Exploring Knowledge Management Integration through EAI in Local Government Domain

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Abstract

Information Technology (IT) infrastructure integration and knowledge management share communal objectives e.g. to make organisations more effective and efficient, agile and innovative, and more responsive to market changes. Such association when assimilates bona fide knowledge management philosophy, it offers the IT departments a headship opportunity for organisational transformation in affiliation with the rest of the establishment. Notwithstanding, in the context of Local Government Authorities (LGAs), the non-integrated nature of the IT infrastructure is associated with inefficient data and knowledge exchange and reduction in LGA services' quality. Therefore, numerous data inconsistencies and redundancies occur that impact LGA services to their citizenry. LGAs have deployed Enterprise Application Integration (EAI) technological solutions to integrate their legacy with new developed Information Systems (IS). Literature indicates that EAI achieves integration at five layers namely: (a) connectivity, (b) transportation, (c) transformation, (d) process integration and (e) knowledge integration. This research adapts a Revised Model for Integration Layers (REAL) and tests through a case study in a local authority. The results indicate that cases leading to data inconsistencies and replication can be prevented by integrating knowledge through EAI.

Keywords: Knowledge Management, Enterprise Application Integration, Local Government, Information Systems, Information Technology

1. Introduction

During the recent years, several LGAs have widely focused on the use of information systems to overcome their organisational problems and automate their business processes and functions (Kamal *et al.*, 2009; Grimsley and Meehan, 2007; Irani *et al.*, 2006). 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 infrastructures (Lam, 2005; Beaumaster, 2002). The reason is that each LGA autonomously made its own IT operation decisions based on its needs (Janssen and Cresswell, 2005; Di Natale *et al.*, 2003; Aldrich *et al.*, 2002). 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 displays differences in the way: (a) their business processes are implemented to provide citizen services, and (b) makes its decisions that differs a lot from other private organisations (Johnson and King, 2005; Ward and Mitchell, 2004). Such theorised evidences illustrate that LGAs operate and function independently and do not share information and functionality with other LGAs (Gortmaker and Janssen 2004; Ralphs and Wyatt, 1998).

Such aforesaid concerns have resulted in several problems that have influenced the decision-making process in LGAs. For example, Beynon-Davies and Williams (2003) report that within LGAs there is not enough emphasis on the re-engineering of legacy business processes and applications. Moreover, while adopting new IT solutions, a major concern for LGAs' management is the investment decision associated with the change in organisation and their IT infrastructure due to lack sufficient amount of money (Signore *et al.*, 2005; Ward and Mitchell, 2004; Beaumaster, 2002). Another vital problem notable is concerned with citizen privacy – as a continued problem in e-

Government discipline (Tillman, 2003), whereas Lam (2005) identified citizen privacy as a barrier to integrating e-Government. Furthermore, a long-term government sector concern is the need for efficient and effective application integration (Kamal, 2009; Beynon-Davies and Williams, 2003). Janssen and Cresswell (2005) report that service provisioning is likely to fail if the information systems within LGAs that need to work together to provide a service are not integrated. Thus, all 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 information systems, and (e) persistent business process transformation. The normative literature well analyses and discusses the barriers that are caused by the heterogeneity of the existing IS (Stonebraker, 1999).

The assessment of the aforesaid literature illustrates that LGAs need a technological solution to overcome their IT infrastructure limitations. Elmagarmid and McIver (2001) also support that government initiatives still need better solutions. The need for integration may be attributed to several government projects that were either never implemented or abandoned immediately after implementation. Due to this many problems such as data integration and security interoperability that are technical in nature, remain most apparent at developmental and functional levels (Heeks, 1999). Literature indicates that several efforts have been made to achieve integration at various levels of the government in the last decades. These efforts include among others: (a) AnalysePilot (Janssen *et al.*, 2003), (b) SeamlessUK – PINPoint (Atherton, 2002), (c) PASSPORT (Gouscos *et al.*, 2001), (d) TAXISnet (Stamoulis *et al.*, 2001), (e) CiTel (Signore *et al.*, 2005), (f) Local Authorities Secure Electoral Register (LASER) project (UK Online, 2002), SINET (Corbett and Noyes, 2004), Goodna Service Integration Project (Boorman and Geoff, 2002), The Delivery and Access to Local Government and Services (DALI) Project (Ranerup, 1999).

