

The Application of Knowledge Management to Overcome Barriers to Enterprise Architecture Adoption: A South African Motor Vehicle and Asset Finance Case Study

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Abstract: Information Technology (IT) enables an organisation to gain competitive advantage by exploiting new opportunities and capabilities offered by evolving technologies. Therefore, it is required to holistically align IT strategy with organisational strategy, and Enterprise Architecture (EA) is considered as a means to achieve such alignment. However, EA adoption is impacted by many organizational barriers and in particular organisational culture factors. Knowledge Management (KM) is a candidate to address these organisational culture issues. Therefore, the purpose of this study, was to understand the barriers to EA adoption, as well as the KM interventions likely to increase the success of EA initiatives. The study was conducted in the South African motor vehicle and asset finance industry and the lack of understanding the purpose of EA, as well as employees not actively participating in the development of EA, were identified as major barriers. The KM interventions identified to be effective in overcoming the barriers pointed to the promotion of knowledge sharing between employees and the EA team, and the increased involvement of EA stakeholders and users in EA development. By considering the research findings, organisations may apply KM, in overcoming barriers that prevent the successful implementation of EA initiatives.


1 INTRODUCTION

Enterprise Architecture (EA) is considered to be a means to achieve and maintain alignment between the shifts in organisational strategy, business processes and an increasingly complex Information Technology (IT) landscape (Löhe and Legner, 2014, Bente et al., 2012). According to Pham, et al. (2013), EA comprises of a set of processes and artefacts applied to transform an organisation's business strategy into an IT roadmap with the aim to implement an organisation's business strategy. EA is therefore positioned to support strategic enterprise planning by establishing the best use of available information, processes and technology in fulfilling business and IT strategies (Pham et al., 2013).

However, EA is perceived to be an invasive endeavour that involves interactions with all the dimensions of an organisation encountering many implementation issues and barriers such as resistance

to change or a general lack of understanding of the purpose or role of an EA endeavour (Syynimaa, 2015). The wide scope of EA further compounds the situation as multiple dimensions such as culture, technology, structure and procedures are essential contributors to successful EA implementation (Jahani et al., 2010). The role of employees is also emphasised as they are responsible for the management of the business and information exchange operations of the organisation, to the extent that modern enterprises are perceived as "human-driven" (Gilliland et al., 2015: 43). Strategic initiatives such as EA therefore also depend on effective human involvement. In the context of EA initiatives, the introduction and compliance to EA may limit the design freedom of employees and such constraints have a potential to lead to significant resistance within the organisation (Aier and Weiss, 2012, Aier, 2014). There is a requirement for solutions to overcome the difficulties encountered

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during EA implementations in order to conduct EA successfully (Aier, 2014).

One enabler of the collective intelligence in an organisation supporting the organisation's strategic objectives, is Knowledge Management (KM). KM ensures that knowledge is created, communicated and applied to achieve business goals (Wang and Yang, 2016). It enables an organisation to become more competitive by facilitating the processes of identifying, managing and leveraging individual and collective knowledge (Liao, 2003). Furthermore, KM is able to address culture, people issues, technical, structural and procedural elements of an organisation as it provides appropriate practices, tools, and methods to effect changes to the culture of an organisation (Corfield and Paton, 2016). In addition, the implementation of KM processes infuses changes in organisations, which affects employees and the organisation's operation (Smuts and Juleka, 2018, Rusly et al., 2015). Therefore, the research question that this paper aims to address is: "how can KM be applied to overcome the barriers experienced in EA implementations?". By addressing this question, organisations are able to apply KM and its associated processes to successfully adopt EA.

In Section 2 we present the background to the study followed by the research approach in Section 3. Section 4 details the data analysis and findings, while Section 5 concludes the paper.

2 BACKGROUND

Information collection, -communication, and -exchange are important constituents of EA (Buckl and Schweda, 2009). In addition, the dynamic nature of EA is also about transformation and modelling for change (Trinskjær, 2009). Successful EA implementation offers a wide range of benefits to an organisation, including reduced complexity, cost savings, more effective decision-making processes, successful delivery of transformation projects and the strategic capability arising from the better digital business platform built during the transformation (Tamm et al., 2015).

EA adoption is a resource intensive undertaking requiring significant investments in costs, time and effort. As a result, a poorly executed EA implementation results in significant losses and problems for the organisation (Smuts and Juleka, 2018).

However, KM has the potential capacity of supporting EA adoption by providing access to existing resources within the organisation that may

support adoption. This would then have the effect of reducing the acquisition of additional resources, already present, to enable and support EA adoption (Wang and Yang, 2016).

In the next sections we consider EA adoption and acceptance, and highlight the role of KM interventions to increase the possibility of success for EA initiatives.

2.1 EA Adoption and Acceptance

EA provides the support required to enable an organisation to achieve effectiveness (Ross et al., 2006), agility (Bente et al., 2012), durability (Hausman, 2011) and overall efficiency (Schekkerman, 2004). Moreover, it has also been found that EA makes it possible for organisations to coordinate the various organisational initiatives that are aimed at eliminating the existence of information islands as well as those initiatives that align the business and IT domains (Tamm et al., 2015, Bricknall et al., 2006).

