



Designing an Enterprise Architecture for an Electronic Football Match Ticket Sales Information System at Kanjuruhan Stadium Using The Zachman Framework

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Abstract

This research aims to design an enterprise architecture for an electronic football match ticket sales information system at Kanjuruhan Stadium using the Zachman framework. A qualitative method with a case study approach at Kanjuruhan Stadium was employed. Data collection techniques included in-depth interviews with prospective users (spectators) and stadium management staff, observations of existing processes, and a review of operational documentation. The collected data were thematically analyzed to identify the needs, perceptions, constraints, and expectations of stakeholders. The findings reveal various challenges in the existing manual processes, such as long queues and potential ticket security issues. Qualitative analysis indicates a profound need for a system that is easily accessible, informative, secure, and supported by responsive services, all contributing to an enhanced user experience. Based on this in-depth understanding from the qualitative findings, the design of the information system architecture using the Zachman Framework facilitates a structured mapping of needs and solutions from conceptual to implementational levels. The implications of this research suggest that the Zachman Framework, informed by in-depth qualitative analysis, can be a strategic approach for developing information systems in large-scale institutions, particularly in supporting the digitalization of public services in the sports sector.

Keyword: Zachman Framework, Enterprise Architecture, Information System, Electronic Ticket Sales, Kanjuruhan Stadium, Qualitative Research

1. Introduction

General Phenomenon of Research Variables

In the current digital era, the utilization of information technology has become a critical aspect in supporting the effectiveness and efficiency of various services, including in the sports sector. A tangible implementation of digital transformation is the adoption of information systems to support electronic ticket sales processes. Such systems not only simplify the purchasing process for users but also assist organizers in managing spectator data, minimizing the risk of counterfeit tickets, and enhancing security and comfort during matches. However, many stadiums in Indonesia have not yet optimally implemented electronic ticket sales information systems. Issues encountered include long queues during ticket purchases, lack of control over ticket distribution, and limitations in reporting and analyzing visitor data. Based on these phenomena and needs, this research focuses on designing an enterprise architecture for an electronic football match ticket sales information system at Kanjuruhan Stadium using the Zachman Framework. This study is expected to contribute to the development of integrated information systems and support digital transformation in public services within the sports domain.

II. Problem Approach (Gap Analysis)

To address these challenges, the application of information technology offers ease of access, reduced operational costs, improved security, and enhanced data analysis capabilities (Alonso-Dos-Santos et al., 2021). Nevertheless, the development of complex information systems, such as e-ticketing, requires meticulous planning to align with business objectives and the needs of all stakeholders. According to Surendro (2009), failures in information system development are often due to a lack of comprehensive architectural planning. Without an enterprise architecture blueprint, developed systems may become unintegrated, redundant, and difficult to manage in the long-term (Lankhorst, 2017). This is supported by Pratama et al. (2020), who emphasize the importance of enterprise architecture in ensuring alignment between business strategy and information technology. The current gap is the absence of a specific enterprise architecture model for the e-ticketing system for football matches at Kanjuruhan Stadium that can guide comprehensive system development, coupled with a lack of in-depth understanding—to be explored through a qualitative approach—of the success factors for such an information system's implementation from the perspectives of users and management.

III. Research Objectives

This research aims to:



- Identify the functional and non-functional requirements of an electronic ticket sales system from the perspectives of users (spectators) and Kanjuruhan Stadium management staff through qualitative data analysis of in-depth interviews and observations.
- Analyze the operational constraints experienced by staff and the in-depth perceptions of users regarding the existing ticket sales system or manual processes at Kanjuruhan Stadium, based on qualitative findings.
- Design an enterprise architecture for the electronic football match ticket sales information system at Kanjuruhan Stadium using the Zachman Framework, with primary input from the interpretation of qualitative data regarding the needs, preferences, and perceptions of users and management.
 - a. Produce an enterprise architecture blueprint that can serve as a guide for the development and implementation of an effective, efficient, secure, user-oriented e-ticketing system that supports operational efficiency, based on mapping qualitative findings to the cells of the Zachman Framework.