The analysis of these projects report that they have their own sets of considerations and each of them differs from other since their design is not focused on analogous parameters. Although these projects have provided significant benefits, they have not resulted in the development of an integrated IT infrastructure that efficiently automates and integrates LGA business processes and services. The reasons may be that they were developed according to specific requirements and solving certain problems. Moreover, all these projects have been developed in different geographical areas e.g. AnalysePilot project developed for Dutch municipalities, SeamlessUK – PINPOINT developed for UK local authorities, PASSPORT developed for Greek local government. It can be argued that projects developed for a specific area and solving particular problems may not comply with the integration needs in different areas. This may be due to differences in: (a) size and nature of the government organisations in different geographical areas, (b) organisational integration needs, (c) organisational culture, strategies, structure and functionalities etc. Literature also indicates that there are cultural and structural differences in the private and public sector organisations (Ward and Mitchell, 2004). Thus, although the undertaken projects have not achieved the level of integration needed, they have contributed to better understand the limitations of LGA IT infrastructures and integration of information systems. In doing so, several researchers and practitioners turn towards the development of integrated LGA IT infrastructure.

The literature is full of criticisms of *why* and *how* system development approaches have failed to provide solutions to the problems of developing robust and flexible IS (Fitzgerald and Russo, 2005; Irani *et al.*, 2003). Much of this is due to a lack of ability to provide a suitable framework for management in its pursuit of setting and realising corporate, strategic and tactical objectives (Themistocleous *et al.*, 2009). Yet, as such objectives change due to demands of the environment, new systems are often designed to follow the old and tested, traditional 'safe' system models, rather than challenging the status quo and opting for a more radical integrated approach (Themistocleous *et al.*, 2009). This paper attempts to contribute to this area by testing new ideas in the area of systems integration. The work presented herein, focuses on EAI technological solutions and their impact on knowledge management in a local government backdrop. Thereafter, the author presents the research methodology employed that assists in exploring and testing the views points as aforementioned.

Empirical findings are presented along with the limitations and future directions summarised in the conclusion.

2. Enterprise Application Integration and its Significance in Local Government Domain

Literature indicates a new generation of integration technologies i.e., EAI technologies that combines a variety of integration technologies such as: (a) message brokers, (b) adapters, and (c) application servers etc, to build a centralised integration infrastructure (Lam, 2005; Themistocleous, 2004; Linthicum, 2000). It incorporates functionality from a diversity of systems and results in the development of flexible and maintainable integrated IT infrastructures (Serian, 2002; Zahavi, 1999). In other words, EAI acts as a software data translator that takes information from, for example, organisational Enterprise Resource Planning (ERP) systems and convert it into formats that other applications can understand (Linthicum, 2000). EAI also allows the organisations to simplify interactions among applications by adopting a standard approach to integration, replacing hundreds or thousands of ad hoc integration designs (Lam, 2005; Ruh *et al.*, 2000; Linthicum, 2000). Literature indicates that for "***x***" applications a total of "***(x*(x-1)/2)***" interconnections are needed when each application is interconnected with the rest of the applications (Themistocleous, 2004). This can be explained as e.g. when an application is interconnected (through traditional integration) to several other applications that require any change, it affects all other applications because it has equivalent number of interconnections with those applications. On the other hand, when the same application that is integrated through EAI architecture requires some changes; the rest of the system is rarely affected. The reason is that these systems are not directly interconnected with the application that requires those changes. Thus, this way only those applications that require changes are altered, resulting in a reduced maintenance effort and increased flexibility with few interconnections among the applications (Themistocleous, 2004).

