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Abstract

Literature indicates that Local Government Authorities (LGAs) have problems in meeting citizens' demands. This may be attributed to the limitations of LGAs Information Technology (IT) infrastructures that are not integrated and do not allow them to deliver end-to-end integrated services. During the recent years, Enterprise Application Integration (EAI) has emerged to support organisations to integrate their IT infrastructures and deliver high quality of services. Despite the fact that many other types of organisations e.g. healthcare sector, multinational, Small Medium Enterprises (SMEs) and large organisations have adopted EAI, its application in the LGAs is limited. For this reason, LGAs need to realise the importance of EAI and speed up their decision-making process to adopt it. As a result, further research is required to support the decision-making process of LGAs when taking decisions for EAI adoption. Although existing models related to EAI adoption have been reported in literature, the applicability and validity of these models is arguable and under research, as these models were proposed to support the decision-making process in other sector organisations and not in LGAs. The reason is that there are differences indicating that the factors that influence the decision-making process for EAI adoption differ from one type of organisation to the other depending among others on the nature, and the size (e.g. one set of factors is used to support EAI adoption in SMEs and another in large organisations). Similarly, there are differences among factors that are used in healthcare sector, multinational, SMEs and large organisations. Due to this reason, these factors may not be applicable in LGAs. Thus, the authors demonstrate that it is of high importance to investigate this area within LGAs and result in research that contributes towards successful EAI adoption in LGAs.

Keywords

EAI, LGAs, Factors, Adoption

1. Introduction

During the last decades, several LGAs have widely focused on the use of Information Systems (IS) to overcome their organisational problems and automate their business processes and functions. In addition, LGAs focused on IS to provide direct support to meet citizens' needs including housing, social services, and the management of a complex service infrastructure that supports communities and businesses (Johnson and King, 2005). However, IS developments within LGAs have resulted in non-integrated IT infrastructure (Beaumaster, 2002). The reason is that each LGA autonomously made its own IT operation decisions based on its needs (Janssen and Cresswell 2005). Additionally, there was rarely a single approach for developing IS, as organisations have developed their applications without a common architectural planning (Markus and Tanis, 1999). Moreover, each LGA display differences in the way: (a) their business processes are implemented, and (b) they make their decisions that differs a lot from other private organisations. These theorised evidences illustrate that LGAs operate and function independently and do not share information and functionality with other LGAs. The aforesaid concerns resulted in several problems that influenced

LGAs decision-making process. For example, (a) lack of emphasis on the re-engineering of legacy business processes and IS (Beynon-Davies and Williams, 2003), (b) the reluctance in government officials to bring change in their operational practices and availability of non-integrated legacy IS has resulted in poor citizen service provisioning and making decision-making process more complex (Lam, 2005), (c) concern on the privacy and confidentiality of citizens' personal data (Signore *et al.,* 2005) and (d) existing IS are typically built using architectures that do not readily support enterprise-wide integration, thus requiring major efforts to take decision to develop new architectures and systems to implement e-Government (Beynon-Davies and Williams, 2003).

Thus, the aforementioned problems illustrate that there is a need for LGAs to: (a) undergo structural and operational changes to accommodate changing citizen needs, (b) enhance decision-making process, (c) adopt cost-effective integration solutions, (d) integrate their autonomous IS, and (e) persistent business process transformation. In doing so, the authors attempt to identify and evaluate organisational and support factors that may influence EAI adoption in LGAs. Moreover, assist the LGAs in building an understanding before the take-up of EAI to resolve their organisational and integration problems. In the aforesaid literature, the authors briefly illustrated the issues in LGAs. Section 2 begins by discussing on EAI. In section 3, the authors investigate on existing EAI adoption models in private and public domains. The purpose is to understand how EAI may support LGAs' IS integration and enhance their decision making process. Section 4 discusses on current research conducted on EAI adoption in LGAs. Discussions presented in sections 3 and 4 along with the critical review of the literature on government area, lead the authors in highlighting the organisational and support factors that may support EAI adoption in LGAs in section 5. Section 6 presents the research methodology. In section 7, the authors present a case study. The findings derived from the case study are presented in section 8 and finally, summarising the conclusions in section 9.

2. Enterprise Application Integration

EAI is a generation of software that combines a variety of integration technologies e.g.: (a) message brokers, (b) adapters, and (c) application servers etc, to build a centralised integration infrastructure (Themistocleous, 2002). It incorporates functionality from a diversity of systems and results in the development of flexible, and maintainable integrated IT infrastructures (Serian, 2002). EAI also allows the organisations to simplify interactions among organisation applications by adopting a standard approach to integration, replacing hundreds or thousands of ad hoc integration designs (Ruh *et al.*, 2001). Organisations that integrated their IT infrastructures with EAI have reported benefits (Bass and Lee, 2002). Themistocleous and Irani (2001) analysed and explained the benefits that derive from the use of EAI technology and classified them into: (a) organisational (e.g. results in more organised business processes), (b) managerial (e.g. achieves return on investment), (c) operational (e.g. reduces cost), (d) strategic (e.g. increases collaboration among partners), and (e) technical (e.g. achieves data, objects and process integration).

However, the high investment costs associated with EAI have caused much concern for many organisations (Chen, 2005). Sanchez *et al.,* (2002) argues that although the initial cost of investing in EAI technological solutions may be daunting to several sector organisations, the cost of integration are in fact more extensive when EAI technological solutions not adopted. The authors report here that on prolonging the integration problem is likely to be more costly than an initial EAI investment, especially when long-term plans including new technologies and IS into the IT infrastructure. The reason may be that while not taking integration into consideration, each application that is initially developed based on own requirements, may have its own meaning of organisational objects (e.g. citizens). Thus, each application that has data (with own meaning) may overlap with data in other applications. This data redundancy and inconsistency generates significant data integrity problems and increases the maintenance and integration cost.