Adoption and acceptance are terms that are regularly used interchangeably in both literature and industry to articulate the decision to use or to introduce and use new technologies or organisational strategies (Gilliland et al., 2015). However, there is an important difference between adopting and accepting new technology or strategy (e.g. EA) by the organisation (Gilliland et al., 2015). *Adoption* implies that members of the organisation have decided to use the organisation's new technologies or strategy. This decision is then followed up with the necessary planning, acquisition and implementation of such strategy or technology within the organisation (Smuts and Juleka, 2018, Gilliland et al., 2015). Meanwhile, *acceptance* is specifically about the acceptability of the organisation's strategy or technology to the organisation's people (Gilliland et al., 2015). For the purposes of this study, we considered *adoption* in the context of EA.

The challenge with EA adoption is that changes to the organisational culture are inevitable (McNabb and Barnowe, 2009). For EA adoption to be successful, it is important that members of the organisation consider EA adoption to be necessary, achievable, valuable to the organisation, beneficial to the individual, and supported by top-management (Syynimaa, 2015). In this context, at the initiation of EA adoption, the knowledge and understanding of EA may be considered as low, emphasising the requirement for effective communication during EA adoption (Syynimaa, 2015, Lemmetti and Pekkola, 2012).

The challenges faced by EA are the hurdles that have to be overcome by an organisation in the pursuit of attaining long-term success during the implementation of enterprise initiatives (Wißotzki et al., 2013). Some of the difficulties encountered during EA implementation are (Löhe and Legner, 2014, Bente et al., 2012, Wißotzki et al., 2013):

- The initial gathering of information requires a great effort
- Outdated EA artefacts as well as low quality of EA artefacts.
- Existing EA artefacts are not regularly used in day-to-day work as well as in decision-making.
- Lack of EA acceptance in the IT organisation and difficulties in enforcing EA policies and standards.
- Lack of coordination between the EA life cycle processes and the existing established IT processes.
- Having emerged from Information Systems Engineering which is a technical domain, there is insufficient general business awareness of EA
- Delivering tangible EA value proposition remains one of the major challenges for organisations.
- Organisations often lack the ability to articulate their information needs, thereby hindering efforts aimed at designing fit-for-purpose solutions.
- For every enterprise a specific EA has to be developed based on the practice of that organisation.
- EA tasks often entails complex approaches which are typically difficult to teach and sometimes even harder to depict graphically.
- Lack of common language / glossary inside IT and between Business and IT to achieve consensus on a common terminology (common understanding) to be used within the organisation.
- Issues pertaining to data quality and data consolidation are some of the biggest obstacles due to continuous changes to the business requirements.
- The increase in compliance requirements as well as the promulgation of new regulations are challenging particularly for organisations operating in the banking, telecommunication, insurance, and utilities sectors.
- Unlike in other industries like automotive, IT systems are regularly enhanced and altered while in use. This makes EA an open-ended initiative whose end product has to keep

changing. As a result, the effectiveness and tangible benefits of EA are not readily identified.

Notwithstanding the great benefits of EA as discussed in this paper, its adoption is fraught with challenges which must be overcome for EA adoption to succeed.

In the next section we present an overview of the KM lifecycle and interventions.

2.2 KM Lifecycle and Interventions

There are numerous definitions of the knowledge life cycle, also referred to as KM phases or activities. The KM lifecycle comprises of four phases (Lech, 2014: 554):

- acquisition / creation / generation,
- retention / storage / capture,
- share / transfer / disseminate, and
- application / utilization / use.

In this context, knowledge sharing is regarded as the transfer of knowledge among individuals (members of an organisation), groups (e.g. teams), departments and organisations leading to an improvement in the performance of the organisation as a whole (Zhang and Jiang, 2015, Oztekin et al., 2015). In order to facilitate knowledge sharing, there are three main approaches to knowledge sharing / transfer (Alshurah et al., 2018). The *first* approach places greater emphasis on the importance of technology in the dissemination of knowledge. Technological advances make knowledge sharing between individuals, teams, departments and organisations effective and geographically feasible (Oztekin et al., 2015, Alshurah et al., 2018). The *second* approach emphasises the importance of social interactions and cultural aspects within the organisation. Various scholars have emphasised that formal or informal social processes and cultural issues are as important as the technology systems in knowledge sharing and transfer (Peng et al., 2019). Scholars caution that technological systems are not a guarantee that people will share knowledge in the organisation. It is the quality and frequency of social interactions and the structure of organisational culture that encourage people to share knowledge (Peng et al., 2019, Nonaka and Takeuchi, 1995). The *third* approach combines the technology and socio-cultural aspects of KM (Oztekin et al., 2015, Peng et al., 2019).

