Investigating the Practical Application of Enterprise Architecture Artifacts as an Instrument for Knowledge Management Systems

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Abstract

Reusability is a crucial consideration for Enterprise Architecture Artifacts and is widely discussed in the IS industry. However, limited articles explore their application in the broader domain to enhance the reusability of Enterprise Architecture Artifacts for organizational optimization. This paper synthesizes 13 common EA artifacts from 12 scholarly literature sources and investigates their potential as instruments for implementing a knowledge management system. The study uses McCampbell et al.'s (1999) Knowledge Management (KM) building blocks to support the analysis. Our research found that the chosen artifacts may be used to develop the knowledge management system. However, only a few EA artifacts are useful beyond the system design stage. Therefore, EA artifacts could be considered narrow-purpose knowledge management implementation instruments to achieve business-IT alignment.

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1. Introduction

Enterprise Architecture (EA) serves as a comprehensive blueprint for an organization's business and IT landscape, comprising multiple individual documents, known as EA artifacts, that define and model various aspects to assist the organization in attaining IT-business alignment, where reusability is the key to achieving a higher architecture maturity level (TOGAF®, 2018; Bernard, 2012).

Knowledge Management (KM) functions as a tool that facilitates the efficient creation, utilization, distribution, and transfer of knowledge within organizations. One manifestation of KM is the Knowledge Management System (KMS) (Moscoso-Zea et al., 2016), where implementation can be challenging, as it often lacks a structured approach and varies between companies. Hence, an effective KMS can provide the organization with a short-term competitive advantage (Wang & Wang, 2016).

Previous research has indicated that EA artifacts can be viewed as narrow-purpose knowledge management practices and using them might assist in achieving alignment and maximizing the artifacts' reusability (Buckl et al., 2010; Kotusev et al., 2023). However, only a few subsequent articles explore the practical application of EA. This study investigates the potential of 13 EA artifacts as implementation instruments for organizational knowledge management systems using the McCampbell et al. (1999) KM building blocks.

This paper is structured as follows: section 2 explores the paper's theoretical background. Section 3 examines the properties and characteristics of selected EA artifacts, investigates the KMS implementation procedure, and explores EA artifacts as tools for knowledge management system implementation in light of the literature review and findings. Section 4 concludes the paper by addressing the research question's answers, limitations, and further insight.

2. Literature Review

2.1. Background and Key Terms

This section explores key terms and the theoretical background.

2.1.1. EA and EA artifacts

Enterprise Architecture serves as a comprehensive visual representation encompassing an organization's business processes, information systems, and technology infrastructure management (Jonkers et al., 2006). It provides a holistic approach to facilitating IT-related decision-making and improves business and IT alignment (Kotusev et al., 2022).

In order to enhance the implementation of Enterprise Architecture, EA artifacts have been introduced. These artifacts consist of various diagrams, models, and documents that describe the current and future state of the organization and visually represent the relationships among different architectures (Kotusev et al., 2022; Lusa & Dana, 2011). The report selects 12 articles and synthesizes the most frequently mentioned EA artifacts in the literature, summarizing them in Table 1.

Table 1: Synthesis Matrix for Identified Common EA Artifacts

Dimension	EA Artifacts	Boost the potential of EA: Essential Practice Guo et.al, 2021	Enterprise Architecture as Enabler of Organizational Agility – A Municipality Case Study Carvalho et al, 2014	Enterprise architecture and enterprise architecture artifacts: Questioning the old concept in light of new findings Kotusev et al., 2023	The practical roles of enterprise architecture artifacts: A classification and relationship	Enterprise architecture artifacts as boundary objects: An empirical analysis' Kotusev et al., 2023	A decision-making support system for Enterprise Architecture Modelling Pérez-Castillo，2020	Agile enterprise architecture modelling: Evaluating the applicability and integration of six modelling standards Gill, 2014	Using enterprise architecture artefacts in an organisation, Niemi & Pekkola, 2015	TOGAF-based Enterprise Architecture Practice: An Exploratory Case Study. Kotusev, 2018	Use it or lose it? The role of pressure for use and utility of enterprise architecture artifacts. Bischoff et al, 2014	A hybrid method for evaluating enterprise architecture implementation. Nikpay et al. 2016	Empirical insights into the development of a service-oriented enterprise architecture. Alwadain et al, 2015	Total
Business Architecture	EA Documentation									✓			✓	2
	BPMN							✓		✓				2
	Business Capability Models			✓	✓	✓				✓				4
	Mission		✓											1
	Asset Register				✓									1
	Vision		✓		✓		✓					✓		4
	Strategy Goal		✓								✓			2
	Project Portfolios		✓						✓					2
	Principles/ standards			✓		✓			✓	✓	✓	✓	✓	7
	Guideline					✓								1
	Roadmaps / blueprint	✓		✓	✓	✓				✓	✓			6
	EA model	✓					✓		✓					3
	Landscape diagram			✓	✓	✓				✓	✓			5
	Management Policy		✓				✓		✓				✓	4
	Services		✓				✓							2
	Process (process model)		✓	✓	✓			✓			✓			5
	Target State / Business Continutiy / Maintance		✓						✓		✓	✓		4
Technology Architecture	IT infrastructure document / Technology reference model	✓		✓	✓	✓	✓	✓		✓				7
	Hardware Documentation		✓								✓		✓	3
	IT Roadmap			✓	✓								✓	3
	Software Documentation		✓	✓									✓	3
	IT principle			✓	✓					✓			✓	4
	IT Landscape diagram			✓	✓						✓			3
Data Architecture	Conceptual, Logical, and physical Data Model		✓	✓	✓	✓	✓				✓			6
Application Architecture	Application catalogue / Solution Design		✓	✓	✓	✓		✓	✓	✓		✓	✓	9
	Application Components		✓					✓			✓			3
	Application Services		✓					✓						2
	Application portfolio / Solution Overview			✓	✓	✓	✓		✓	✓				6

Based on the analysis, Table 2 lists the 13 common enterprise architecture artifacts identified in the literature.

Table 2: 13 Common EA Artifacts

Business Architecture	Application Architecture	Data Architecture	Technology Architecture
• Roadmaps/blueprint • Landscape diagram, • Process (process model) • Business Capability Models • Vision • Target State / Business Continuity / Maintenance • Services • Principle/standards	• Application Catalogue / Solution Design • Application Portfolio / Solution Overview	• Conceptual, Logical, and Physical Data Model	• IT infrastructure document / Technology reference model • IT principle

2.1.2 Knowledge Management and Knowledge Management System

Knowledge can be categorized into two types: tacit and explicit. Explicit knowledge is information that is documented or recorded physically or electronically, while tacit knowledge refers to knowledge that is based on professional experience and practice and is difficult to visualize and impart (Virkus, 2011; Nupap, 2022). Exploring tacit knowledge can lead to discovering new explicit knowledge, although the process can be complex.