3. Investigating Existing EAI Adoption Models in Private and Public Domain

Due to limitations on EAI adoption literature in LGAs, a review on other areas supporting EAI adoption was performed e.g. Mantzana (2006) and Khoumbati (2005) in healthcare, Themistocleous (2002) in multinational, and adoption of emerging integration technologies in SMEs and large organisations by Chen (2005). This may assist the authors in building an understanding on different factors influencing EAI adoption in other areas.

3.1 EAI Adoption in Multinational Organisations

Themistocleous (2002) established the scope by studying EAI in multinational organisations. In doing so, evaluated the adoption and impact of EAI on multinational organisations and proposed a conceptual model for EAI adoption. The conceptual model illustrates a number of factors: (a) benefits, (b) barriers, (c) IT infrastructure, (d) costs, (e) external pressures, (f) IT sophistication, (g) framework for evaluating integration technologies, and (h) support. After pragmatic results, Themistocleous (2002) added more factors: (a) internal Pressures, and (b) framework for evaluating

EAI packages. However, further analysis shows that Themistocleous (2002) extended these factors e.g. classifying cost factor into three sub factors such as: (a) direct cost, (b) indirect human cost, and (c) indirect organisational cost. Then, explaining (a) operational, (b) managerial, (c) strategic, (d) technical and (e) organisational benefits and barriers, whereas, illustrating organisational internal pressures, and external pressures into: (a) competitors and (b) trading partners. Similarly, describing support factor into: (a) consultant support, (b) vendor global presence, and (c) vendor support. These factors have been well researched and analysed in private and public domain.

3.2 EAI Adoption in Healthcare Organisations

Khoumbati (2005) followed the stream on EAI and evaluated EAI and proposed a model for EAI adoption in healthcare organisations. Khoumbati (2005) adapted to and revised Themistocleous (2002) EAI adoption model. Khoumbati (2005) added specific healthcare related factors from EAI and healthcare informatics literature. In addition to the factors incorporated from Themistocleous (2002) model, Khoumbati (2005) included more factors such as: (a) patients satisfaction, (b) organisation size, (c) physician and patient relationship, (d) telemedicine, and (e) compatibility. After practical results, Khoumbati (2005) revised the model and added two more factors: (a) education, and (b) security and confidentiality.

3.3 Framework of Actors and Factors Affecting EAI Adoption in Healthcare Organisations

The literature indicates that IS adoption remains a time-consuming and complex process and issues associated with its management would appear to be of paramount importance (Irani and Love, 2001). However, not only technical and organisational, but also human factors need to be considered to reduce the complexity of EAI adoption and enhance its management (Fitzerald *et al.*, 2002). The unawareness of human actors increases the actors' resistance to adopt EAI (Mantzana, 2006). Thus, decision-makers involved in the development, evaluation and adoption processes may need to consider the actors to successfully accomplish them (Turunen and Jan, 2000). In doing so, Mantzana (2006) utilised Khoumbati (2005) EAI adoption model and extended the research area in healthcare sector, by identifying the healthcare actors involved in EAI adoption process and the causal relationships among the healthcare actors and factors that influence EAI adoption.

3.4 Integration Technologies Adoption in SMEs and Large Organisations

Chen (2005) reviewed integration technologies and reported that the findings derived from the study of large organisations cannot be applied in SMEs due to the distinct characteristics of SMEs. Thus, Chen (2005) identified the significant differences in the way that SMEs and large companies approach integration technologies. In doing so, the factors used to explain the adoption of integration technologies in SMEs and large organisations are identified such as: (a) nature of organisations, (b) company size, (c) integration needs, (d) time, and (d) adoption factors for SMEs and large organisations. Additionally, adoption factors for SMEs and large organisations are found and classified into three categories such as: (a) adoption factors explicit to SMEs, (b) adoption factors explicit to large organisations, and (c) common factors. Chen (2005) further extended these categories and added sub factors such as: adoption factors explicit to SMEs included: (a) adopter characteristics, (b) IT sophistication, (c) dependency on trading partners, and (d) government regulations; adoption factors explicit to large organisations include: (a) IT infrastructure, (b) IS complexity, (c) internal pressure, (d) perceived future prospects; and common factors include: (a) perceived benefits, (b) perceived barriers, (c) perceived financial goals, (d) external pressures, and (f) competitive pressure. Thus, a revised conceptual model was proposed to explain different factors that influence adoption of integration technologies between SMEs and large organisations.

Literature on EAI adoption in private and public domain illustrates that Themistocleous (2002) adapted to several EDI factors to develop an EAI adoption model in multinational organisations. Mantzana (2006), Khoumbati (2005) and Chen (2005) further adapted to several common factors (e.g. benefits, barriers, cost) from Themistocleous (2002). In addition, Mantzana (2006) identified different actors influencing EAI adoption in healthcare organisations; Khoumbati (2005) and Chen (2005) also presented domain specific factors in their models. The authors argue here that although Mantzana (2006), Khoumbati (2005) and Chen (2005) validated Themistocleous (2002) findings and their outcome, these models may or may not be applicable or generalised to LGAs. The reason may be that, e.g. in healthcare organisations, Khoumbati (2005) reported 'physician and patient relationship' as a factor for EAI adoption in healthcare organisations. The authors argue that this factor is not relevant for LGAs or other sector organisations. The rationale is that 'physician and patient relationship' signifies the relationship involved between two actors that are specifically related to healthcare sector and not others. On the other hand, although Chen (2005) adapted to some common factors from Themistocleous (2002) EAI adoption model, yet still Chen's (2005) model differs from models proposed by Themistocleous (2002), Mantzana (2006) and Khoumbati (2005). The authors report that Chen (2005) did not specifically research on EAI; instead Chen (2005) identified the significant differences in the way that SMEs and

large companies approach integration technologies. Thus, the general applicability of the studies in SMEs and large organisations may also be questionable if applied to LGAs.