Organisations that have integrated their IT infrastructures through EAI have reported significant benefits (Bass and Lee, 2002). For example, Themistocleous and Irani (2001) analysed and explained the benefits that derive from the use of EAI technology. They classified the benefits into: (a) *organisational* (e.g. resulting in organised business processes), (b) *managerial* (e.g. achieving significant return on investment), (c) *operational* (e.g. reducing the operational cost), (d) *strategic* (e.g. increase in collaboration among different partners and suppliers), and (e) *technical* (e.g. achieving integration at different levels i.e. data, objects and process). Literature also indicates another significant EAI business benefit i.e. the reduction of overall integration cost and the reason for this is due to the decrease in both integration time and maintenance costs (Linthicum, 2000). In addition, EAI provides a flexible, manageable and maintainable IT infrastructure that supports the changing business and technical requirements (Themistocleous *et al.*, 2005). Based on the EAI integrated organisation-wide architecture, organisations can increase their productivity and provide better services for their customers and improve their relationships with their clients (Ruh *et al.*, 2000). In this context, by employing EAI effectively, LGAs can: (a) leverage their existing assets to provide enhanced services, (b) improve their relationships with customers and other stakeholders, (c) improve their performance, as well as (d) to streamline its operations (Kamal *et al.*, 2009; Themistocleous *et al.*, 2005).

The significance of EAI in the context of LGAs can also be realized with other benefits such as: (a) the provision of a centralised point of control, (b) the reduction of skills level required to integrate applications, and (c) faster time to marketing and increased market share. Moreover, as EAI incorporates organisational and cross-organisational applications (Zahavi, 1999), from this viewpoint, EAI can lead to integrated intra and inter-organisational systems. By enabling all these capabilities, Kamal *et al.*, (2009) claimed that EAI can help an organisation create a competitive advantage. However, the high investment costs associated with EAI have caused much concern for many organisations (Chen, 2005). Sanchez *et al.*, (2002) argued that although the initial cost of investing in EAI may be daunting to several organisations, the cost of integration is in fact more

extensive when EAI technological solutions not adopted. An example of the use of EAI in UK local government domain is given in Figure 1 and illustrates that LGAs built their own EAI architecture with which they incorporate their systems. The integration is based on a strategic approach, which requires the re-engineering and automation of their business processes both at intra and inter-organisational level.