Organisations should therefore seek to adopt an approach to knowledge sharing that codifies explicit knowledge (knowledge that has been articulated e.g. text, diagrams or product specifications) in tangible

forms, while tacit knowledge (personal and context-specific) is shared through (1) strengthening weak ties, and (2) creation of an environment where sharing tacit knowledge results in personal benefit (Smuts and Juleka, 2018, Joe et al., 2013, Nonaka and Takeuchi, 1995). This combination of approaches will ensure that the project team deploying EA can access both explicit and tacit knowledge that is necessary to ensure that the resulting EA products are appropriate and sufficiently cater for the different stakeholders' needs.

Furthermore, some of the significant knowledge transfers pertinent during EA projects are (Smuts and Juleka, 2018, Joe et al., 2013):

- Transferring of organisational knowledge from members of the organisation such as key users to the entire project team (which includes external consultants).
- Transfer of project knowledge between the project manager, the project team and key users. Typically, the project team provides feedback on their progress, as well as any potential risks and changes in the scope of the project.
- Project managers share with the team the plans to manage the proposed changes as well as plans to mitigate the project risks. The project managers also provide the team (and other stakeholders) with updates regarding the status of the overall project.
- Transfer of solution knowledge from EA experts to all the team members.

These are aligned with Lech's (2014) observations with regards to knowledge transfers during Enterprise Resource Planning (ERP) implementations.

In the next section, we consider EA in the context of KM.

2.3 EA and KM in Context

According to Gøtze (2013: 321), "much of what enterprise architects do is transmit, translate and transform knowledge across boundaries, whether the boundary is between customer and vendor, between business silos, or between classic business and IT". In a similar manner, the importance of the knowledge created and shared during EA planning and development is key as such knowledge is an important organisational resource which must be properly managed (McGinnis and Huang, 2007). Similarly, the introduction of change to the organisation requires an analysis of possible impacts triggered by this change and EA can support this

analysis as EA provides a comprehensive view of the entire organisation (Azevedo et al., 2015).

In an instance where EA is adopted and accepted, an organisation has the advantage to also obtain knowledge about how employees involved in EA operate (Gilliland et al., 2015). Capturing and retaining such useful "human" knowledge may result in reusable information that will enable EA to facilitate effective flow of information thus promoting KM within an organisation (Gilliland et al., 2015).

It is therefore appropriate for the relation between EA and KM to be studied and made explicit. With such a relation, whenever there are KM-induced organisational capabilities such as changes to organisational processes or changes to the IT landscape as a result of KM, the EA would accordingly require updating to continue supporting the provision of the organisation's products and services (Smuts and Juleka, 2018).

In order to consider this relation between EA and KM, we present the research approach followed for this study in the next section.

3 RESEARCH APPROACH

The overall objective with this paper was to investigate the application of KM and EA for the success of EA in the context of a bank operating in the South African (SA) motor vehicle and asset finance industry. This industry in SA is highly competitive and is dominated by four leading finance houses that hold 92% of the market share (Competition Tribunal of South Africa, 2013).

The outcome of this study provided insight into the extent to which EA stakeholders believe that EA efforts might benefit from the introduction of KM activities. In addition, it considered the barriers encountered during EA adoption. In order to achieve this outcome, we conducted quantitative research and employed a survey research strategy with the selection of a large sample of participants from a predetermined population of interest (Leedy and Ormrod, 2014). We utilised an online questionnaire for data collection as it enabled us to obtain the same kind of data from a large group of people, in a standardised format (De Villiers, 2012). Non-probability purposive sampling was used to identify potential research participants and specific criteria guided their identification i.e. experts in the fields of EA, project management, business analysis, systems analysis, IT management, software development,

software testing and IT infrastructure across all levels in the case study organisation.

The design of the online questionnaire consisted of main topic areas: understanding the barriers and facilitators to EA adoption, and recognising the application of KM practices to overcome barriers to EA adoption.

Table 1: Research participant profile.

	Response Count	Response Percent
I did not know Enterprise Architecture exists	5	6.0%
I know what EA does, but do not believe it is important	19	22.6%
I know what EA does and I believe it is important	60	71.4%

Research participants provided their opinion by using a 5-point Likert scale. A web link to the online questionnaire was emailed to 110 prospective participants of which 84 participated in the research yielding a response rate of 76%. The EA engagement of respondents are shown in Table 1.

Most of the respondents, 94% indicated that they were aware of EA, while 71% believed having an EA capability was important. Although 22% of respondents were aware of EA, they indicated that they did not believe it added value.

In the next section, we discuss the quantitative analysis of the data collected in order to understand the barriers to EA adoption, as well as the KM interventions to increase the possibility of success for EA initiatives.

4 DATA ANALYSIS AND FINDINGS

Inferential statistical analysis was performed to determine whether a relationship exists between the respondents that perceived EA to be yielding the expected benefits and the other nine factors pertinent presented in the questionnaire. Simple descriptive statistics, as well as frequency tables were analysed in order to derive suggestions for intervention. Pearson chi-square tests were used to examine the associations/ relationships between the responses to the statement “EA is yielding the expected benefits” and responses to the other statements posed in the questionnaire. The detailed outcome is depicted in Table 2, and in the next sections, a detailed analysis of each of the factors are presented. In Figure 1, the frequencies are presented. The number of Likert scale

options were combined: “Agree” and “Strongly Agree” to “Agree”, and “Disagree” and “Strongly Disagree” were combined to “Disagree”.