IV. Systematics of Article Writing

This article is structured as follows: The Introduction outlines the background, problem approach, research objectives, and systematics. The Literature Review discusses relevant theories and previous research, including the relevance of the DeLone and McLean Model as a conceptual guide. The Research Method section explains the qualitative approach, data collection techniques (interviews and observations), and thematic data analysis. The Results and Discussion section presents the main qualitative findings, data interpretation, and the application of the Zachman framework. Finally, the Conclusion summarizes the qualitative insights and provides implications and suggestions.

2. The Art of Research

Sound research is built upon a solid theoretical foundation and a thorough understanding of previous works. This literature review aims to explore the core concepts underpinning the research, namely Enterprise Architecture, the Zachman Framework, and the DeLone and McLean Information System Success Model as a conceptual framework for qualitatively understanding user need dimensions, as well as the context of its application to e-ticketing systems for sports events.

1. Enterprise Architecture

Enterprise architecture is a systematic approach to designing and managing the structure, processes, information, and technology within an organization to align with business objectives (Sessions, 2007). In the context of large-scale event venues such as stadiums, enterprise architecture helps simplify operational complexity, enhance security, and improve service efficiency. Lankhorst (2017) emphasizes that this architecture is crucial for ensuring integration between business needs and information technology systems.

2. Zachman Framework

The Zachman Framework was introduced by John A. Zachman in 1987 as a conceptual framework for designing information systems architecture in organizations. This framework consists of a matrix of 6 rows (perspectives: Planner, Owner, Designer, Builder, Subcontractor, and User/System in Operation) and 6 columns (interrogatives: What, How, Where, Who, When, Why) that explain the elements of architecture from various viewpoints (Zachman, 1987). This framework is non-linear and flexible, allowing its use for organizations of various scales. Research by Saepudin, S., Pudarwati, E., Warman, C., Sihabudin, S., & Giri, G. (2022) demonstrated that the Zachman Framework can effectively structure an online tour ticket booking system.

3. DeLone and McLean Information System Success Model as a Conceptual Guide

The DeLone and McLean Information System (IS) Success Model, originally proposed in 1992 and notably updated in 2003 (DeLone & McLean, 1992; DeLone & McLean, 2003), is a widely recognized framework for understanding and measuring IS success. While this study does not employ quantitative measurement via questionnaires, the dimensions articulated in the updated 2003 model—specifically System Quality, Information Quality, Service Quality, Use, User Satisfaction, and Net Benefits (DeLone & McLean, 2003)—provide a valuable conceptual guide for formulating interview questions and directing qualitative analysis. The aim is to gain an in-depth understanding of user perceptions and expectations regarding these critical aspects in the context of an e-ticketing system.

4. E-ticketing in the Sports Industry

The sports industry is increasingly adopting digital solutions for ticketing to enhance fan experience, improve operational efficiency, and increase security. Research by Rinaldi, D. (2021) on designing a web-based ticket ordering and spectator management system highlights the benefits of reducing queues and facilitating ticket purchases. Budiana, A. (2022) also explored enterprise architecture for an electronic train ticket system, which shares common principles with sports e-ticketing.

5. The Art of Research in System Design

This literature review also refers to "The Art of Research" approach, which is how researchers not only rely on logic and data, but also creativity, context sensitivity, and synthesis ability in developing a framework. According to Gray and Malins (2004), effective research in the field of design and information systems requires a deep understanding of user needs and contextual interpretation of the theory used.

3. Method

This research used a qualitative descriptive approach with the aim of describing the application of the Zachman Framework in designing enterprise architecture in a football stadium, namely Kanjuruhan Stadium. This approach was chosen because it allows researchers to explore in depth the process and context of designing information systems in a specific business environment.

1. Type of Research

This study employed a descriptive qualitative research method with a case study approach. This approach was chosen as it allows the researcher to deeply explore the processes, context, and perceptions of stakeholders regarding the design of an electronic ticket sales information system within the specific environment of Kanjuruhan Stadium. The primary focus of the research is to holistically understand the needs and expectations that will inform the architectural design.