4. Current Research on EAI Adoption in LGAs

LGAs are complex organisations and have developed their own structures and systems according to their requirements (Senyucel, 2005). Nye (1999) states that such LGA structures have been based traditionally on a bureaucratic model that emphasizes decentralisation and specialisation in a mechanical and pre-planned approach. LGA service delivery and administration has also tended to be organised in the same bureaucratic manner (Senyucel, 2005). Due to the bureaucratic nature and the culture, LGAs have been experiencing from what may be termed as – IT lag time (Beaumaster, 2002). The research indicates that LGAs have experienced approximately ten years of lag time between the adoption of new technologies and IS and its acceptance and routinisation across the organisations (Danziger *et al.,* 1986). This shows that LGAs have been laggards in adopting new technological solutions. The authors report that laggards can be summarised as those who adopt a technology only when they have no choice. In fact, many laggards do not explicitly adopt technologies at all, but rather acquire them accidentally when a particular technology is a component of a packaged solution (Rogers, 1995). Sometimes LGAs are forced to adopt new technologies, as other LGAs may require them to adopt as well (Kamal and Themistocleous, 2006). Thus, LGAs may be categorised in the late majority group. There might be an exceptional case where LGAs might be considered as innovators, such as cases where LGAs (Singapore) that have proactively adopted sophisticated information technologies to boost their economy (Devadoss *et al.,* 2002). Whereas, in other cases, LGAs wait till a technology becomes mature and then push the private sector to adopt this technology (Themistocleous *et al.,* 2004). The authors report that EAI adoption by LGAs does not significantly differ from other information technologies adopted within LGAs. However, today there are only a few published research case studies for EAI adoption in LGA domain published in the normative literature (most of them discuss EAI in healthcare, SMEs and multinational organisations). The lack of published cases can be interpreted in many different ways. Some explanations may be that: (a) LGAs adopt new IT reactively compared to private organisations (Themistocleous, 2004), (b) lack of skilled staff and reluctant to adopt new technologies, lack of understanding and knowledge of EAI in the LGAs (Kamal and Themistocleous, 2006), (c) LGAs have been very slow or even unprepared for technological transformations (Devadoss *et al.,* 2002), and (d) LGAs are unable to react proactively as technologies constantly change and evolve around them (Beaumaster, 2002).

Additionally, several LGAs consider that the uncertainty about the costs and benefits of adopting EAI is a central problem (Janssen and Cresswell, 2005). The reason is that the information needed about costs and benefits may be incomplete or inaccessible to several LGAs. Carter *et al.,* (2001) argues here that the access to information can be limited by organisational and functional boundaries that distribute knowledge of value-added activities such that no one, including top management, has complete knowledge of the processes. Due to the lack of insight LGAs are still reluctant to adopt EAI unless they are forced to do so (Janssen and Cresswell, 2005). Other reason may also be that LGAs do not know whether and to what extent they should invest in EAI and they are unable to assess the return on these investments. The decisions taken in one LGA can have a profound influence on the activities, costs and benefits of other LGAs. Often the implications for other LGAs are not clear, consequently these other LGAs do not want to invest or change their processes to profit from EAI. There is a debate about how costs are divided and how benefits should be distributed over LGAs. The authors report that these barriers may impede the adoption of EAI in LGAs. Despite the aforesaid theorised conceptions on EAI adoption in LGAs, the authors developed a conceptual model on EAI adoption in LGAs (Kamal and Themistocleous, 2006). The model highlights several factors, however, it is not the intent of the authors to discuss on all the factors in this paper. The authors attempt to evaluate the organisational and support through a case study conducted in a government organisation. Initially, the authors briefly discuss on several organisational and support factors that may influence EAI adoption in LGAs.

5. Organisational and Support Factors Influencing EAI Adoption in LGAs

In the previous sections, the authors identified that several factors play an important role in EAI adoption. The analysis and the applicability of these factors that cover the broad scope of the organisation in different sectors as reported in previous sections; provide sufficient support to the authors to build an understanding for the development of EAI adoption model in LGAs. The authors also reviewed the literature on government and EAI area, by which several organisational and support factors were identified, that may assist EAI adoption in LGAs. These factors are explained and manipulated in the light EAI adoption in LGAs.

5.1 Formalisation

Formalisation refers to the existence of clear procedures, norms and formal processes for carrying out organisational tasks effectively and efficiently (Lee *et al.,* 2003). Ebrahim *et al.,* (2004) reports formalisation as an organisational

factor that is internal to the public sector, which influences the adoption and design of e-Government applications. According to Serour and Henderson-Sellers (2002) innovation adoption provides challenges to organisations due to the fact that innovation adoption not only addresses changes in technology and systems but also deals with the need for changing the way an organisation runs its business in terms of processes, workflows, policies, procedures, and structure. This illustrates that highly formalised processes that create a structured environment would be useful for systems planning and information processing. In addition, the authors also state that written procedures and more formal environment will eliminate any ambiguities, and this may facilitate EAI adoption. Thus, formalisation may play an important part in EAI adoption within LGAs since formalisation may constrain or facilitate the adoption process.

5.2 Centralisation

E-Government initiatives have prompted public sector to rethink about their IT strategies and the way they design and manage their business processes to provide responsive services to the public (Ebrahim *et al.,* 2004). As with many IT projects, one of the anticipated benefits of e-Government is improving efficiency by reducing errors and improving the consistency of outcomes through automating standardised tasks. In addition, IT managers believe that e-Government projects will increase efficiency and effectiveness of organisation and save money through increased centralisation of resources (Melitski, 2003). Centralisation refers to the degree of power or decision-making authority in organisations and encompasses participation in decision-making and authority hierarchy (Reich and Benbasat 1996). In centralised organisations, decision-making is typically concentrated at the top level of hierarchy while in decentralised structures decision-making is distributed across different hierarchical levels (Bretschneider and Wittmer, 1993). Since the decision-making for IT adoption is typically concentrated at top management level in public sector (Ebrahim *et al.,* 2004), hence, the degree of centralisation may influence EAI adoption in LGAs.