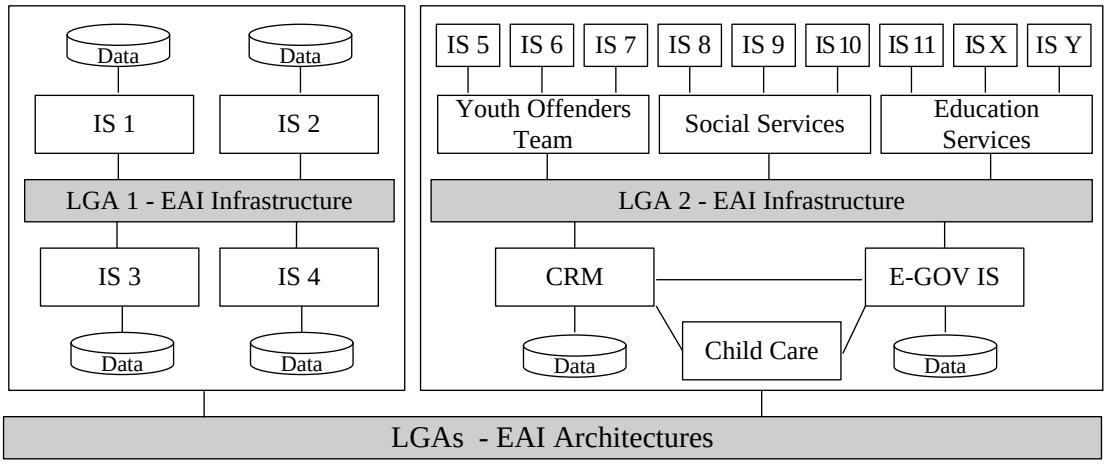

Figure 1: Examples of EAI Infrastructure in LGAs

As illustrated in Figure 1, EAI architecture integrates the supply chain within different services areas (i.e. departments). Such architecture allows end-to-end exchange of information within departments and externally with other LGAs. The benefits derived from such EAI architecture will be: the generic benefits associated with EAI implementations as described in literature (Puschmann and Alt, 2001) and the specific benefits that are related to local government integration (e.g., less data duplication errors, better and efficient services, and seamless flow of information) (Kamal, 2009).

3. Integration Layers: The REAL Model

Several approaches were proposed in the normative literature to describe EAI. Duke *et al.*, (1999) suggest that a solution based on enterprise application integration involves the transportation and transformation of information between one or more applications. It also supports: (a) the timing and sequencing rules that govern when the transportation and transformation takes place and, (b) the integrity constrains that determine the success or failure of the integration. However, Themistocleous *et al.*, (2009) proposed a model and reported that EAI supports four levels of integration: (a) data, (b) process, (c) knowledge management and (d) application integration. In addition, Themistocleous *et al.*, (2006) model also consists of the following integration layers: (a) connectivity, (b) transportation, (c) translation and (d) process integration and (e) knowledge management integration and described below (as illustrated in Figure 2):

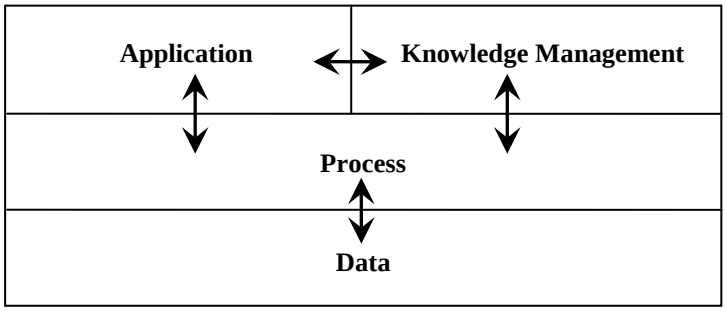

Figure 2: EAI Integration Layers

- **Data Integration Level:** Literature refers to the first three layers (connectivity, transportation and translation) using the term data integration level (Themistocleous *et al.*, 2006). The connectivity layer creates common points of access between the interconnected applications and EAI infrastructure. The transportation layer is responsible for the exchange of application elements (e.g. data, objects) between EAI and applications i.e. transferring the information from source application to the integration infrastructure and from the latter to the target application (Stonebraker, 1999; Zahavi, 1999). The translation layer converts and reformats the application elements into a recognisable format for the target(s) systems.

- **Process Integration Level:** The process integration level uses the data integration level to automate and integrate the business processes (Themistocleous *et al.*, 2006). Depending on the requests and information, the process integration level receives and triggers all appropriate applications or tasks to integrate a business process. Literature indicates that EAI supports business process integration that results in efficient operations and flexible delivery of business services to the customer (Themistocleous and Corbitt, 2006; Erasala, 2002). An example of the use of EAI in the UK public domain is given in Figure 1, which exemplifies that few LGAs have built their own EAI architecture in collaboration with their EAI software vendors and consultants, with which they incorporate their systems (Themistocleous *et al.*, 2004; Themistocleous *et al.*, 2005). Integration requires the re-engineering, and automation of the business processes within the organisational level.