During the transformation process, companies need to consider four critical factors, 'Knowledge', 'People', 'Processes' and 'Technology' (Ayinde et al., 2021). The knowledge being explored, and the transformation process, are unique to each company and are heavily influenced by factors such as company structure, culture, and strategic goals. The behavioural differences of tacit knowledge owners further complicate matters (Nieto & Díaz, 2021). Hence, success in conducting the process could contain a substantial and temporary competitive advantage for it (Santoro et al., 2018).

A Knowledge Management System (KMS) implements knowledge management practices. Most KMS encompass IT infrastructures, collaborative technologies, and ICT adoption (Santoro et al., 2018). Standard formats of KMS include knowledge repositories and maps (Wang & Wang, 2016). The success or failure of KM in organizations depends on their ability to identify the resources that enable organizations to recognize, create, transform, and disseminate knowledge (Ayinde et al., 2021). Organizations can create sustainable value and improve their performance in the marketplace by providing a structured format. Through effective integration and application of knowledge, companies can enhance their innovation capabilities, capitalize on opportunities more agilely, and achieve better alignment with their strategic objectives (Nupap, 2022; Huemer, 2022; Santoro et al., 2018).

2.1.3. EA (artifacts) and Knowledge Management Systems

Enterprise Architecture (EA) serves as a structured and comprehensive approach to strengthen decision-making and facilitate knowledge transfer within an organization by transforming tacit knowledge into explicit knowledge through knowledge management practices (Moscoso-Zea et al., 2016). EA ensures consistency and improves overall performance by aligning knowledge management with business goals. The objectives, approaches, and methodologies overlap substantially with knowledge management (Kotusev et al., 2022).

As reusable tools for the organization, Enterprise Architecture Artifacts have been identified as valuable resources in knowledge management implementation to achieve alignment (Buckl et al., 2010; Kotusev et al., 2023). One of the examples is Bitkowska's (2017) exploration of the usage of BPMN (Business Process Model and Notation) EA artifacts, a type of EA artifact that aims to model and visualize business processes (Salvadorinho & Teixeira, 2021), in knowledge management, which emphasizes that it could transform the implicit knowledge of employees' experience, specific knowledge, procedures and routines into explicit knowledge of flow charts. Different categories of EA artifacts correspond to distinct utilization scenarios, which may be related to the different characteristics of the tool and the codification or personalization of knowledge management strategies (Kotusev et al., 2021).

2.2. Research Gap

Buckl et al. (2010) advocated using EA artifacts to investigate knowledge management, as KM implementation remains challenging for the organization (Wu & Chen, 2014). Bitkowska (2017) applied the BPMN to it, and Kotusev et al. (2021) followed the research and applied the eight common EA artifacts to the KMS system. However, Kotusev also mentioned many artifacts whose properties and applications have yet to be explored. The research topic broadens the current understanding of EA artifacts' application. It investigates how to better assist with KM/KMS implementation through synthesizing common EA artifacts and examines how they could be applied in the KMS implementation by using the McCampbell et al. (1999) knowledge management building block. The research question could be formulated as follows:

'How can EA artifacts be used as instruments for knowledge management building block-based system implementation?'

3. Discussion

3.1. 13 EA artifacts format and reflected knowledge

This section examines the selected EA artifacts' knowledge. Table 3 provides concise descriptions and analysis of the informational content of the identified 13 prevalent EA artifacts from a knowledge perspective.

Table 3: Common EA artifacts format and reflected knowledge

EA artifacts	Brief Description	Reflected knowledge	Format
Business Architecture			
Roadmaps/ Blueprint	• Outlines the steps to achieve a specific goal or objective (Kotusev, 2017) • A blueprint is a detailed plan that outlines the design of a specific project, process or system (Labuscagne, 2020)	A clear view of initiatives can be applied to guide decisions and prioritize investments in IT planning, business processes optimization and product development (Kotusev, 2017). Blueprints provide a comprehensive view of the interactions and dependencies within each part of the organization. They prioritize investments and guide decisions to ensure alignment with business goals. Blueprints can be applied to IT architecture, project management, and business process management (Labuscagne, 2020).	**Explicit**
Landscape diagram	• A high-level view of an organization's IT landscape (Rosa, 2011).	This provides a comprehensive view of the IT environment, including applications, infrastructure, data and users, which helps identify opportunities for improvement and optimization. Landscape maps can be used to facilitate IT strategy development, investment planning, and project execution (Rosa, 2011).	**Explicit**
Process (process model)	• Document and visualize the flow of activities and tasks through a business process (Sivasubramanian, 2016).	Sivasubramanian (2016) describes process models that can document, analyze and improve business processes and uncover standardization, automation and optimization. These models find application in various areas such as business processes, project, and IT service management.	**Explicit**

Business Capability Models	• Describe the relationship and hierarchy between the various business capabilities in the organization (Chiu & Chen, 2016).	The Business Capability Model is used to identify critical capabilities necessary for achieving strategic goals and to guide resource allocation. It can support portfolio management, business strategy development, and enterprise transformation initiatives (Chiu & Chen, 2016).	**Explicit**
Vision	• Describes the long-term expectations and aspirations of the organization (Garfield, 2018).	Executives and leaders usually develop the Vision to provide direction and focus for investment decisions, strategic planning, and transformation initiatives. It helps align stakeholders' expectations, drive organizational change, and provide motivation (Garfield, 2018).	**Explicit and Tacit**
Target State / Business Continuity / Maintenance	• The desired state of being achieved in a future period (Wan et al., 2014) • The organization's ability to maintain business continuity in the event of an incident (Gomes et al., 2017) • Maintenance of the organization's infrastructure, systems and facilities (Hacks & Lichter, 2017)	Wan et al. (2014) state that Target State is used to identify the future goal the organization is working toward and to guide resource allocation and decision-making to achieve that goal. The target state helps maintain alignment with stakeholder interests, prioritize investments, and measure the process of developing strategic objectives. This is used to develop plans, procedures and strategies to ensure the continuity of essential developments and services and to maintain stakeholder confidence (Gomes et al., 2017). Maintenance is used to ensure that technology assets are kept in optimal condition and support the operational and strategic goals of the business. Maintenance activities can include corrective maintenance, preventive maintenance, adaptive maintenance, etc. and are critical to maximizing the value of the investment (Hacks & Lichter, 2017).	**Explicit and Tacit**
Services	• A separate unit of functionality is provided by an application (Brahmachary, 2018).	It specifies a service's dependencies, interactions with other components, and functional and non-functional requirements. It permits flexible and modular building, encouraging uniformity and reuse (Brahmachary, 2018).	**Explicit and Tacit**
Principle/ Standards	• The basis and guiding philosophy for the organization to develop strategies, decisions and practices (Malik, 2018) • A document or artifact that defines guidelines, requirements, and best practices for the enterprise architecture's particular aspects (Kotusev, 2017).	Principles can be employed to guide the architecture's creation, implementation, and maintenance, to ensure coherence and quality in the IT environment throughout the organization. A robust set of guiding principles can provide effective governance and clear guidance for decision-making (Malik, 2018). Standards, on the other hand, provide an official and documented approach to ensure consistency and compatibility across the organization. They facilitate adopting best practices and industry standards, promoting alignment with the organization's goals and objectives (Kotusev, 2017).	**Explicit and Tacit**