5.3 Managerial Capability

The availability of personnel who have ample competencies for producing new ideas is one of the significant factors for IT adoption (Mohr, 1969), and innovations are likely to be proposed by personnel who have expertise in a particular discipline (Daft, 1978). Especially, IT adoption tends to start from ingenious application devised by managers with a technical background (Kim and Bretschneider, 2004). Therefore, managerial capability, which can be defined as the ability of managers to identify problems of the current systems, and to develop and evaluate alternatives to improve the IT infrastructure of the organisation appears to be important. However, Senyucel (2005) argues that some managers are not realistic in their demands regarding IT infrastructure, which can be traced back to an inward-looking approach in the literature. This was attributed to some managers still having difficulties seeing the long-term benefits of e-Government. Several departmental managers were seen as highly suspicious of new initiatives and unsupportive. Such managerial shortsightedness has the potential to jeopardise the success of e-Government facilitation. Senyucel (2005) also suggests that the managerial resistance in particular, has emasculated the application of the idea of e-Government at the local level. These theorised conceptions illustrate that managerial capability can be considered as an important factor that may influence EAI adoption in LGAs.

5.4 Barriers

Literature indicates that the adoption of EAI presents a similar case to ERP systems in terms of its barriers (Themistocleous, 2002). Like ERP systems, EAI: (a) promises to integrate IT infrastructure, (b) introduce changes to the organisational structure and the way of doing business, (c) influences the employees tasks as well as inter-organisational relationships, (d) it costs a lot of money and, (e) is more likely adopted by big organisations. Since there are a lot of failures on ERP adoption (Songini, 2004), organisations tend to estimate the possible impact of EAI adoption before proceeding to its adoption. Barriers are also reported by Ngai and Gunasekaran (2004) and Chwelos *et al.,* (2001) as a factor that influences the adoption of EDI technology. Similarly, Wu and Sawy, (2003) and Estrem (2003) reporting barriers as an influential factor for web services adoption. Thus, the authors suggest that the barriers may be considered as an influential factor for EAI adoption in LGAs.

5.5 Benefits

Benefits refer to the level of recognition of the advantages that the integration technologies could provide to the organisation. Iacovou *et al*., (1995) classified perceived benefits into direct and indirect. Direct benefits were mostly operational saving-related (e.g. reduced transaction cost) and indirect benefits were mostly tactical and competitive advantages that had an impact on business process and relationships (e.g. increased operational efficiency). Similarly, Bradford and Florin (2003) report benefits as organisational benefits that include the facilities for the integration problems, real-time planning, user satisfaction and support to quick customer response. In addition, Themistocleous

(2004) extended benefits to cover: (a) operational benefits (e.g. increase productivity, reduce cost and reduce lost sales), (b) managerial benefits (e.g. increase performance, improve data quality, and support decision making), (c) technical benefits (e.g. increase flexibility, reduce redundancy, achieves process integration and results in reliable data), (d) strategic benefits (e.g. achieve customers' stratification and return on investment) and (e) organisational benefits (e.g. allow organisation to do business effectively). Thus, the above analysis gives sufficient justification to the authors to consider the benefits as an influential factor for EAI adoption in LGAs.

5.6 Size

Akbulut (2002) measures size in terms of the size of the community served and the number of the services provided by the organisation. In the central government and LGAs, organisational size was found to positively influence IT adoption (Brudney and Seldon, 1995). Norris (1999) reported that larger cities would adopt more sophisticated and advanced IT compared to smaller cities because larger cities: (a) have greater financial resources, (b) are in more need of these technologies and, (c) have superior institutional ability such as IT departments, to support the technologies. Conversely, Mohr (1969) reported that larger organisations, simply because they are large, are unlikely to adopt IT. Recognising that size and adoption are often associated, Mohr (1969) stated that size itself is not related to innovativeness by logical necessity; it becomes significant only when it implies or indicates the conceptual variables that are important in them. Size may indeed have indirect effects. However, it is also likely to lead directly to economies of scale, which enhance the feasibility of IT adoption. Literature indicates that larger organisations input sufficient volume to justify the adoption of new technology to accommodate variations in input even when variations occur infrequently. Smaller organisations, however, experience many types of input variations so rarely that they could not reasonably expect to benefit from making similar accommodations (Moch and Morse, 1977). While Mohr (1969) is likely to be correct in reporting that size has indirect effects on adoption, it is likely that, conceived as input volume, size has a direct effect as well. Hence, size may influence EAI adoption in LGAs.

5.7 Higher Administrative Authority (HAA)

Improving LGA technological facilities depends on whether support from HAA elected or appointed top administrators, LGAs and also the central government is available for IT managers who are in charge of implementing technology adoption process and its utilisation (Tolbert and Zucker, 1983). Kim and Bretschneider (2004) report that even in the case that IT managers initiate technology adoption, support from HAA may play a significant role. Support from HAA can be expressed as: First, top administrators' innovativeness is important for mobilising the resources. Adopting new technology requires huge investments, and its effects are not realised in a short term. To implement technology, top administrators are expected to take the risk of failure or delay of technology adoption. Therefore, the top administrator has to have risk-taking tendency to support IT managers to design and implement technology adoption plan without worrying about the results (Kim and Bretschneider, 2004). Second, administrators' knowledge of technology should be considered. Administrators knowledgeable of the potentials of technology are more likely to have more positive attitude to technology adoption and to endorse the initiatives raised by IT managers. Third, legislative body i.e. LGA is as important as top administrators, as budget allocation and other legislative supports are finally authorised by LGAs. Like top administrators, LGAs technology and knowledge form a crucial part of support from HAA. Fourth, the central governments' influence also needs to be considered. The central government makes efforts for state-wide technology diffusion, e.g. providing information on technology, financial support during development, and procedural facilitation (Moon and Bretschneider, 1997). However, all such evidences endorse the significance of HAA and moreover may assist in EAI adoption in LGAs.