4.1 The Organisation Has an Open-minded Approach to New Ways of Working and the Changes Necessitated by EA

Of the 79 respondents that perceived the organisation to have an open-minded approach to new ways of working, the majority (46) perceive EA to be yielding the expected benefits. Since the chi-square value is equal to 6.436 with 1 degree of freedom and a p-value = 0.011, there is a significant association between the stated perceptions at the 5% level of significance. In this case, there is strong evidence of a significant relationship between those who perceived EA to be yielding the expected benefits and those who perceive the organisation to have an open-minded approach to new ways of working and the changes necessitated by EA.

4.2 The Purpose and Goals of EA Are Well Understood in the Organisation

Of the 56 respondents that perceived that the purpose and goals of EA are well understood in the organisation, 29 perceived EA to be yielding the expected benefits while almost the same number (27) did not agree that EA initiatives are yielding the expected benefits. Since the chi-square value is equal to 0.601 with 1 degree of freedom and a p-value = 0.438

A total of 17 respondents reported that EA activities are yielding the expected benefits while reporting that the purpose and goals of EA are not well understood in the organisation. Therefore there is an alignment between the expected and recorded number of respondents that perceived that EA activities are yielding expected results while perceiving that the purpose and goals of EA are not well understood in the organisation.

Moreover, 11 respondents reported that EA activities are not yielding expected results and that the purpose and goals of EA are not well understood in the organisation. This further highlights the minimal difference between the respondents’ expected and reported views with regards to the two perceptions.

While there is no statistically significant association between the perceptions analysed, it is a meaningful metric to note that 63% of the respondents perceived that EA is yielding the

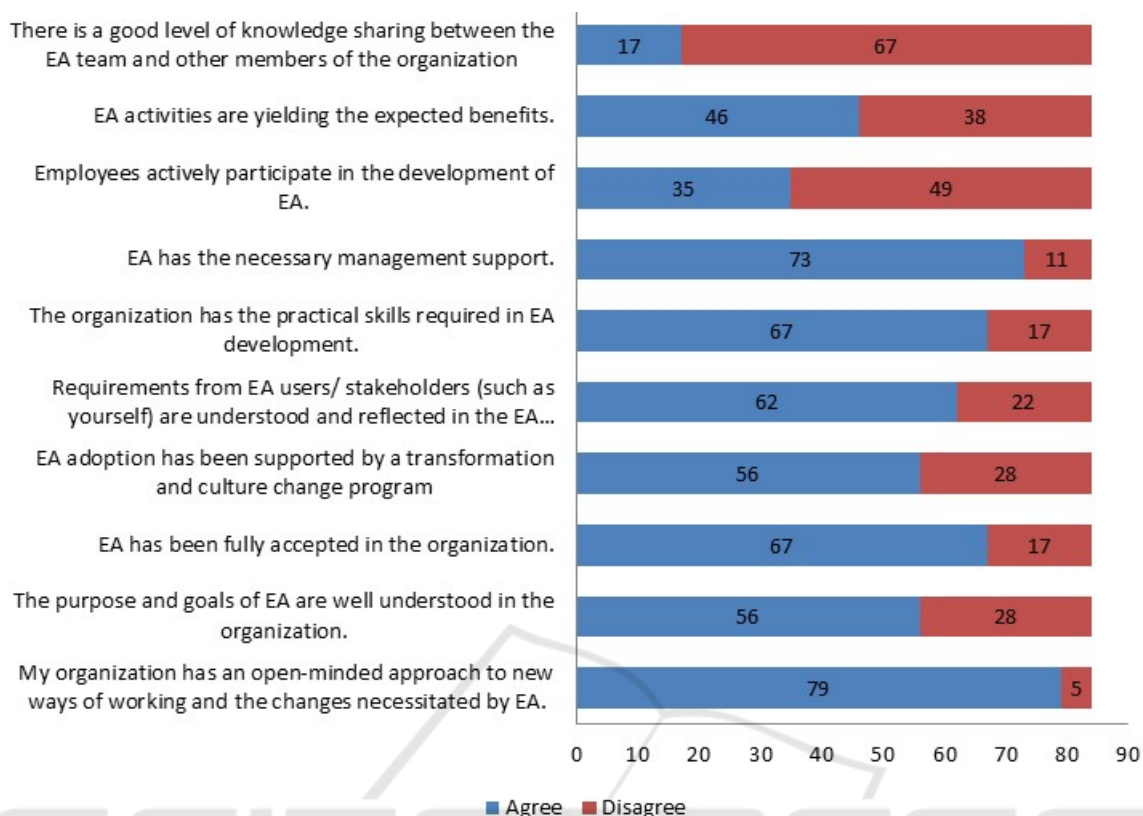


Figure 1: Frequency count for factors affecting EA adoption.

expected benefits while also perceiving that the purpose and goals of EA are well understood in the organisation. The remaining 37% perceived EA to be yielding the expected benefits while perceiving that the purpose and goals of EA are not well understood in the organisation. This suggests that the possibility of success for EA initiatives (i.e. EA is perceived as yielding the expected benefits) is increased when the purpose and goals of EA are well understood in the organisation.