Application Architecture			
Application Catalogue / Solution Design	• A list or directory of applications in an enterprise or organization (Egbu & Botterill, 2003) • Define and design the architecture and configuration of software or technology solution features, to meet specific requirements (Kotusev, 2017)	The application catalogue enables efficient management and documentation of software applications and typically provides a more detailed view of specific applications. It can support various EA activities, including impact analysis and portfolio management (Egbu & Botterill, 2003). The solution design provides instructions on how the solution should be constructed and how it should work with the other elements of the architecture. It includes essential information such as data model, system requirements, data model, technology choices and implementation plan (Kotusev, 2017).	**Explicit**
Application Portfolio / Solution Overview	• A collection of applications in an organization (Daniels & Smits, 2006) • Broad overview of a specific solution or system being developed or implemented within the enterprise architecture (Kotusev, 2017)	The application portfolio offers a more comprehensive view of the company's software programmes, including its business capabilities and technical details (Daniels & Smits, 2006). The solution often outlines its goal and scope, commercial value, key requirements and constraints, stakeholders involved, etc. It may include a high-level architecture diagram and information about the solution's interfaces, data flows, and more (Kotusev, 2017).	**Explicit**
Data Architecture			
Conceptual, Logical, and Physical Data Model	• A simplified and conceptual view of the organization's architecture (Polovina & Von Rosing, 2018) • A more detailed and structured view of the organization's data assets and relationships (Polovina & Von Rosing, 2018) • Defines how data is stored, processed, and accessed in a specific technology environment (Polovina & Von Rosing, 2018)	Enterprise architecture's underlying principles are communicated and captured via a conceptual model, enabling individuals to understand and visualize the organization's structure (Polovina & Von Rosing, 2018). The logical model uses standard notation to specify entities, properties, and interactions between them. It bridges the high-level conceptual and more detailed physical models (Polovina & Von Rosing, 2018). The physical model provides implementation-specific information on data types, access techniques, security, and other technical factors. It facilitates mapping the logical model to physical storage structures, such as databases or file systems (Polovina & Von Rosing, 2018).	**Explicit**
Technology Architecture			
IT infrastructure document / Technology reference model (TRM)	• Documentation of IT system infrastructure, information, and configuration (Aviv et al., 2021) • A methodical approach to organizing and understanding various technologies in an information technology ecosystem (Kotusev, 2017).	This documents the current status of the IT infrastructure, including hardware, software, networks, and systems. Additionally, it provides details about the organization's IT policies, standards, and practices (Aviv et al., 2021). The TRM provides a comprehensive view of an organization's technological environment and serves as a manual for introducing new technologies. It typically includes a taxonomy of technology areas, such as networking, security, application development, and management, along with standards and guidelines for each area (Kotusev, 2017).	**Explicit**
IT principle	• Guidelines or rules that guide and regulate IT decisions and practices (Kotusev, 2017).	IT principles establish a framework for decision-making regarding selecting, implementing, and managing IT solutions. They ensure that an organization's IT investments align with its strategic objectives, operational procedures, and core values (Kotusev, 2017).	**Explicit and Tacit**

Table 3 demonstrates that the major EA artifacts reflect organizational knowledge pertaining to business and IT domains, facilitating knowledge exchange in Enterprise Architecture construction.

It should be noted that only explicit knowledge can be formally documented, making EA artifacts the primary source of detailed knowledge within the Enterprise Architecture structure, although they may contain some tacit knowledge (Davenport & Prusak, 1998).

3.2. KM(s) Implementation Roadmap

This section examines the KM implementation roadmap. The report utilizes the 14-step knowledge management building blocks proposed by McCampbell et al. (1999) as a foundation to systematically investigate the process of implementing KM(s).

Table 4: Implementation steps for a knowledge management strategy

	Brief Description	**Detail Procedure**
Pre- Construction / Knowledge Creation		
Step 1: Form a powerful coalition	Convince individuals that change is essential. The key is senior management support (McCampbell et al., 1999). Frequently that demands strong leadership and visible backing from the organization's key staff members (Kotter, 1997).	• Manage the organizational culture and manage change(s) (Sunassee & Sewry, 2002) • Create a vision for the KM initiative and provide a Leader (Sunassee & Sewry, 2002). • Align the KM effort with the business strategy (Sunassee & Sewry, 2002).
Step 2: Communicate vision of KM	Integrate the message into regular company operations (McCampbell et al., 1999).	• Determine the change's fundamental values, including the organization's future state. (Kotter, 1997). • Create a strategy to execute that vision (Kotter, 1997).
Step 3: Establish teams for needs assessment	Create a Needs Evaluation Team and Subteams (McCampbell et al., 1999).	• Team assembles
Step 4: Analyze the needs of KM	Conduct needs assessment (McCampbell et al., 1999).	• Perform a knowledge-based SWOT analysis. Sunassee & Sewry, 2002). • Plan & Design the KM project (set goals and objectives) (Sunassee & Sewry, 2002). • Identifying Content Portfolio (Chen, 2007) • Gap Analysis of Baseline and target business architectures
Construction / Knowledge Codification		
Step 5: Identify and collect knowledge	Determine implicit knowledge and gather explicit knowledge (McCampbell et al., 1999).	• Mobilizing knowledge • Knowledge Searching • Set knowledge management priorities • Selecting Content From Relevant (Chen, 2007) • Share personal tacit knowledge (Nupap, 2022)

		○ Convert tacit knowledge to explicit (Nupap, 2022)
Step 6: Design a technological structure to store knowledge.	Internal and external knowledge of the warehouse	• Creating Knowledge Source Catalogue (Chen, 2007) • Knowledge Capturing (Chen, 2007) • New Knowledge Discovery (Chen, 2007) • Mapping The Knowledge Network (Chen, 2007) • Knowledge Storing (Chen, 2007) • Knowledge distribution • Knowledge Organization / Categorizing (Chen, 2007) • Creating Knowledges Repository (Chen, 2007) • Indexing Knowledge Repositories (Chen, 2007) • Combine explicit knowledge systematically
Step 7: Test the technology	Run system test and conduct needs assessment update meeting	• System Test
Knowledge Transfer/ Testing Construction		
Step 8: Maintenance of the technology	Collect user reviews and update needs assessments from the meeting (McCampbell et al., 1999).	• Problem identification and motivation (Sarnikar & Deokar, 2017) • Problem objectives (Sarnikar & Deokar, 2017) • Design and development (Sarnikar & Deokar, 2017) • Demonstration (Sarnikar & Deokar, 2017) • Evaluation (Sarnikar & Deokar, 2017) • Communication of research (Sarnikar & Deokar, 2017)
Step 9: Retest the technology	Run system test	• Test each unit of a system (Nupap, 2022) • Integrate each unit and test the integration of a system (Nupap, 2022) • Test the whole system (Nupap, 2022) • Write and design documents: manual and system (Nupap, 2022)
Step 10: Training of knowledge workers	Conduct company-wide training programs on the use of knowledge management tools (McCampbell et al., 1999).	• Internal lectures and knowledge-sharing seminars (Abad-Segura & González-Zamar, 2021) • Regularly updating databases of good work practices and lessons learned (Abad-Segura & González-Zamar, 2021) • Preparing written documentation such as lessons learned, training manuals, good work practices, and articles for publication (Abad-Segura & González-Zamar, 2021) • Knowledge-sharing committees
Knowledge Application / Post Construction		
Step 11: Roll out use of knowledge management practices	Initiate the use of intranet-developed data repositories (McCampbell et al., 1999).	• Knowledge retrieving (Hsia et al., 2006) • Knowledge-based collaboration (Hsia et al., 2006) • Analytical application (Hsia et al., 2006) • Decision support (Hsia et al., 2006) • Developing knowledge maps (Hsia et al., 2006)
Step 12: Track usage	Generation of management report (McCampbell et al., 1999).	• Knowledge reservoir use frequency (Sarnikar & Deokar, 2017)