5.8 Top Management Support

Top management support has been recognised as one of the most important elements necessary for the successful implementation of integration technologies and integrated packages (Ngai and Gunasekaran, 2004). Beath, (1991) reports that one of the most successful factors associated with large-scale IT implementation projects is securing the support of top management. In addition, sustained top management support considered as the most relevant factor in IT implementation projects, is needed throughout the implementation project. The reason is that as the project progresses, active involvement of top management remains critical in terms of constantly monitoring the progress of the project and providing direction to the implementation teams. Moreover, as top management's primary responsibility is to provide adequate financial support and adequate resources for building a successful system, the support of management ensures that the implementation project has a high priority within an organisation and that it receives the required resources and attention. Therefore, all such facts provide sufficient justification to consider top management support as an influential factor for EAI adoption in LGAs.

5.9 IT Support

The authors consider IT support as a factor that influences EAI adoption. The reason is that the EAI adoption requires organisations to invest considerable amount of moneys on their IT infrastructure (Stal, 2002). Therefore, it is essential for organisations to have IT support from vendors and consultants. Themistocleous (2002) report that support factor affects the introduction of EAI in organisations. This issue has been well investigated and verified through various case studies. For example, consultants' support is an important parameter that affects EAI adoption. As reported in case studies, consultants supported IT departments to introduce and evaluate EAI in organisations. In doing so, supported and influenced the decision-making process. Moreover, support factor improved IT sophistication and enhanced the organisations' knowledge regarding applications integration and EAI. Vendors' support has a correlation with IT infrastructure since vendors provide services (e.g. maintenance) to the organisations. As reported in case studies the: (a) close relationships between one organisation and its hardware vendors and, (b) the dependence of the other organisation on the vendor's solution (hardware), influenced the decision for purchasing EAI package from the vendor. This indicates how vendors' support may influence the decisions for EAI adoption. Since LGAs have insufficient knowledge on EAI packages, and seek for vendors and consultants that can support them (Themistocleous *et al.,* 2005). Therefore, IT support can be considered as an influential factor for EAI adoption in LGAs.

6. Methodology

The role and the applicability of EAI in developing integrated IT infrastructures remains under investigation with LGAs. This paper attempts to study EAI to understand how public organisations use EAI technology to develop integrated IT infrastructures. The authors have followed an interpretive, qualitative case study approach to conduct this research. Interpretitivism stance was adopted, as the aim of this paper is to understand how LGAs integrate their IT infrastructures. An interpretivism stance allows the authors to navigate and better explain this phenomenon. Also, the authors suggest that in the context of this research a qualitative approach is more appropriate as such approach can be used to: (a) investigate little-known phenomena like EAI, (b) examine organisational and support factors, (c) examine the phenomenon in its natural setting and, (d) learn from practice. In addition, the authors used a case study strategy to explore and understand the development IT infrastructures in LGAs. In doing so, various data collection methods such as interviews, documentation, and observation were used. The bias that is considered to be a danger in using qualitative research approach is overcome by data triangulation. The use of multiple data collection methods makes the triangulation possible, which provides stronger substation of theory (Eisenhardt, 1989). For the purpose of this paper, three types of triangulation are used namely: (a) data (b) methodological and, (c) interdisciplinary triangulation.

7. Case Data

The case organisation is a local government that serves citizens and businesses in a specified region in United Kingdom (UK). For confidentiality reasons the authors use the coded-name as LGA. The case organisation (LGA) is a big borough that aims to provide better and quicker services to its citizens. It employs a large number of employees and provides its services through various sectors including social and environmental services, property, education, health etc. LGA relied on its software vendor expertise to develop and integrate their IT infrastructure. Since, the software vendor has an important role in this project, the authors refer to it as Softcom. Softcom is a large multinational company that employs over 40,000 employees in 145 countries. It provides integration solutions for the LGAs looking to integrate various sectors (e.g. housing, property gazetteers).

7.1 Section Process

During the last 3-4 years, LGA collaborated with Softcom to introduce a Customer Relationship Management (CRM) solution that was incorporated with modules like complaints, street care, housing benefits and council tax. All these packages provided by Softcom have improved the citizens' satisfaction, the efficiency and performance of the LGA, and speeded up business processes. Nonetheless, there was a lot of scepticism regarding the integration of Softcom applications with non-Softcom systems within LGA. The CRM solutions earlier adopted could communicate with other ERP packages but had limitations, as they could not exchange information with non-Softcom applications. The insufficient nature of the then existing IT infrastructure and the need for integration led LGA to revisit its e-Government, customer services and investment strategy. One solution was to phase out the non-Softcom applications and replace them with new ones. However, such a solution would have had cost millions of pounds to LGA. There was less time and money and no proper justification to do so (such as eliminating the functionality of reliable systems). Also, the risks associated with such an approach were high. Conversely, the IT department was seeking possible solutions through integration. The IT management was persuaded that integration can deliver measurable business benefits to LGA that are worth the costs.

LGA relied on Softcom technical expertise to develop and integrate their e-Government and IT infrastructure. Softcom is a large multinational company that provides integration solutions for the LGAs looking to integrate various applications and IS from different departments (e.g. housing, education). The LGA follows a proactive approach when adopting IT solutions and aims to be amongst the first LGAs (in the UK) that will integrate their IT infrastructure. For that reason, LGA took the decision to integrate its CRM and e-Government applications with the back office systems using EAI architectures and technologies. Since the Softcom provides EAI solutions, the LGA decided to collaborate with and integrate its systems. In doing so, LGA bought EAI software from Softcom without evaluating other alternative EAI packages. Such a decision differs from the practices of other organisations that evaluate EAI software before selecting one. When the IT manager were asked for the reasons that led their organisation to this action reported that: (a) LGA lacks of knowledge and expertise on EAI and (b) there is trust and close collaboration between LGA and Softcom which led the organisation to follow the suggestions of Softcom. Conversely, the Softcom provides a solution, which is a mixture of some EAI technologies put together to promote the sales of their solution within various LGAs. The Softcom has strategically invested in this project, as EAI is a new market in public domain. Softcom, by designing and customising a solution for one LGA, can package this solution and easily sell it to other LGAs. Thus, it can easily gain a competitive advantage and market leadership.