4.3 EA Has Been Fully Accepted in the Organisation

Of the 67 respondents that perceived EA to have been fully accepted in the organisation, the majority (46) perceived EA to be yielding the expected benefits.

The chi-square value is equal to 25.800 with 1 degree of freedom and a p-value < 0.001. We can therefore infer that there is a significant association between the stated perceptions at the 5% level of significance. In this case, since the p-value < 0.001, there is convincing evidence of a significant relationship between those who perceived EA to be yielding the expected benefits and those who

perceived EA to have been fully accepted in the organisation.

Since all respondents that perceived EA activities to be yielding expected results also perceived that EA has been fully accepted in the organisation, the organisation should therefore direct their efforts to ensuring that EA is accepted in the organisation.

4.4 EA Adoption Has Been Supported by a Transformation and Culture Change Program

Of the 56 respondents that perceived EA adoption to have been supported by a transformation and culture change program, 29 perceived EA to be yielding the expected benefits while 27 did not perceived EA to be yielding the expected benefits. The chi-square value is equal to 0.601 with 1 degree of freedom and a p-value = 0.438.

Some 17 respondents reported that EA activities are yielding the expected benefits while reporting that EA has not been supported by a transformation and culture change program. There is therefore minimal difference between the expected (15.3) and recorded (17) number of respondents that perceived that EA

activities are yielding expected results but that EA has not been supported by a transformation and culture change program.

While there is no statistically significant association between the perceptions analysed, it is worth noting that 63% of the respondents perceived that EA is yielding the expected benefits and EA adoption has been supported by a transformation and culture change program. Compared to 37% that perceived EA to be yielding the expected benefits and that EA adoption has not been supported by a transformation and culture change program suggests that it is beneficial to support EA adoption by a transformation and culture change program.

4.5 Requirements from EA Users / Stakeholders Are Understood and Reflected in the EA Artefacts

Of the 62 respondents that perceived that the requirements from EA users/ stakeholders are understood and reflected in the EA artefacts, 35 perceived EA to be yielding the expected benefits while 27 did not perceived EA to be yielding the expected benefits. The chi-square value is equal to 0.273 with 1 degree of freedom and a p-value = 0.601. We can therefore not conclude that there is an association between the stated perceptions.

Table 2: Cross Tabulation Results between the KM attributes and the perception that EA activities are yielding the expected benefits.

Cross tabulation Results – KM attribute compare to “EA activities are yielding the expected benefits”	Pearson Chi-Square	Continuity Correction	P-value	<i>Note: N=84</i>
KM attributes				Pearson Chi-Square NOTE
My organisation has an open-minded approach to new ways of working and the changes necessitated by EA	6,436	4,3	0.011 [N/A]	2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.26.
The purpose and goals of EA are well understood in the organisation	0,601	0,294	0.438	0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.67.
EA has been fully accepted in the organisation	25,80	23,10	<0.001	0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.69.
EA adoption has been supported by a transformation and culture change program	0,60	0,29	0.4388	0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.67.
Requirements from EA users/ stakeholders (such as yourself) are understood and reflected in the EA artefacts	0,27	0,08	0.601	0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.95.
The organisation has the practical skills required in EA development.	2,16	1,43	0.142	0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.69.
EA has the necessary management support.	15,32	12,88	<0.001	1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.98.
Employees actively participate in the development of EA.	49,57	46,48	<0.001	0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.83.
There is a good level of knowledge sharing between employees and the EA team	17,61	15,39	<0.001	0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.69.

Some 11 respondents reported that EA activities are yielding the expected benefits while reporting that requirements from EA users / stakeholders are not understood or reflected in the EA artefacts. Moreover, 11 respondents reported that EA activities are not yielding expected results and that the requirements from EA users / stakeholders are not understood or reflected in the EA artefacts.

While there is no statistically significant association between the perceptions analysed, 76.1% perceived that EA is yielding the expected benefits and that requirements from EA users / stakeholders are understood and reflected in the EA artefacts. Only 23.9% perceived EA to be yielding the expected benefits and that requirements from EA users / stakeholders are not understood or reflected in the EA artefacts. This suggests that it is beneficial to ensure that requirements from EA users / stakeholders are understood and reflected in the EA artefacts.

4.6 The Organisation Has the Practical Skills Required in EA Development

Of the 67 respondents that perceived that the organisation has the practical skills required in EA development, 34 perceived EA to be yielding the expected benefits while 33 did not perceive EA to be yielding the expected benefits. The chi-square value is equal to 2.155 with 1 degree of freedom and a p-value = 0.142. We cannot then conclude that there is an association between the stated perceptions. Twelve respondents reported that EA activities are yielding the expected benefits while reporting that the organisation does not have the practical skills required in EA development.

