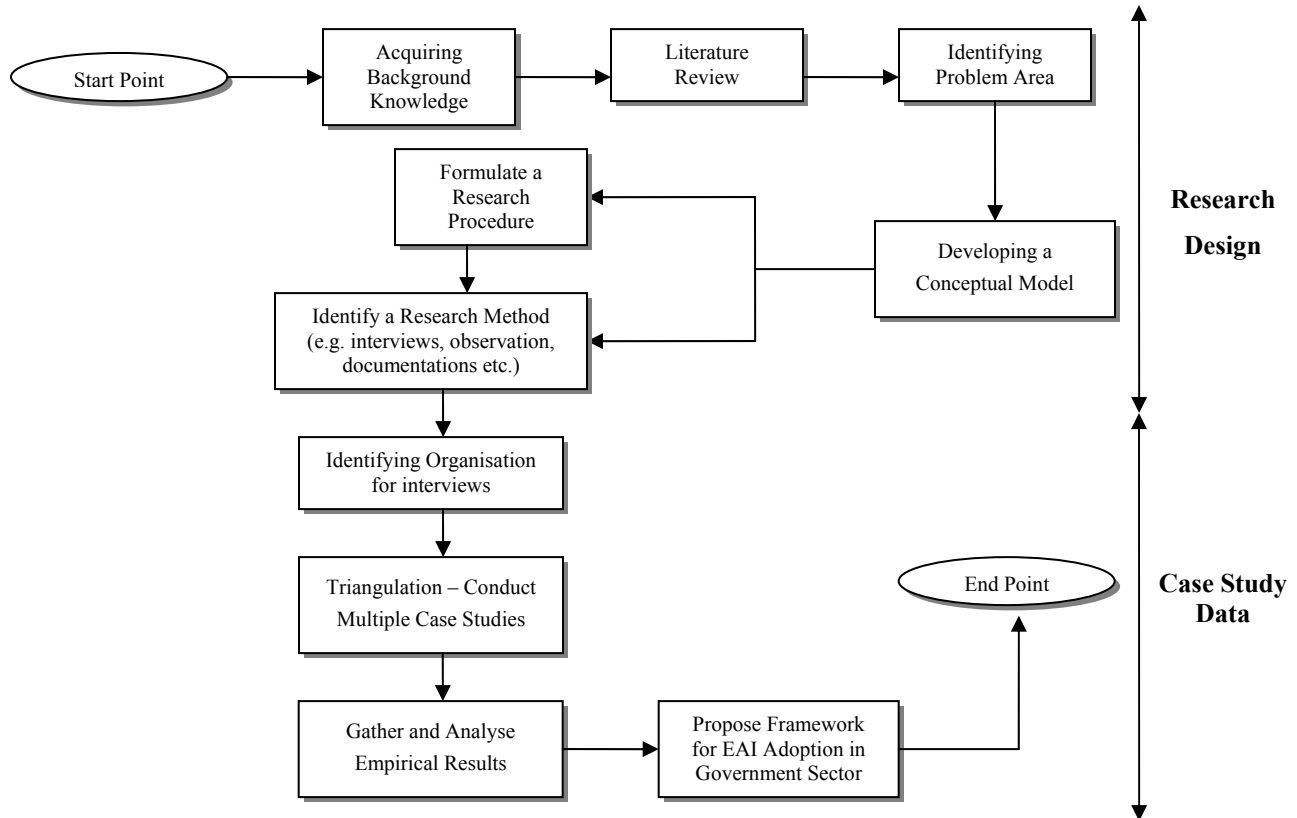


Figure 2: Proposed Research Design and Case Study Approach

## 7. CONCLUSIONS

Enterprise Application Integration software addresses integration problems from both technical and business perspective. It combines a variety of integration technologies to build a centralised integration infrastructure. EAI addresses the need to integrate both intra and inter-organisational systems through incorporating functionality from different applications. There is an increasing demand to integrate the IT infrastructures in the governmental organisations. But as EAI is an emerging research area in the government sector, there remains an absence of theoretical models, which means there is still a case for the identification of factors that influence the decision making process for EAI adoption in the government sector. The government structure is highly distributed and consists of various autonomous information systems, thus there is an increasing demand to integrate the IT infrastructures in the government sector. In doing so, this paper explores EAI adoption in government sector and presents an extended conceptual model. Therefore based on the extended conceptual model for EAI adoption presented, the author suggests that EAI may be employed as a portfolio of technologies in improving government IT infrastructure.

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