7.2 Integration Process

Initially the LGA decided to integrate few of their business processes and information systems including: (a) housing and (b) Local Land Property Gazetteer (LLPG). This approach demonstrated that the LGA does not follow a strategic adoption of EAI but an opportunistic one and seeks to overcome point problems to improve key business processes. Different issues were highlighted during the interview sessions, for example: (a) LGA interviewees followed the suggestions of Softcom, as there was a lack of knowledge and skills in the LGA on EAI adoption. Softcom influenced them that this is the easiest way to develop an integrated IT infrastructure, (b) LGA interviewees mentioned that this is the best way to implement a small-integrated IT infrastructure. Based on the evaluation of this small demonstration pilot project they could expand the project (e.g. including other business processes) in the future, (c) LGA interviewees suggested that there is no need to integrate all business processes but only a subset of them. From the discussions, it appeared that there is lack of understanding the benefits of an integrated IT infrastructure within the LGA, (d) LGA interviewees believed that such a solution will result in an exemplar integrated IT infrastructure in an LGA within the UK and there is therefore no need to integrate all the processes and (e) LGA interviewees seem to be sceptical about the risk and the cost of such an integrated solution. Since this is one of the first attempts to piece together e-Government, CRM and back office systems in the UK, they want to eliminate the cost of a possible failure.

7.3 The Demonstration Pilot Project (DPP)

The DPP is a project within the LGA where an integrated solution is being developed to provide multi-LGA access and sharing of information. Currently various other local authorities own and manage their own applications and databases. Local authorities are not aware of the information held on a specific citizen within another local authority. The DPP is based on integrating multi-local authority to enable the local authorities involved with monitoring citizens to share information, track and monitor records of all citizen queries and take action when required. The problem is lack of communication between the local authorities, which could have resolved citizen problems. The need to integrate these systems is raised to avoid similar mistakes from the past reoccurring. The aim of DPP project is to demonstrate LGA officials and other local authorities that investing in a long-term programme of integration between Softcom solutions and non-Softcom solutions is necessary. On this basis the adoption of integration architecture within and among other local authorities will deliver measurable business benefits.

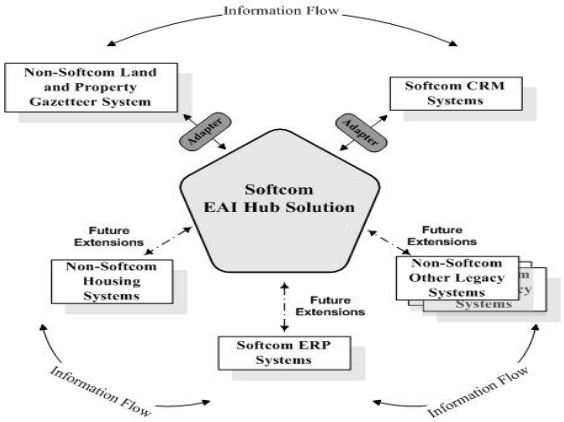

Figure 1: Demonstration Pilot Project.

Figure 1 illustrates that LGA was working towards a 'hub and spoke' methodology. The 'HUB' is a single Softcom database from which applications (the 'SPOKES') draw data and to which they return data. The integration between LGAs' Local Land Property Gazetteer (LLPG) and CRM system via Softcom HUB i.e. (Softcom InterConnect Integration HUB) will enable a two-way flow of data between LGAs' LLPG and CRM system via Hub. For example, citizens will be able to request changes to addresses through the CRM system that will then update LLPG; and changes from other sources to LLPG will update the property elements of the CRM system.

7.4 The Solution

The need for integration is to provide a common view of information from all the systems. There are different contacts telephone numbers for each LGA and e.g. if a citizen wants to contact social services as well as the benefits department by telephone, a call is either transferred to the benefits department or the citizen has to call the benefits department specific line. This makes call handling difficult, slow and lowers the number of calls answered to offer services to the citizens. LGA planned that by using CRM application as the front office linked to the existing back office applications, a common view of information held in all back office applications could be achieved. In addition, using the call centre facilities of CRM, a single call answered from a citizen can solve queries regarding various sectors, handled by one agent. This will enhance quick, efficient provision of services, a higher number of calls will be handled and the long list of numbers (one for each sector) is reduced to 'single point of contact'. Citizen contact via mail or email also needs to be directed to the required sector currently, using CRM application there is a variety of communication channels, which can be used, and all information processed from the CRM application.

However, as reported earlier just by using CRM applications is not enough, as it still needs to communicate with other applications at the back-office. To communicate with other applications there is need to integrate CRM applications with the back-office applications. The reason is that CRM applications need integration with the other points of contact, leading to a single view of multi-channel interactions including internal personnel as well as external customers. Figures 2 and 3 depict the scenarios of "AS IS – Before Integration" and "AS AFTER – After Integration" information flow. In both the Figures, (a)…(b) represents the message transmission steps, the dotted boxes represents the connectivity layer, arrows demonstrate the transportation layer, 123…abc illustrate translation layer and b…n represents the number of adapters. Figure 2 focuses on developing a design for the process of information flow from the CRM application to the back-office without applying integration technologies and architectures. Figure 3 focuses on developing a design for the process of information flow from the CRM application to the back-office applications using integration technologies and architecture.