While there is no statistically significant association between the perceptions analysed, it is noteworthy that 73.9% of the respondents perceived that EA is yielding the expected benefits and that the organisation has the practical skills required in EA development. This figure is almost 3 times higher than the 26.1% that perceived EA to be yielding the expected benefits and that the organisation does not have the practical skills required in EA development. This suggests that ensuring the organisation has the practical skills required in EA development increases the possibility of successful EA initiatives by a factor of almost three.

4.7 EA Has the Necessary Management Support

Out of a total of 73 respondents that perceived EA to have the necessary management support, the majority (46) perceive EA to be yielding the expected benefits.

The chi-square value is equal to 15.322 with 1 degree of freedom and a p-value < 0.001. We can therefore infer that there is a significant association between the stated perceptions at the 5% level of significance. In this case, since the p-value < 0.001, there is convincing evidence of a significant relationship between those who perceive EA to be yielding the expected benefits and those who perceive EA to have the necessary management support.

The standardised residuals were used to determine which cells in the cross tabulation contributed most to the significant overall association. A standardised residual value smaller than -2 or greater than 2 is an indication that the particular cell in the cross tabulation made a large contribution to the overall association. In this case the standardised residuals are 2.7 and -2.5.

None of the respondents reported that EA activities are yielding the expected benefits while reporting that EA does not have the necessary management support. In addition, 11 respondents highlighted that EA activities are not yielding expected results and that EA does not have the necessary management support.

Since all respondents that perceived EA activities to be yielding expected results also perceive that EA has the necessary management support, securing management support is therefore essential in increasing the possibility of success for EA initiatives.

4.8 Employees Actively Participate in the Development of EA

Of the 35 respondents that perceive that employees actively participate in the development of EA, all of them perceive EA to be yielding the expected benefits. The chi-square value is equal to 49.565 with 1 degree of freedom and a p-value < 0.001. We can therefore infer that there is a significant association between the stated perceptions at the 5% level of significance. In this case, since the p-value < 0.001, there is convincing evidence of a significant relationship between those who perceive EA to be yielding the expected benefits and those who perceive that employees actively participate in the development of EA.

The standardised residuals were used to determine which cells in the cross tabulation contributed most to the significant overall association. A standardised residual value smaller than -2 or greater than 2 is an indication that the particular cell in the cross tabulation made a large contribution to the overall

association. In this case the standardised residuals are 3.4 and -3.1.

A total of 11 respondents reported that EA activities are yielding the expected benefits while reporting that employees did not actively participate in the development of EA.

Additionally, 38 respondents indicated that EA activities are not yielding expected results and that employees did not actively participate in the development of EA. Since all respondents that perceived employees to be actively participating in EA development also perceived that EA activities to be yielding expected results, the organisation should therefore direct its efforts to promote employee participation in the development of EA.

4.9 There Is a Good Level of Knowledge Sharing between the EA Team and Other Members of the Organisation

Of the 17 respondents that perceived that there is a good level of knowledge sharing between the EA team and other members of the organisation, all of them perceive EA to be yielding the expected benefits.

The chi-square value is equal to 17.607 with 1 degree of freedom and a p-value < 0.001 . We can therefore infer that there is a significant association between the stated perceptions at the 5% level of significance. In this case, since the p-value < 0.001 , there is convincing evidence of a significant relationship between those who perceived EA to be yielding the expected benefits and those who perceived that there is a good level of knowledge sharing between the EA team and other members of the organisation.

The standardised residuals were used to determine which cells in the cross tabulation contributed most to the significant overall association. A standardised residual value smaller than -2 or greater than 2 is an indication that the particular cell in the cross tabulation made a large contribution to the overall association. In this case the standardised residuals are 2.5 and -2.8.

A total of 29 respondents reported that EA activities are yielding the expected benefits while reporting that there is a lack of a good level of knowledge sharing between the EA team and other members of the organisation. Additionally, 38 respondents reported that EA activities are not yielding expected results and that there is a lack of a good level of knowledge sharing between the EA team and other members of the organisation.

Since all respondents that perceive that there is a good level of knowledge sharing between the EA team and other members of the organisation also perceived that EA activities to be yielding expected results, the organisation should therefore direct its efforts to promote knowledge sharing.

5 KM PRACTICES THAT OVERCOME BARRIERS TO EA ADOPTION

In the previous sections we focused on analysing and presenting the results of the empirical investigation of this research. The main findings i.e. barriers to EA adoption was the fact that the purpose and goals of EA are not well understood in the organisation and that employees are not actively participating in the development of EA. The main objective pursued in this research was to determine how KM can be used to overcome these barriers towards successfully adopting EA.

The challenge with EA adoption is that changes to the organisational culture are inevitable and for EA adoption to be successful, it is important that members of the organisation consider EA adoption to be necessary, achievable, valuable to the organisation, beneficial to the individual, and supported by top-management.

In order to establish which KM interventions are best suited to support and enable EA initiatives, research participants also rated such initiatives by indicating “no improvement”, “slight improvement” and “significant improvement” as depicted in Table 3.