- **Knowledge Integration Level:** This implies that knowledge can be exchanged, shared, evolved, refined and be made readily available to the point of need (Badii and Sharif, 2003). Conversely, Themistocleous *et al.*, (2006) and Badii and Sharif, (2003) suggested that EAI can not only support the data and process integration levels but also the knowledge integration level. This signifies that EAI can successfully integrate the knowledge that is stored in multiple locations, services and IS (Themistocleous *et al.*, 2006). In doing so, the researcher presents two exemplar cases from the public domain literature to exhibit that the knowledge integration level results in more efficient, effective and enhanced decision-making process. This finding also supports the researcher's point of view that EAI is an appropriate solution for the integration problems faced by LGAs. Themistocleous *et al.*, (2006) stated that the knowledge management integration layer is related to the application integration level as knowledge is pull out from applications and is integrated using important elements from the process integration level.

- **Application Integration Level:** Themistocleous *et al.*, (2006) reported that knowledge management integration layer is related to the application integration level as knowledge is pull out from applications and is integrated using important elements from the process integration level.

4. Research Methodology

The author followed an interpretivism, qualitative based case study approach to conduct this research and test the applicability of the REAL model (illustrated in Figure 3) in the context of local government domain. Interpretivism assumes that the knowledge of reality is gained only through social constructions such as consciousness, shared meanings, language, documents, tools and other artefacts (Saunders *et al.*, 2000). An interpretivism stance allows the researchers to navigate and better explain this phenomenon. It is also anticipated that as the social world cannot be reduced to isolated variables, such as space and mass, it must be observed in its totality. Therefore, the author asserts that, there is a need for a research approach that may allow LGAs to be viewed in their entirety and permits the author to get close to participants (i.e. the interviewees), penetrate their realities, and interpret their perceptions. Hence, the author considers interpretivism as more appropriate for the research reported herein. Having justified the use interpretive research approach, the author describes the nature of qualitative research approach in order to justify its relevance to the research presented in this paper. Qualitative research is multi-method in focus, involving an

interpretive, naturalistic approach to its subject matter (Denzin and Lincoln, 1994). This implies that the qualitative researchers study things in their natural environment, and they comprehend events in terms of meanings that people bring to them. The qualitative paradigm recommends that researchers observe human behaviour and action as it occurs in mundane everyday life (Schutz, 1967). Thus, the author suggests that in the context of this research a qualitative approach is more appropriate as such approach can be used to: (a) investigate less acknowledged phenomena like EAI, (b) examine the in-depth complexities and processes, (c) examine the phenomenon in its natural setting, (d) provide considerable flexibility during interviews and observations and (c) learn from practice.

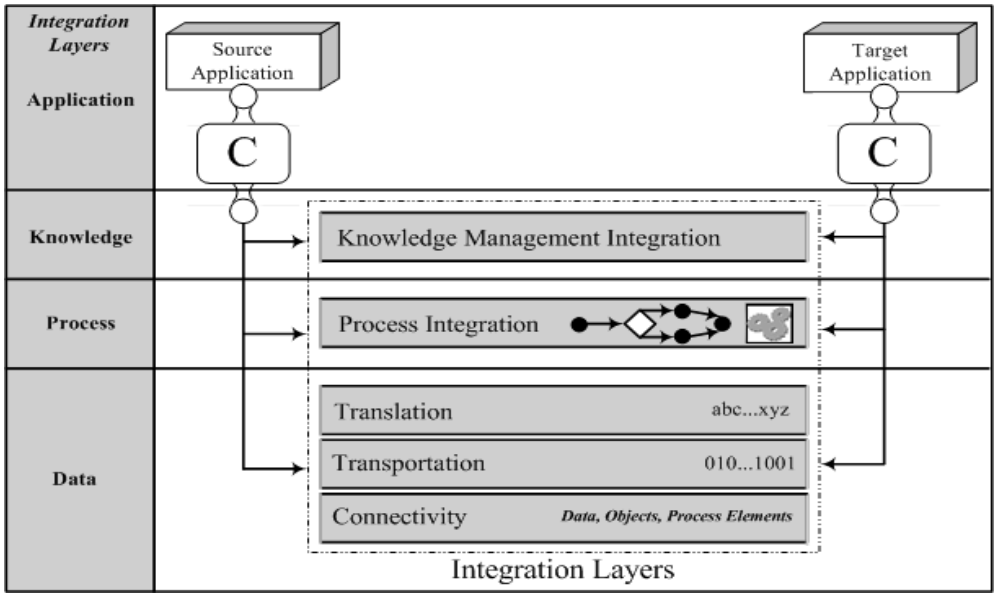

Figure 3: The REAL Model (Source: Themistocleous *et al.,* 2009)