		• Recognition of knowledge contributors (Sarnikar & Deokar, 2017)
Step 13: Make systems go live	Initiate the use of external knowledge management data repositories (McCampbell et al., 1999).	• Presentations and discussions are organized by communities of practice (Sarnikar & Deokar, 2017).
Step 14: Measure quality and productivity.	Refine reporting techniques (McCampbell et al., 1999).	• Reduced process cycle time (Sarnikar & Deokar, 2017) • Peer evaluation ratings (Sarnikar & Deokar, 2017) • User feedback (Sarnikar & Deokar, 2017)

3.3 KM Implementation Realized by EA Artifacts

This section examines how selected EA artifacts can be adopted in the McCampbell et al. (1999) basis KM building blocks by exploring the relationship between the previous two discussion sections.

Step 1: Form A Powerful Coalition

'Vision' as an EA artifact aligns with the phase's requirements. Vision represents a standard view of the organization and its future by business and IT. It is designed to help achieve alignment between IT investments and long-term business outcomes (Kotusev, 2017). Forming a powerful coalition requires that the organization develop a vision for the knowledge management (KM) initiative. This crucial step helps persuade individuals that change is necessary (McCampbell et al., 1999). Therefore, Vision in this step can help communicate the importance of knowledge management and the need for change. It provides a framework to align KM with the organization's business strategy and guide decision-making, as strategic planning typically revolves around Vision's EA artifacts (Kotusev, 2019).

The development of a common vision developed by the Corporate Internal Audit department can be achieved by using the Vikobama method, which first develops an individual vision, then translates it into an individual organizational vision, and finally integrates it to create a shared organizational vision (Kaiser et al., 2021). This demonstrates the application of shared vision development in knowledge management to coordinate and guide the collective effort.

Step 2: Communicate Vision of KM

Communicate the Vision Of KM, request integration of the message into regular company operations, and create a strategy to execute that Vision (Kotter, 1997). The '**Roadmap'** is appropriate for this step, as it provides the significant steps that help the organization transform from the current baseline business architecture to the target business architecture from a high-level perspective of the current and desired business or IT capabilities in the respective domain (Kotusev et al., 2021). This can include identifying the necessary resources and timelines to ensure the successful implementation of the **'Vision',** which could help determine the change's fundamental values and incorporate the organization's future state (Kotter, 1997). For example, the study supports the application of the roadmap to knowledge management in government human capital management by including the roadmap in three standard aspects, namely people, process and technology, thus engaging the guiding principles of the ministries in government human capital management (Cahyaningsih et al., 2017). The roadmap integrates knowledge management implementation with organizational strategic plans and uses tools to measure readiness and identify gaps.

Simultaneously, the **'Roadmap/Blueprint'** outlines the strategy for implementing and communicating the KM vision to the stakeholders. This is because it can detail the key activities, milestones, and deliverables required to execute the Vision and provide a clear plan for how the KM initiative will be integrated with the company's regular operations.

Step 3: Establish Teams for Needs Assessment

The synthesis of EA artifacts in Section 2.1.1 primarily focuses on applying EA artifacts based on the team's existing setup. **Therefore, these artifacts may not apply to this step**. Additionally, Kamoun's (2013) description of EA mainly focuses on four aspects: business planning, business operations, process rationalization, and enabling IT infrastructure. All four categories are enterprise macro-operation and IT-related operation deployment, while the micro-enterprise behavior of team building does not consider EA architecture. Therefore, EA artifacts are not suitable for team assembly.

Step 4: Analyze the Needs of KM

The **'Business Capability Model'** provides a structured visual presentation depicting the relationships and hierarchies of all organizational business capabilities (Kotusev et al., 2021). Organizations can utilize this model to determine the knowledge-related needs of the organization, understand those needs, and identify business capability and content portfolio (Chen, 2007). For example, the Business Capability Model identifies various knowledge-related capabilities, such as creation, acquisition, organization, sharing, and application. These capabilities and content enable companies to generate insights, gather and structure information, facilitate collaboration, and apply knowledge to enhance all aspects of the business (Babatunde, 2020). Additionally, the model helps identify and assess an organization's knowledge-related capabilities, supporting knowledge-based SWOT analysis through a gap analysis of current and target state capabilities.

On the other hand, **'Roadmap'** provides a structured graphical view of all planned IT operations in a specific domain, typically including indications of both current and target states (Kotusev et al., 2021). This roadmap serves as a guide for planning and designing knowledge management projects, allowing organizations to identify gaps by comparing the **'Target State'** with the current state, which all contribute to the analysis needs of KM and KM strategic objectives. (Wan et al., 2014). For example, organizations like YTI use a living roadmap that undergoes regular updates. It acts as a framework for monitoring knowledge management projects. This document reflects the interrelationship between current work, works for the future and planned milestones and goals (Yeh, 2005). By considering both the current and target state, organizations can establish necessary actions to bridge the gaps, such as developing new technologies, establishing knowledge-sharing agreements, and conducting training programs (Smith & Farquhar, 2000). This analysis facilitates the refinement of the overall KM strategy while keeping the KM program aligned with the strategic goals.

Step 5: Identify and collect knowledge.

Two EA artifacts could help determine implicit knowledge and gather explicit knowledge.

The **'Process Model'** formalizes and standardizes software development or business processes, enabling data collection and information through Model Mapping. It provides a detailed view of these processes' activities, tasks, and workflows. By analyzing the Process Model, an organization can establish knowledge management priorities, share knowledge, and make tacit knowledge explicit. This analysis helps gather raw data and information about the organization's current KM practices and facilitates the retrieval of mechanical system design drawings (Levett & Guenov, 2000). It also assists in identifying business processes that generate or use knowledge. Sivasubramanian (2016) highlights that GDC's standard knowledge management processes are used within projects and organizations, including processes related to describing knowledge requirements, knowledge capture, and motivation techniques, are utilized within projects and organizations. Relevant software artifacts created in the project are identified and followed as a formal method for capturing documented knowledge. The explicit capture mechanisms include documents, presentations, spreadsheets, system designs in different languages, etc.