The empirical evidence reveals that promoting knowledge sharing between employees and the EA team would make a significant contribution in supporting EA initiatives. Empirical evidence also showed that increasing involvement of EA users/stakeholders in EA development would also greatly benefit EA initiatives. Empirical evidence also showed that regularly communicating EA-related issues and success stories, continuously communicating the purpose and goals of EA as well as increasing the level of user involvement in EA would be highly effective in overcoming the reported barriers. Empirical evidence presented revealed that KM activities such as knowledge sharing are perceived to hold great potential to support EA adoption.

Table 3: KM interventions to increase the possibility of success for EA initiatives.

Intervention	Improvement		
	None	Slight	Significant
Increase management involvement in EA.	7%	47%	46%
Continuous communication pertaining to the purpose and goals of enterprise architecture.	8%	22%	70%
Regularly communicating EA-related issues and success stories.	26%	22%	52%
Increase involvement of EA users/ stakeholders in EA development	27%	0%	73%
Promoting knowledge sharing between employees and the EA team	38%	0%	62%

Some of the significant discoveries made in this research are that EA is well recognised and perceived to be important. Some of the barriers to successful EA adoption are that (i) the purpose and goals of EA are not well understood in the organisation; and that (ii) employees are not actively participating in the development of EA. Some of the KM interventions that are believed to be effective in overcoming the barriers are: (i) promoting knowledge sharing between employees and the EA team; (ii) increase involvement of EA users / stakeholders in EA development; and (iii) increased management involvement in EA.

6 CONCLUSION

IT is a key enabler for business as it facilitates organisations to exploit new opportunities and capabilities offered by new technologies in order to gain competitive advantage in their markets. Since EA is increasingly being used to align organisational strategy with IT strategy, its successful adoption is important to business.

However, EA adoption is fraught with difficulties, particularly human and organisational culture factors. KM promises to address and improve these human and organisational culture issues. Therefore, the purpose of this study in the South African motor

vehicle and asset finance industry, was to better understand the barriers to EA adoption, as well as the KM interventions to increase the possibility of success for EA initiatives. KM is a field that provides effective tools and methods to influence human and organisational culture issues. This research study indicated that there is a clear possibility in the usage and application of KM, more specifically knowledge sharing, in overcoming barriers that prevent the successful implementation of EA initiatives. Multiple barriers to successful EA adoption were highlighted and the lack of understanding of the purpose and goals of EA in the organisation, as well as employees that are not actively participating in the development of EA, were identified as major barriers in the case study organisation. Some of the KM interventions that were identified to be effective in overcoming the barriers pointed to the promotion of knowledge sharing between employees and the EA team, the increased involvement of EA stakeholders in EA development, and the increased management involvement in EA.

Conducting this study has contributed in two ways. This study has added to the existing EA and KM body of knowledge, thus contributing to the academic literature on both EA and KM as well as the relation between the two. This study has also offered practical steps of incorporating KM activities during EA adoption thus contributing to the domain of EA practitioners.

REFERENCES

- Aier, S. 2014. The Role of Organizational Culture for Grounding, Management, Guidance and Effectiveness of Enterprise Architecture Principles. *Information Systems And E-Business Management*, 12, 43–70.
- Aier, S. & Weiss, S. An Institutional Framework for Analyzing Organizational Responses to the Establishment of Architectural Transformation. *Proceedings of the 20th European Conference on Information Systems, 2012 Barcelona*.
- Alshurah, M. S., Zabadi, A. M., Dammas, A. H. & Dammas, D. H. 2018. Impact of Organizational context & Information Technology on Employee Knowledge Sharing. *International Journal of Business and Management*, 13.
- Azevedo, C., Van Sinderen, M., Pires, L. & Almeida, J. 2015. Aligning enterprise architecture with strategic planning. *International Conference on Advanced Information Systems Engineering*, 426-437.
- Bente, S., Bomboch, U. & Langate, S. 2012. *Collaborative Enterprise Architecture - Enriching EA with Lean, Agile, and Enterprise 2.0 practices*, Waltham, MA, Morgan Kaufmann.