A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities e.g. people, groups, or organisations (Yin, 1994). In the context of this paper, a single case study was conducted at LGA_UK. Case studies enable the researchers to investigate a phenomenon in depth, getting close to the phenomenon, providing rich primary data and revealing its deep structure within the organisational context (Cavaye, 1996). Data was collected via interviews, observation, and documentation based on a detailed questionnaire. Interviews are regarded as the main tool of qualitative research for data collection process. In this research, interviews constituted the main data source in the case organisations. Three participants from LGA_UK were interviewed using structured interviews for about 45-60 minutes. Structured interviews were based on the interview agenda. Using the interview agenda, the interviewees replied in specific questions regarding EAI adoption. Semi-structure interviews also took place to clarify some issues that derived from this research. All the structure or semi-structured interviews took place at interviewees' office. Unstructured interviews dealt with discussions that the author had with interviewees but without using a structured or semi-structured type of interview. The author had unstructured interviews during lunches, and coffee breaks. Using unstructured interviews some important data regarding the case study was collected. The interviews were tape recorded and transcripts prepared as soon as possible after each individual interview. Tape recording supported in collecting accurate data and interpreting without time pressures.

5. Case Organisation

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_UK. The case organisation 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_UK was working towards a 'hub and spoke' methodology. The 'HUB' is a single vendor database from which applications (the 'SPOKES') draw data and to which they return data. The integration between LGA_UKs' Local Land Property Gazetteer (LLPG) and CRM system via vendor HUB i.e. (InterConnect Integration HUB) will enable a two-way flow of data between LGA_UKs' 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.

5.1 The Demonstration Pilot Project (DPP)

The DPP is a project within LGA_UK where an integrated solution is being developed to provide multi-LGA access and sharing of information. Currently various local authorities own and manage their own applications and databases. LGAs are not aware of the information held on a specific citizen within another local authority. The DPP is based on integrating multi-LGAs to enable the LGAs 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 LGAs, 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_UK officials and other LGAs that investing in a long-term programme of integration between vendor solutions and non-vendor solutions is necessary. On this basis the adoption of integration architecture within and among other LGAs will deliver measurable business benefits.

5.2 The Enterprise Application Integration 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 local authority 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 4 and 5 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 4 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 5 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. The author employs 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.