A **'Conceptual Data Model'** can help the organization develop descriptions that explain relevant data for prediction, pattern detection, exploration, or general data organization. It provides a framework for identifying and collecting knowledge in an organized and structured manner, facilitating the conversion of tacit knowledge into explicit knowledge (Abdelhedi et al., 2016). For example, conceptual data models can encompass data attributes related to hypotheses, experimental results, and research findings in a research and development setting. These models organize the explicit representation of this knowledge, enabling the organization to capture valuable insights and serve as a foundation for collaboration and learning among people within the organization (Mylopoulos, 2001).

Step 6: Design A Technological Structure to Store Knowledge

This step aims to design the knowledge management infrastructure. The **'IT Infrastructure Document'** can help identify the resources used to support the implementation of a knowledge management repository. The **'Application Catalogue/Solution Design'** is used to design a technological structure compatible with existing systems, ensuring seamless integration with the knowledge management repository. The **'Application Portfolio'** offers a more comprehensive view of the company's software programs (Daniels & Smits, 2006), providing a landscape for KM design. The **'Physical Model'** visually represents the IT infrastructure and can assist in creating a comprehensive system at the people level. These artifacts optimize the technological structure, ensuring that it meets the knowledge management requirements of the repository and that the structure and authority structures have been well governed, as systematically combining explicit knowledge is the key to a successful knowledge management infrastructure (Chen, 2007).

An example of implementing knowledge management at the National Taiwan Normal University is the use of e-portfolios which systematically gather and showcase students' learning objectives, processes, feedback, works, results, and other pertinent information, thereby organizing explicit knowledge throughout the process (Barrett & Garrett, 2009). According to the related research, e-portfolios significantly positively impact knowledge management compared to the knowledge management system without an application portfolio. MANCOVA analysis found that the experimental group surpassed the control group in overall knowledge management performance and in all five specific aspects. Additionally, using an Application Portfolio in the knowledge management system significantly impacts knowledge innovation, followed by knowledge accumulation (Chang et al., 2013).

Step 7: Test the Technology

EA artifacts can provide valuable insights into testing by offering information about relevant business processes and data flow. For instance, the **'Application Catalogue'** can identify potential integration issues and test the compatibility of knowledge management systems with existing applications and solutions. **'IT Infrastructure Documents'** can be used to identify the technical requirements and limitations of knowledge management systems and to evaluate the suitability of different technological solutions.

Furthermore, the knowledge management test model presented by Ong and Lai (2007) illustrates the application of IT infrastructure documents. In their study, the test model includes 147 TSMC, UMC, AU Optronics Corporation (AUO), and Macronix International (MXIC) respondents. It gathers information and creates IT infrastructure documents summarizing four companies' implemented knowledge management system (KMS) features. The IT infrastructure documents demonstrate aspects such as support for unstructured content and utilization of PIM integration. Moreover, the documents formed the foundation for testing and evaluating the structural validity of the existing system. Besides, Cronbach's alpha and scale purification iterative were employed to further assess user satisfaction with KMS.

However, as the above example illustrates, relying solely on EA artifacts is insufficient for evaluating technology. Testing requires specialized knowledge, skills, and tools, such as testing frameworks, test automation tools, and performance testing tools. These tools and techniques should be tailored to the specific aspects of the evaluated technology, such as software code, hardware components, network infrastructure, and security protocols (Quellmalz & Pellegrino, 2009). It is important to note that while EA primarily focuses on IT-business alignment, it is not designed to evaluate the technology itself (Kamoun, 2013).

Step 8: Maintenance of Technology

'Roadmaps' can provide a long-term perspective of the technology landscape by delineating the key initiatives, milestones, and dependencies necessary to maintain and improve the technology (Cahyaningsih et al., 2017). This guidance can assist in aligning KM maintenance efforts with the organization's strategic objectives. For example, the roadmap was employed in a knowledge management system for Indonesia's Jakarta Transnational Theological Seminary (STTLB). By dividing the implementation process into eight clear key points, the roadmap standardized the key responsibilities of different members in the pre-implementation, implementation, and post-implementation stages, ensuring a sustained and continuous utilization of the knowledge management system (Nainggolan, 2015).

'Landscape Diagrams' provide a high-level overview of an organization's IT landscape, facilitating the identification of potential KM maintenance issues and component dependencies (Rosa, 2011). **'Process Models'** contribute to documenting and analyzing maintenance processes and workflows. This can aid in identifying enhancement opportunities and ensure the efficiency and effectiveness of KM maintenance activities (Sivasubramanian, 2016). Process models have gained popularity among architects due to their remarkable effectiveness and versatility. For instance, process models can be utilized to evaluate and rate content within a knowledge management system, enhancing user search and selection experiences and improving content presentation (Poston & Speier, 2005).

Additionally, **'Process Models'** are valuable for establishing a collaborative product framework in design chains and facilitating knowledge sharing among design group activities in a distributed design environment. This improves process efficiency for individuals from diverse backgrounds (Xu, 2010). **'Business Capability Models'** help ensure that maintenance efforts align with the organization's strategic objectives and focus on the most critical business capabilities.

'Business Continuity' defines the desired state of KM technology and designates the necessary actions to reach it. **'Principles and standards'** are used to ensure that maintenance efforts are consistent and that best practices can assist in maintaining the technology efficiently, effectively, and securely (Espadinha-Cruz & Cabrita, 2018). **'Application catalogues and solution designs'** can ensure that maintenance efforts focus on the areas that require it most and that the organization's strategic objectives maintain the technology. **'IT infrastructure documents and technology reference models'** can help ensure that maintenance efforts focus on the areas that require it most.

Step 9: Retest the Technology
(See Step 7).

Step 10: Training of Knowledge Workers.

'Principles' such as creating a knowledge-sharing culture and enabling knowledge, guide the development and implementation of knowledge management initiatives in organizations. Organizations can value and leverage a culture of knowledge as a strategic asset to ensure that KM initiatives align with the organization's needs (Malik, 2018), thereby avoiding information isolation. For example, in the case of legal knowledge management training in Greece, the principle aims to re-educate public administrators and internal stakeholders, enabling them to join the digital process and create an environment conducive to modern legislation, better regulation and governance. To achieve this, the Greek government chose LEOS to provide e-learning technologies with open tools, open standards and mechanisms that enhance stakeholder participation dimensions. Moreover, LEOS is designed modularly, serving as a common legislative platform that supports multiple languages and can adapt and interact with various pre-installed systems in the organization, improving effective information communication (Fitsilis & Papastylianou, 2023). Hence, the selection of LEOS to host and train the knowledge management system aligns with the project's principles.

The **'Process Model'** can assist in identifying the knowledge worker training procedure. It outlines the steps to conduct company-wide training programs, organize internal lectures and knowledge-sharing seminars, update databases, create written documentation, and form knowledge-sharing committees. **Application Catalogues** list and describe the knowledge management tools used in the training programs, efficiently identifying and managing the different types of knowledge in an organization (Egbu & Botterill, 2003).