- Bricknall, R., Darrell, G., Nilsson, H. & Pessi, K. Enterprise architecture: critical factors affecting modelling and management. *European Conference on Information Systems, 2006 Göteborg, Sweden*.
- Buckl, S. & Schweda, C. Future Research Topics in Enterprise Architecture Management - A Knowledge Management Perspective. *Workshop Trends in Enterprise Architecture Research, 2009 Stockholm*.
- Competition Tribunal Of South Africa. 2013. *Volkswagen Financial Services South Africa (Pty) Ltd and Volkswagen Financial Services South Africa, a division of Wesbank, a division of FirstRand Bank* [Online]. Available: <https://www.comptrib.co.za/> [Accessed April 2019].
- Corfield, A. & Paton, R. 2016. Investigating Knowledge Management: Can KM Really Change Organisational Culture? *Journal of Knowledge Management*, 20, 88-103.
- De Villiers, M. R. 2012. Models for interpretive information systems research, part 2: Design research, development research, design-science research, and design-based research - a meta-study and examples. *Research Methodologies, Innovations and Philosophies in Software Systems Engineering and Information Systems*, 238-255.
- Gilliland, S., Kotzé, P. & Van Der Merwe, A. Work Level Related Human Factors for Enterprise Architecture as Organisational Strategy. *Third International Conference on Enterprise Systems, 2015. IEEE Computer Society*, 43-54.
- Gotze, J. The Changing Role of the Enterprise Architect. *17th IEEE International Enterprise Distributed Object Computing Conference Workshops, 2013 Vancouver, British Columbia, Canada*.
- Hausman, K. 2011. *Sustainable enterprise architecture*, Boca Raton, Fla, CRC Press.
- Jahani, B., Javadein, S. & Jafari, H. 2010. Measurement of enterprise architecture readiness within organizations. *Business Strategy Series*, 11, 177-191.
- Joe, C., Yoong, P. & Patel, K. 2013. Knowledge loss when older experts leave knowledge-intensive organisations. *Journal of Knowledge Management*, 17, 913-927.
- Lech, P. 2014. Managing knowledge in IT projects: a framework for enterprise system implementation. *Journal of Knowledge Management*, 18, 551-573.
- Leedy, P. D. & Ormrod, J. E. 2014. *Practical Research: Planning and Design*, New Jersey, Pearson Education Limited.
- Lemmetti, J. & Pekkola, S. 2012. Understanding Enterprise Architecture: Perceptions by the Finnish Public Sector. In: SCHOLL, H. J., JANSSEN, M., WIMMER, M., MOE, C. & FLAK, L. (eds.) *Electronic Government: Proceedings of the 11th IFIP WG 8.5 International Conference*. Kristiansand, Norway.
- Liao, S. 2003. Knowledge management technologies and applications—literature review from 1995 to 2002. *Expert Systems with Applications*, 25, 155-164.
- Löhe, J. & Legner, C. 2014. Overcoming implementation challenges in enterprise architecture management: a design theory for architecture-driven IT Management (ADRIMA). *Information Systems and E-Business Management*, 12, 101-137.
- McGinnis, T. & Huang, Z. 2007. Rethinking ERP success: A new perspective from knowledge management and continuous improvement. *Information & Management Journal*, 44, 626-634.
- McNabb, D. & Barnowe, J. 2009. Trends Shaping Public Sector Transformation: Knowledge Management, E-Government and Enterprise Architecture. *Journal of Information & Knowledge Management*, 8, 25-34.
- Nonaka, I. & Takeuchi, H. 1995. *The Knowledge Creating Company*, Oxford University Press.
- Oztekin, A., Delen, D., Zaim, H., Turkyilmaz, A. & Zaim, S. 2015. The Influence of Knowledge Management on Financial and Non-Financial Performance. *Journal of Information & Knowledge Management*, 14, 1-14.
- Peng, J., Quan, J., Zhang, G. & Dubinsky, A. J. 2019. Knowledge Sharing From Employee's Perspective: Social Relationship, Contextual Performance, and IT Competence. In: HABIB, M. (ed.) *Handbook of Research on the Evolution of IT and the Rise of E-Society*. IGI Global.
- Pham, T., Pham, D. & Pham, A. 2013. *From business strategy to information technology roadmap: A practical guide for executives and board members*, Boca Raton, FL, CRC Press.
- Ross, J., Weill, P. & Robertson, D. 2006. *Enterprise architecture as strategy: creating a foundation for business execution*, Boston, Massachusetts, Harvard Business School.
- Rusly, F., Sun, P. & Corner, J. 2015. Change readiness: creating understanding and capability for the knowledge acquisition process. *Journal of Knowledge Management*, 19, 1204-1223.
- Schekkerman, J. 2004. *How to survive in the jungle of enterprise architecture frameworks: Creating or choosing an enterprise architecture framework*, Victoria, B.C, Trafford.
- Smuts, H. & Juleka, B. 2018. Enabling Business transformation through enterprise architecture and the knowing cycle. *International Journal of Engineering & Technology*, 7, 95-102.
- Syynimaa, N. 2015. *Enterprise Architecture Adoption Method for Higher Education Institutions*. Doctor of Philosophy Dissertation, Henley Business School University of Reading.
- Tamm, T., Seddon, P., Shanks, G., Reynolds, P. & Frampton, K. M. 2015. How an Australian Retailer Enabled Business Transformation Through Enterprise Architecture. *MIS Quarterly Executive*, 14, 181-193.
- Trinskjær, J. 2009. *Combining Enterprise Architecture and ERP Systems*. Doctoral dissertation, IT University of Copenhagen.
- Wang, M. & Yang, T. 2016. Investigating the success of knowledge management: An empirical study of small and medium-sized enterprises. *Asia Pacific Management Review*, 12, 79-91.
- WiBotzki, M., KOÇ, H., WEICHERT, T. & SANDKUHL, K. 2013. Development of an enterprise architecture management capability catalog. *International*

Conference on Business Informatics Research. Berlin Heidelberg: Springer.

Zhang, X. & Jiang, J. 2015. With whom shall I share my knowledge? A recipient perspective of knowledge sharing. *Journal of Knowledge Management*, 19, 277-295.