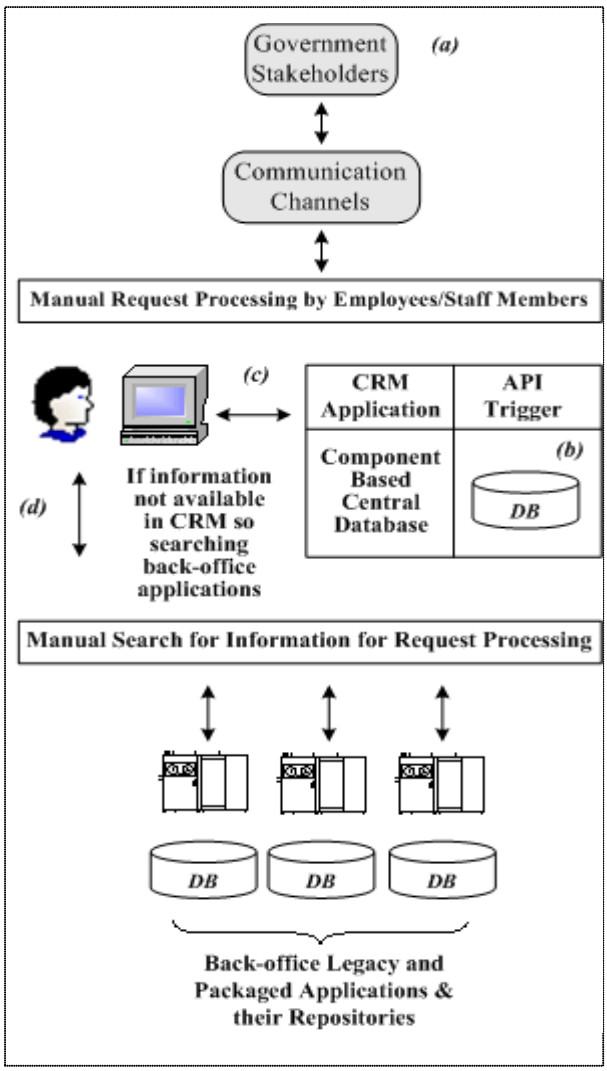

Figure 4: Information Flow "**Before**" Integration

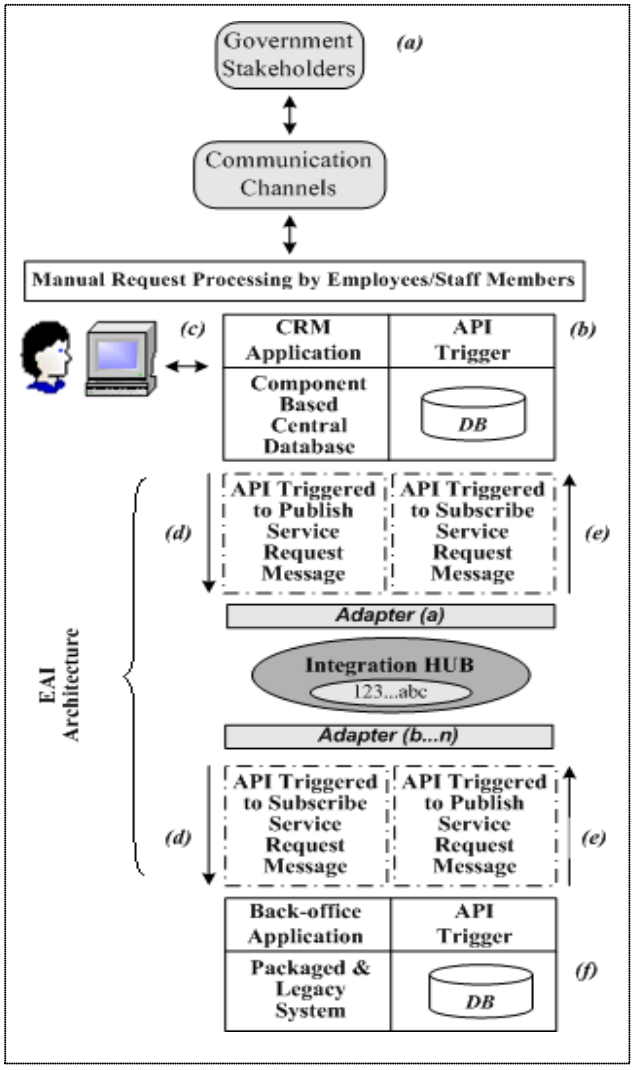

Figure 5: Information Flow "**After**" Integration

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

  (a) Different stakeholders contact LGA through different communication channels (channels such as vendor'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).

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

  (a) Different stakeholders contact LGA through different communication channels (channels such as vendor'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)*.