The **'IT infrastructure document'** helps identify and share knowledge about an organization's IT systems and processes, thereby improving its IT performance, reducing IT-related risks and enhancing the overall quality of IT services (Aviv et al., 2021). It ensures that the IT infrastructure required to support training is in place and aligns with the current version of the organization's IT infrastructure. This alignment ensures that all training practices are consistent with the organization's expectations.

Step 11: Roll out the use of KM practices.

Modifications can be characterized during a phased rollout to market testing, reducing market uncertainty (Pennings & Lint, 2000, p. 127). Organizations can adopt a phased approach in the rollout of knowledge management practices, utilizing EA artifacts as a formatted approach. For example, Sivasubramanian (2016) provides a rollout model based on the level of the key process areas, employing a phased approach that enhances effectiveness and project success.

A **'Landscape diagram'** offers a high-level view of the organization's IT landscape and demonstrates how the knowledge management rollout utilization fits into the overall landscape**,** which can help identify the current state of internal IT systems and technologies and integration points. Seamless integration of knowledge management practices into the existing landscape is crucial, allowing organizations to plan for smooth integration without disrupting existing processes.

An **'Application Catalogue'** is employed to define and design the architecture and configuration of software or technology solution features required for implementing knowledge management practices. It assists in developing useful knowledge maps during the rollout stages of KM practices. The catalogue helps identify and select the required software solutions, such as document management systems, collaboration platforms, knowledge bases, or other tools that facilitate knowledge sharing and retrieval. This also ensures that the selected tool meets the organization's knowledge management goals and requirements and facilitates integration with existing systems, ensuring interoperability and data exchange to establish a seamless knowledge management ecosystem.

'Services' as an EA artifact define the specific components and requirements of the knowledge management system. This is critical for facilitating digital transformation and innovation by supporting the integration of applications, exchanging data, and managing information (Brahmachary, 2018). Services provide a clear understanding of the system's target, aligning knowledge management systems with the usage patterns of workers, and making it easier for them to access the information they need. This ensures that the system is user-friendly and aligned with how employees' access and consume knowledge on a daily basis.

Step 12: Track Usage

Organizations can make data-driven decisions based on the report generated by integrating the '**Vision**' into usage tracking mechanisms (Kotusev, 2017). For example, organizations can evaluate the KM practice's effectiveness by capturing usage metrics and analyzing them against the defined Vision. **'IT Infrastructure Documents'** can provide guidelines for storing the data collected from usage tracking, such as usage patterns and the time employees spend in the systems. Proper data storage methods ensure that the collected data can be analyzed effectively, promoting efficient data management and accessibility (Nikiforova et al., 2022). Adhering to the guidelines in the IT infrastructure documents ensures accurate data collection and analysis in alignment with the organization's '**IT principles,** which emphasize aligning IT investments with strategic objectives, operational procedures, and core values (Kotusev, 2017). However, having IT principles in mind could ensure that data is collected and analyzed accurately. Management reports are reliable and trustworthy at this stage (Aviv et al., 2021), aligning with the business needs.

Organizations can gain insights into how employees engage with the KM systems by tracking usage and analyzing the collected data in conjunction with the abovementioned EA artifacts. This information can help identify improvement areas, assess the KM practices' impact on knowledge sharing and collaboration, and make informed decisions for optimizing KM initiatives. Regular monitoring and analysis of usage data help organizations measure the effectiveness of the implemented KM practices and identify opportunities for refinement and enhancement.

Step 13: Make Systems Go Live.

Making the KM system go live involves configuring the technology infrastructure based on the specifications provided in the IT Infrastructure Document. Organizations could use the **'IT Infrastructure Document', 'Application Catalogue',** and **'Application Portfolio'** to ensure the technology is properly configured and deployed. For example, the software applications identified in the Application Catalogue are deployed and integrated into the existing IT landscape, considering the dependencies and interconnections outlined in the Application Portfolio. It may also use the **'Roadmap'** to provide a clear plan and timeline for the implementation process, which guides the deployment process, ensuring tasks are executed per the defined plan and timeline.

Step 14: Measure Quality and Productivity

'Vision' can guide the measurement frameworks and methodologies aligned with the KMS. It provides a holistic, longitudinal perspective for clear understanding and improvement opportunities (Kotusev, 2017). The **'Target State'** can support continuous improvement of the KMS by identifying areas where the system can be improved to better align with the organization's goals and objectives. Organizations can develop measurement frameworks and methodologies that align with the Vision statement. They can define key performance indicators (KPIs) based on the Target State and business needs. These KPIs should be specific, measurable, and aligned with the goals of the KM system. Regularly measuring and analyzing the defined metrics enables organizations to assess the KM system's quality and productivity, identify improvement areas, and track progress over time. The **'Conceptual, Logical, and Physical Data Model'** can establish a baseline for quality and productivity by identifying the key data elements and relationships critical to KMS. It serves as a basis for future improvement and developing metrics of KMS. These measurements provide a basis for evaluating the impact of the KM system on knowledge sharing, collaboration, and innovation, enabling organizations to refine their approaches and optimize the benefits of knowledge management within the organization.

4. Conclusion

4.1. Answer to the Research Question

Our research has determined that all selected EA artifacts can be used to construct the KM building blocks proposed by McCampbell et al. (1999). However, it appears that when it comes to the testing stages and making the system go live, the applicability of EA artifacts is more restricted, as they mainly provide direction and are only partially suitable for these steps.

The most applied EA artifacts in KMS implementation are the Blueprint, Process Model, Vision, Application Catalogue and IT Infrastructure Document / Technology Reference Model, of which all artifacts have been applied in more than three steps (see Table. 4). They are primarily used for communication and knowledge exchange to ensure that the team within the enterprise shares a common understanding of the concepts and that the KMS projects and needs align with the business requirements They help ensure that the IT project/category meets the organization's fundamental needs and address implementation governance aspects. This is consistent with the enterprise application of EA artifacts during the EA construction objective.

However, EA artifacts play a limited role in the later stages of the KMS implementation, which can only be used to track the direction and ensure the KMS is on the right track. They could only partially express the function needs of the later implementation after the system design, which is difficult to use as a tool to track the actual usage.

Hence, as a narrow-purpose KMS implementation instrument, EA artifacts are more suitable for the earlier KMS implementation stage, focusing on ensuring the project aligns with the enterprise objective.

Table 5. 13 EA artifacts applied in the KMS Implementation.