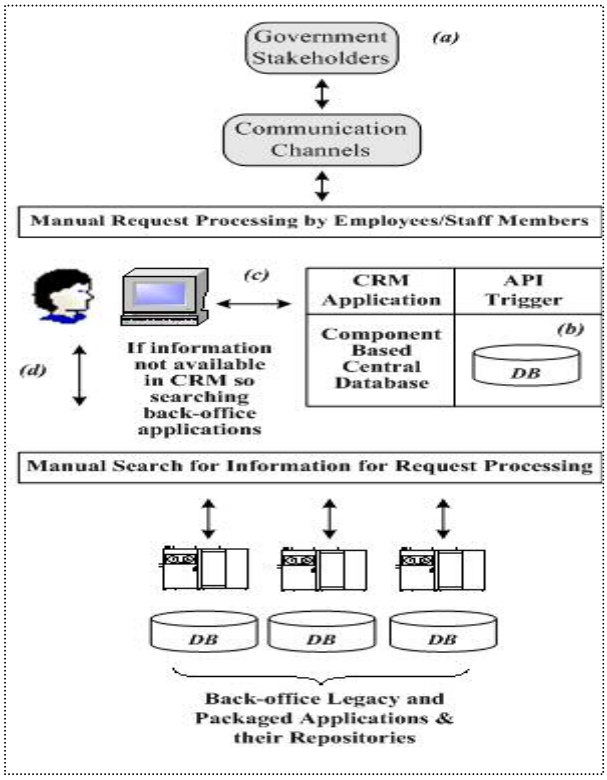

Figure 2: Information Flow "***Before***" Integration

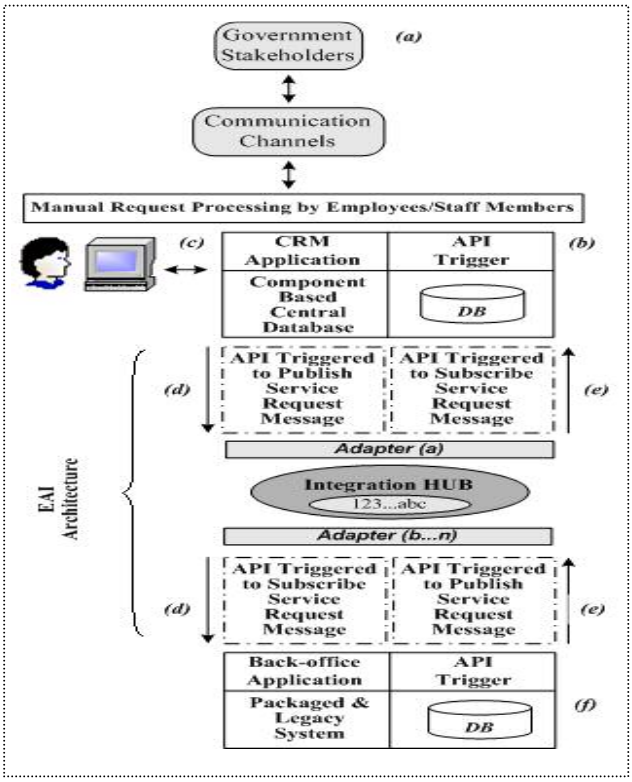

Figure 3: Information Flow "***After***" Integration

The authors employ EAI solutions to integrate back-office with the front office applications. EAI solutions provide integration functionality through integration architecture using a variety of EAI technologies such as: (a) database-oriented middleware, (b) message oriented technologies, (c) transaction based technologies, (d) distributed object technologies, and (e) interface oriented technologies). There are four integration layers that are used to provide integration between CRM applications and back-office applications e.g. connectivity layer, transportation layer, transformation layer, and process automation layer (Themistocleous, 2002).

7.4.1 Description of Information Flow "AS IS - Before Integration"

(a) Different stakeholders contact LGA through different communication channels (channels such as Softcom's interaction channel components of CRM) through Internet, telephony, call centre, kiosks, and face-to-face.
(b) Once the service request information is input in the CRM component an API is triggered to search the central database (central repository) for the this information as requested.
(c) If the requested service request information is available it is relayed back to the employee/staff member, and communicated back to the stakeholder through different communication channels available.
(d) If the requested service request information is not available within the central database in the CRM, the information is then manually searched from the back-office systems/applications by the employees/staff member then follow step (c).

7.4.2 Description of Information Flow "AS AFTER - After Integration"

(a) Different stakeholders contact LGA through different communication channels (channels such as Softcom's interaction channel components of CRM) through Internet, telephony, call centre, kiosks, and face-to-face.
(b) Once the service request information is input in the CRM component an API is triggered to search the central database (central repository) for the this information as requested.
(c) If the requested service request information is available it is relayed back to the employee/staff member, and communicated back to the stakeholder through different communication channels available.
(d) If the requested service request information is not available within the central database in the CRM, another API is triggered which publishes the service request message to the required back-office application through the integration hub. The connectivity layer within the integration hub provides the communication channel from the CRM application to the back-office applications. The service request message is then transported (through transportation layer) and transformed (through translation layer) by the adapter *(a)* to the required format of the receiver and is ready to be routed to the relevant back-office system through the integration hub. Adapter (b…n) then picks the service request message and sends it to the relevant back-office application, which subscribes the service request message. Depending on the type of back-office application, the adapter is selected from (b…n).
(e) Within the back-office application, another API is triggered to search for the requested service request information. When information found, it is published by the back-office application. Adapter (b…n) picks it up, transforms (through translation layer) it to the required format for the CRM, through the hub and adapter *(a)* picks it up and transports (through the transportation layer) to the CRM application, which subscribes to the message. Then follow the step *(c)*.