6. Discussions

Most of the stakeholders from LGA_UK involved in the DPP project were happy as the integrated solution has significantly improved their productivity and performance. The pilot integrated system is believed to increase citizens' satisfaction and trust. From the empirical data it is extrapolated that the REAL model is verified and that EAI - achieves applications', knowledge management and process integration. The main issues derived from the EAI demonstration pilot project reported earlier are presented below along with the interviewees' comments:

- **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, although the head of ICT championed this pilot project but they did not use any evaluation framework or other tools to assess EAI packages. An interviewee supported this and said that:

  > "*… selection of technology with the right knowledge has not always been done very well and it's been ad hoc look at the system often by the people that do not have sufficient technological skills, knowledge and no techniques applied to evaluate the technology ...*"

  The reason for this decision was that there were no clear procedures, norms and formal processes and knowledge for selecting and assessing EAI software and thus ended in taking the decision to select EAI software without assessing by relying on vendor expertise. This decision illustrates two significant issues, the manager's lack of market knowledge on EAI area and thus taking the decision to fully rely on vendor for the selection of EAI packages. This illustrates that LGA_UK adopted EAI software without knowing its risks (e.g. its flexibility, compatibility etc)

and whether this EAI software provided data security and privacy. As the literature indicates that the decision-making for technology adoption is typically centralised at top management level in public sector (Themistocleous *et al.*, 2005; Ebrahim *et al.*, 2004), hence, this decision was of high risk as the LGA_UK top management chose an EAI package that was under development. The risky decision was that LGA_UK fully relied on vendor with experience on IT projects but with no clear view regarding the integration of its packages. Although, in this case study EAI-DPP was successful, the decision for selecting EAI software could have been the other way round.

- **EAI Adoption:** The reason to run the EAI-DPP project were the high costs of maintaining the non-integrated legacy systems, the limited successful cases of EAI application in the public domain and a pilot integration project would be technically feasible. The decision makers also expected that by implementing a pilot project, it would benefit in building up their knowledge and understanding on EAI area. Furthermore, while implementing a major project EAI, the experiences of the pilot project would assist them in realising significant ROI and dealing with citizens' data security and privacy. The EAI-DPP project demonstrates that the integration: (a) is technically feasible and (b) can deliver significant benefits to LGA_UK. Another interviewee supported and said that:

  > "*… because sometimes we have a lots of work to, we do pilot projects, gain knowledge and take this pilot project as a method to develop other big projects …*"

  Other reasons for implementing a pilot project were:

  - An improved understanding of how to undertake subsequent integration, supported by the tools and outputs developed as part of the pilot project.
  - A demonstration to other London boroughs that they do similar integration depending on their organisational and community size.
  - A much better understanding and knowledge of how to deliver integration.
  - A better relationship with vendors to support the chances of technical support and share knowledge in future.
  - Develop expertise and knowledge of working with to date integration technologies among the staff.
  - Use the project as a lever for attracting additional funding for other similar projects.

  Benefits extracted from the EAI-DPP project including among others 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 and knowledge management.

Clearly the empirical data illustrate that EAI supports the integration of data, processes, knowledge and applications. In doing so, EAI extracts data from one application and transfers them to the integration infrastructure. Thereafter, it translates the data and it uses the business logic and the rules to automate and integrate the business processes. Based on the integrated business processes, the various applications can collaborate and share information and knowledge. This contributes towards knowledge management integration and validates the applicability of the REAL model in the context of the LGA_UK.

7. Conclusions

This paper has discussed the role of EAI in achieving knowledge management integration. The author suggests that EAI supports four levels and five layers. Based on these suggestions the author introduced a level oriented approach to explain the functionality of EAI. In doing so, the author adapted to the REAL model that was tested in the local government domain (i.e. in a single case organisation – a limitation). The empirical results validate the applicability of the REAL model and indicate that EAI supports knowledge management. This is of high importance especially in the local government domain as data inconsistencies and duplication occurs due to the lack of a complete view of the citizen data. As illustrated through the case study presented above, EAI can successfully integrate the knowledge that is stored in multiple locations, services and IS. Thus, it results in more efficient, effective, informative and accurate decisions regarding improving services to citizens. This is a significant outcome which extends the body of knowledge and contributes towards the provision of better public services. To this end, the author believes that this research has practical and theoretical implications and scope for timeliness and novel research in this area.

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