	Roadmaps/ Blueprint	Landscape diagram	Process (process model)	Business Capability Models	Vision	Target State / Business Continuity / Maintenance	Services	Principle/standards	Application catalogue / Solution Design	Application Portfolio / Solution Overview	Conceptual, Logical, and Physical Data Model	IT infrastructure document / Technology reference model	IT principle	Total
Step 1: Form Powerful Coalition					✓									1
Step 2: Communicate Vision Of KM	✓													1
Step 3: Establish Teams For Needs Assessment														0
Step 4: Analyse The Needs Of KM	✓			✓		✓								3
Step 5: Identify and collect knowledge.			✓								✓			2
Step 6: Design A Technological Structure To Store Knowledge.									✓	✓		✓		4
Step 7: Test The Technology									✓			✓		2
Step 8: Maintenance of the technology	✓	✓	✓	✓		✓		✓	✓			✓		8
Step 9: Retest the technology														0
Step 10: Traning of knowledge workers			✓						✓			✓	✓	4
Step 11: Roll-out use of knowledge management practices		✓			✓		✓					✓	✓	5
Step 12: Track usage					✓							✓	✓	3
Step 13: Make the system go live	✓								✓	✓		✓		4
Step 14: Measure quality and productivity.					✓	✓					✓			3
Total	4	2	3	2	3	3	1	1	5	2	2	7	3	

4.2. Limitations

The research is subject to certain limitations. Firstly, it is important to note that the KMS framework is highly customized and undergoes continuous change, so the research does not provide a standardized procedure for constructing KMS that can be universally applied to all organizations. Therefore, the research findings may not fully represent the actual process of how corporations construct their KMS.

Furthermore, the report does not address the success rate of converting tacit knowledge into explicit knowledge. The model presented in the research focuses primarily on knowledge acquisition and communication rather than preparing knowledge in advance. This aspect should be taken into consideration when implementing a KMS.

Moreover, while the research explores new directions for constructing KMS applications, it should not be used as a direct guide without further evaluation. The study provides a theoretical discussion of the process overview of KMS applications. It lacks clear case studies to support its feasibility. Therefore, caution should be exercised when applying the research findings in practice.

4.3. Recommendation

This study investigates the relationship between Enterprise Architecture (EA) artifacts and Knowledge Management Systems (KMS). It explores the potential use of 13 commonly mentioned EA artifacts as instruments for implementing KMS based on the framework proposed by McCampbell et al. (1999). These EA artifacts represent both business and IT expertise.

Based on the findings, we recommend that organizations consider incorporating EA artifacts into their KM implementation process. This can ensure that the project is aligned with the overall enterprise objectives and can effectively integrate with other enterprise components.

For future research, it would be valuable to synthesize the standard steps for KMS implementation, considering additional influential factors such as the quality of tacit knowledge, the effectiveness of the transformation process, and the willingness and ability of individuals to share their knowledge. Moreover, conducting case studies to test the feasibility and effectiveness of the research findings would provide practical insights and further validate the proposed framework.

5. References

Abad-Segura, E., & González-Zamar, M.-D. (2021). Knowledge management in higher education institutions. *Enhancing Academic Research and Higher Education With Knowledge Management Principles.* 79–98.

Abdelhedi, F., Ait Brahim, A., Atigui, F., & Zurfluh, G. (2016). Big Data and Knowledge Management: How to Implement Conceptual Models in NoSQL Systems? *Proceedings of the 8th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management*.

Aviv, I., Hadar, I., & Levy, M. (2021). Knowledge Management Infrastructure Framework for Enhancing Knowledge-Intensive Business Processes. *Sustainability*, *13*(20), 11387.

Ayinde, L., Orekoya, I. O., Adepeju, Q. A., & Shomoye, A. M. (2021). Knowledge audit as an important tool in organizational management: A Review of Literature. *Business Information Review, 38*(2), 89–102.

Babatunde, O. A. (2020). Knowledge Acquisition Capability, Strategic Response Capability, And Organizational Performance: A Mediation Analysis. *Business Excellence and Management*, *10*(3), 47–60.

Barrett, H. C., & Garrett, N. (2009). Online personal learning environments: structuring electronic portfolios for lifelong and life-wide learning. *On the Horizon*, 17(2), 142-152.

Bernard, S. A. (2012). *An introduction to enterprise architecture.* AuthorHouse.

Bitkowska, A. (2017). Business processes modelling in knowledge management perspective. *Przedsiębiorstwo we współczesnej gospodarce–teoria i praktyka*, *21*(2), 7-16.

Brahmachary, A. (2018). *Service Knowledge Management System (SKMS) | ITIL Foundation | ITSM.* CertGuidance.

Buckl, S., Matthes, F., & Schweda, C. M. (2010). Future research topics in enterprise architecture management – A knowledge management perspective. *Service-Oriented Computing. ICSOC/ServiceWave 2009 Workshops*, 1–11.

Cahyaningsih, E., Sensuse, D. I., & Noprisson, H. (2017). Multi methods for knowledge management strategy roadmap of government human capital management. *Procedia Computer Scienc*e, 124, 496-503.

Chang, C.-C., Tseng, K.-H., Liang, C., & Chen, T.-Y. (2013). Using e-portfolios to facilitate university students' knowledge management performance: E-portfolio vs. non-portfolio. *Computers & Education*, 69, 216-224.

Chen, W. (2007). A Framework for Designing Nursing Knowledge Management System and the Application to Pediatric Nursing *[NSYSU].*

Chiu, C.-N., & Chen, H.-H. (2016). The study of knowledge management capability and organizational effectiveness in Taiwanese public utility: the mediator role of organizational commitment. *SpringerPlus, 5*(1).

Daniels, H. (2015). Portfolio Optimization as a Tool for Knowledge Management. *www.academia.edu*.

Davenport, H. T., & Prusak, L. (1998). Working Knowledge: How Organisations Manage What They Know. *Choice Reviews Online, 35*(09).

Egbu, C. O., & Botterill, K. (2003). Information technologies for knowledge management: their usage and effectiveness. *Journal of Information Technology in Construction (ITcon)*, 7(8), 125-137.

Espadinha-Cruz, P., & do Rosário Cabrita, M. (2018, September). Integrating knowledge management and business interoperability: a scenario framework. In *European Conference on Knowledge Management* (pp. 242-XVIII). Academic Conferences International Limited.

Fitsilis, F., & Papastylianou, A. (2023). Training of Greek Public Administrators in Legal Knowledge Management by Using the Legislation Editing Open Software (LEOS). *Journal of the Knowledge Economy*, 1-14.

Garfield, S. (2018*). Knowledge Management Visions. medium.*

Gomes, P., Cadete, G., & Da Silva, M. M. (2017). Using Enterprise Architecture to Assist Business Continuity Planning in Large Public Organisations. *2017 IEEE 19th Conference on Business Informatics (CBI)*.

Hacks, S., & Lichter, H. (2017). *Qualitative Comparison of Enterprise Architecture Model Maintenance Processes* (p. 1).

Hsia, T.-L., Lin, L.-M., Wu, J.-H., & Tsai, H.-T. (2006). A framework for designing Nursing Knowledge Management Systems. *Interdisciplinary Journal of Information, Knowledge, and Management*, *1*, 013–022.

Huemer, M. (2022). *Understanding knowledge.* Michael Huemer.

Jonkers, H., Lankhorst, M.M., ter Doest, H.W.L. et al. Enterprise architecture: Management tool and blueprint for the organization. *Inf Syst Front 8*, 63–66 (2006).