8 Findings and Discussions

The main issues derived from the case data presented in section 7 are summarised and described below:

8.1 EAI Selection Process

The selection of EAI software is a complex and important process during an EAI project. As there is a marketplace confusion regarding EAI packages and solutions, many organisations spend time and resources to assess and choose appropriate EAI software. In this case study, LGA did not use any framework or other tools to assess EAI packages. The reason for this decision is that within the LGA; there were no clear procedures, norms and formal processes for selecting and assessing EAI software and thus ended in taking the decision to select EAI software without assessing by relying on Softcom expertise. This decision illustrates two significant issues, firstly, the manager's lack of knowledge on EAI area and thus took the decision to fully rely on Softcom for the selection of EAI packages. Secondly, as the literature indicates that the decision-making for technology adoption is typically concentrated at top management level in public sector (Ebrahim *et al.,* 2004), hence, this decision was of high risk as the LGA top management chose an EAI package that was under development. The risky decision was that LGA fully relied on Softcom with experience on IT projects but with no clear view regarding the integration of its packages. Although, in this case study DPP was successful, the decision for selecting EAI software could have been the other way round.

8.2 EAI Adoption

As aforesaid the authors discussed on three factors as reported in section 5 namely: (a) formalisation, (b) centralisation and (c) managerial capability. The aforesaid arguments on these factors represent that these factors may have influenced EAI adoption in LGA. In addition, to these factors, the authors presented several other factors in section 5 that also influenced the decision making process for EAI adoption in LGAs. All of the factors were validated through this case study. For example, as exemplified from the case study there was IT support from Softcom. Softcom consultants and integrators supported LGA IT department to introduce EAI in LGA. In doing so, supported and influenced the decision-making process. Moreover, IT support from Softcom also improved IT sophistication and enhanced the organisations' knowledge regarding applications integration and EAI. The LGA top management and HAA initially recommended and supported to work on the DPP project and evaluate the outcome. The reason to run the DPP project was the high costs of, and the limited successful cases of, EAI application in the public domain. The DPP project demonstrates that the integration (a) is technically feasible and (b) can deliver significant benefits to LGA.

As reported in section 5 that size can be categorised as the size of the community served and organisational size. The case organisation (LGA) seems to be a large organisation and serves a large community within a specific region of the UK. In doing so, the LGA decided to run a pilot project. The reason was: (a) to demonstrate to other LGAs that they could integrate with Softcom solutions, (b) to develop a better relationship with different vendors (in this case Softcom) to support the chances of technical support from Softcom in the future, (c) to develop expertise of working with to date Softcom technologies among the concerned staff and (d) to use the project as a lever for attracting additional funding for other similar projects. Benefits extracted from the DPP project were: (a) reusability of systems, components and data, (b) reduction in data redundancy, (c) reliable data, (d) support in data sharing, (e) collaboration among departments and (f) improved management and supports decision-making. Whereas, barriers extracted are: (a) reliance on Softcom for expertise, (b) no evaluation frameworks used to assess EAI tools, (c) lack of EAI knowledge, (d) low level of LGA IT infrastructure and (e) lack of Business Process Reengineering (BPR).

8.3 Integration Approach

The authors suggest that the low level of IT infrastructure within the LGA influenced the integration solution. The case data reveals that the LGA was persuaded by the Softcom to implement an integration solution. Another issue related to this decision is the poor analysis and design done during this project. Nonetheless, this is again an issue related to the low level of IT infrastructure. It is also related to the absence of a specific software methodology that explains the main steps in designing and implementing an integrating system in which existing and new applications are bridged together.

8.4 Implementation

One of the biggest problems with LGA in DPP was the lack of knowledge on integrating applications using EAI technology and ignoring the issues related to integration (e.g. BPR). The development team did not carry out a BPR before the implementation of DPP. For example developers developed some functionality, uncovered lack of flow and mismatch of processes and then redesigned the processes and thereafter implemented the functionality again. This is an implementation paradox as other case studies on EAI report that the design and reengineer phase takes place in the beginning of an EAI project and take up to sixty to seventy percent of the overall time (Themistocleous, 2004). The authors suggest, there is need to follow the basic steps of analysing and understanding all the systems in question rather than rushing to install new systems and facing more problems with the existing one.

9. Conclusions

While private companies have continued to take advantage of the IT to improve their businesses, services offered by government organisations have remained deficient over the years. The concept of e-Government has emerged as a credible solution to improve such services as it allows people to access public services from within their own homes or offices. The importance of e-Government has been widely recognised with 30 European ministers agreed upon a plan to speed up the development of e-Government applications in an attempt to modernise the European public sector. During the last years public organisations have adopted CRM applications to improve their services and the relationships with their citizens. The application of CRM is beneficial for LGA as it results in improvements in information sharing and cost reduction. Recently, many LGAs have attempted to link together their e-Government and CRM applications to gain more advantages and deliver better services. Nonetheless, public organisations have realised that they can gain significant advantages when they integrate their CRM and e-Government systems with

their disparate back office solutions. Thus, there are seeking ways to integrate their applications and IT infrastructures. The authors suggest that public organisations can focus on integration technologies like EAI to incorporate their systems and processes, and thus, achieving their goals. Yet, the adoption of EAI by public organisations is still in its infancy with LGAs, researchers need to understand the issues surrounding this technology. In this paper the authors present and analyse one case study that focuses on the development of integrated e-Government and IT infrastructures in an LGA. The case organisation has initially incorporated its e-Government applications with CRM to improve its services. Such interconnectivity has resulted in a partial integration solution, as there was no linkage between the front (CRM, e-Government) and back office systems. Thus, the organisation collaborated with its Softcom to apply an EAI solution and piece together its IS. The extracted results may seem less as they are based on one pilot case study, however it will allow the researchers to take it as a starting point in comparing and better analysing EAI adoption factors when analysing more case studies within LGAs. The authors asserts that as the number of cases will increase it will provide more harmonised results, and will allow better analysis and decision-making for EAI adoption.

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