Kaiser, A., Fahrenbach, F., & Martinez, H. (2021). Creating Shared Visions in Organizations – Taking an Organizational Learning and Knowledge Management Perspective. *Proceedings of the Annual Hawaii International Conference on System Sciences.*

Kamoun, F. A. O. U. Z. I. (2013). Rethinking the role of enterprise architecture during times of economic downturn: a dynamic capabilities approach. *Journal of Information Technology Management, 24*(1), 26.
Kotter, J. P. (1997). Leading change: A conversation with John P. Kotter. *Strategy & Leadership, 25*(1), 18–23.
Kotusev, S., Kurnia, S., & Dilnutt, R. (2021). Enterprise architecture artefacts as instruments for knowledge management: a theoretical interpretation. *Knowledge Management Research & Practice*, 1–13.
Kotusev, S., Kurnia, S., & Dilnutt, R. (2023). Enterprise architecture artefacts as boundary objects: An empirical analysis. *Information and Software Technology*, *155*, 107108.
Kotusev, S., Kurnia, S., Dilnutt, R. (2022).The practical roles of enterprise architecture artefacts: A classification and relationship. *Information and Software Technology*.
Kotusev, S. (2017). Eight Essential Enterprise Architecture Artefacts. *British Computer Society (BCS).*
Kotusev, S. (2017). The Relationship Between Enterprise Architecture Artefacts. *British Computer Society (BCS).*
Kotusev, S. (2018). TOGAF-based enterprise architecture practice: an exploratory case study. *Communications of the association for information systems, 43*(1), 20.
Kotusev, S. (2019). The Process View of Enterprise Architecture Practice. British Computer Society (BCS).
Labuscagne, C. W. (2020). Knowledge forms in the project lifecycle: A blueprint for knowledge management in small creative agencies in Johannesburg. *SA Journal of Information Management, 22*(1).
Levett, G. P., & Guenov, M. D. (2000, September 1). A methodology for knowledge management implementation. J*ournal of Knowledge Management.*
Lusa, S., & Dana, S. (2011). Enterprise architecture model for implementating knowledge management system (KMS). *International Conference on Information and Communication Technology Convergence.*
Malik, H. B. (2018). The principles of knowledge management. *Curtinedu*.
McCampbell, A. S., Clare, L. M., & Gitters, S. H. (1999). Knowledge management: The New Challenge for the 21st Century. *Journal of Knowledge Management*, *3*(3), 172–179.
Moscoso-Zea, O., Luján-Mora, S., Cáceres, C. E., & Schweimanns, N. (2016). Knowledge Management Framework Using Enterprise Architecture and Business Intelligence. *Proceedings of the 18th International Conference on Enterprise Information Systems*.
Mylopoulos, M. (2001). Conceptual models for knowledge management, an empirical study using Knowledge Forum
Nainggolan, E. R. (2015). Membangun Knowledge Management System untuk Membentuk Knowledge Sharing Menggunakan Metode KM-Roadmap. *Jurnal Pilar Nusa Mandiri*, 11(1), 60-69.
Nieto, E. S. D., & Díaz, E. S. P. (2021). Model of Processes and Knowledge Management to Increase Competitiveness. In *Knowledge Management and Sustainability* (pp. 132-151). Routledge.
Nikiforova, O., Kornienko, J., Zabiniako, V., Volodko, I., Garkalns, P., & Rizhko, R. (2022). Definition of Metrics for Work Efficiency Monitoring Based on Multi-System Usage Behaviour Analysis. *2022 17th Iberian Conference on Information Systems and Technologies (CISTI),*
Nupap, S. (2022). Knowledge management system by applying knowledge-creating company: Transforming tacit to explicit knowledge. *2022 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering (ECTI DAMT & NCON).*
Ong, C.-S., & Lai, J.-Y. (2007). Measuring user satisfaction with knowledge management systems: scale development, purification, and initial test. *Computers in Human behaviour*, 23(3), 1329-1346.
Pennings, E., & Lint, O. (2000). Market entry, phased rollout or abandonment? A real option approach. *European Journal of Operational Research*, 124(1), 125-138.
Polovina, S., & von Rosing, M. (2018). Using Conceptual Structures in Enterprise Architecture to Develop a New Way of Thinking and Working for Organisations. *Graph-Based Representation and Reasoning,* 176–190.
Poston, R. S., & Speier, C. (2005). Effective use of knowledge management systems: A process model of content ratings and credibility indicators. *MIS Quarterly,* 221-244.
Quellmalz, E. S., & Pellegrino, J. W. (2009). Technology and testing. *Science, 323*(5910), 75–79.
Rosa, D. L. (2011). The observed landscape: map of visible landscape values in the province of Enna (Italy). *Journal of Maps, 7(*1), 291–303.
Salvadorinho, J., & Teixeira, L.(2021). organizational knowledge in the I4.0 using BPMN: a case study. *Procedia Computer Science,* 981-988.
Santoro, G., Vrontis, D., Thrassou, A., & Dezi, L. (2018). The Internet of Things: Building a knowledge management system for open innovation and Knowledge Management Capacity. *Technological Forecasting and Social Change, 136*, 347–354.

Sarnikar, S., & Deokar, A. V. (2017). A design approach for process-based knowledge management systems. *Journal of Knowledge Management*, *21*(4), 693–717.

Sivasubramanian, S. (2016). Process Model for Knowledge Management https://www.lti.cs.cmu.edu/sites/default/files/Process%20Model%20for%20Knowledge%20Management.pdf

Smith, R. G., & Farquhar, A. (2000). The road ahead for knowledge management: an AI perspective. *AI magazine*, 21(4), 17-17.

Sunassee, N. N., & Sewry, D. A. (2002). A theoretical framework for knowledge management implementation. In *Proceedings of the 2002 annual research conference of the South African Institute of computer scientists and information technologists on Enablement through technology* (pp. 235-245)

The TOGAF® standard, version 9.2. (2018). The Open Group. https://pubs.opengroup.org/architecture/togaf9-doc/arch/

Virkus, S. (2011). Framework for Knowledge Management Tools and Projects. *Knowledge Management Solutions: Knowledge Management Systems.*

Wan, S., Evans, R., Gao, J., & Li, D. (2014). Knowledge Management for Maintenance, Repair and Service of Manufacturing System.

Wang, Y.-M., & Wang, Y.-C. (2016). Determinants of Firms' Knowledge Management System Implementation: An Empirical Study. *Computers in Human Behavior, 64*, 829–842.

Wu, L., & Chen, J.-L. (2014). Knowledge management driven firm performance: the roles of business process capabilities and organizational learning. *Journal of Knowledge Management.*

Xu, H. (2010). A process model of collaborative product design based on design chain and knowledge management. *2010 International Conference on Logistics Systems and Intelligent Management (ICLSIM).*

Yeh, Y. M. C. (2005). The implementation of knowledge management system in Taiwans higher education. *Journal of College Teaching & Learning* (TLC), 2(9).