2. Data Collection Techniques

Data for this study were collected through several qualitative methods:

- In-depth Interviews: Semi-structured interviews were conducted with several key informants selected through purposive sampling. Informants included representative prospective users (regular spectators), stadium operational management staff, and relevant management personnel. An interview guide was developed to explore perceptions of current manual processes, needs for an electronic system, expectations regarding features, ease of use, security, and desired information and service quality (conceptually guided by the dimensions of the DeLone & McLean IS Success Model, 2003).
- Direct Observation: The researcher conducted participant or non-participant observation during manual ticket sales processes (if still occurring) or spectator entry flows to directly understand constraints, interactions, and the relevant physical environment.
- Document Study: Relevant documents such as existing operational procedures (if any), previous user complaints or feedback, and stadium facility development plans were analyzed.

3. Data Analysis Techniques

Qualitative data collected (interview transcripts, field notes from observations, and document summaries) were analyzed using thematic analysis. The analysis process involved several stages:

- 1) Data familiarization: Reading and understanding the entire dataset.
- 2) Initial coding: Identifying relevant data segments and assigning codes.
- 3) Theme searching: Grouping similar codes into potential themes.
- 4) Theme review: Validating and refining the identified themes.
- 5) Theme definition and naming: Providing clear definitions for each main theme.
- 6) Report generation: Presenting thematic findings supported by data excerpts.

4. Development Framework

The development framework refers to the Zachman Framework, which has six perspectives (Planner, Owner, Designer, Builder, Sub-Contractor, and User) and six main focuses (What, How, Where, Who, When, and Why). Each perspective and focus in this framework is explained contextually. The results of thematic analysis of qualitative data serve as the main input to define the elements in each cell of the Zachman Framework, ensuring that the architectural design is rooted in a deep understanding of user needs and context. This framework can be utilized to facilitate a structured mapping of all needs and processes related to electronic ticketing at Kanjuruhan Stadium.

4. Result

a. Object of Research

The main object of this research includes the process and needs related to the electronic ticket sales information system for football matches at Kanjuruhan Stadium, Malang Regency, which are explored from the perspective of key stakeholders. This system is an important part of match operations because it handles ticket purchases, data recording, and entry validation.

b. Main Qualitative Findings

Based on in-depth interviews, observations, and document studies, several key themes were identified that describe the needs, constraints, and expectations related to the ticket sales system at Kanjuruhan Stadium.:

- Theme 1: Frustration with Complicated and Uncertain Manual Processes. Many prospective viewers expressed complaints about long queues, uncertainty about ticket availability, and the risk of scalpers. One respondent stated, "Tired of queuing for hours, not necessarily getting tickets; sometimes they are sold out or scalpers increase the price." Staff also experienced high workloads during manual sales.



- Theme 2: High Expectations for Ease of Access and Transparency of Information through Electronic Systems. There is a strong desire for a system that can be accessed anytime and anywhere (mobile friendly). Real-time information on schedules, prices, and seat availability is highly anticipated. One potential user said, "It would be nice to be able to buy from home, see which seats are available, and pay easily."
- Theme 3: Priority on Transaction Security and Ticket Validity. Concerns about online payment fraud and fake e-tickets are top concerns. Users expect a trustworthy payment system and a secure ticket validation mechanism (e.g., a unique QR code) at the entrance. "The most important thing is secure payment and genuine tickets, so we don't pay and then can't get in," said an informant.
- Theme 4: Need for Responsive Customer Support and Service. While users expect an intuitive system, they are also aware of the potential for technical issues. Therefore, an easily accessible and responsive support channel is considered important. Management staff also require support for any operational system issues.
- Theme 5: Potential Benefits Beyond Ticket Sales. Management sees the potential of the e-ticketing system for better audience data collection, which can be used for future analysis and service improvement, as well as supporting security aspects.

The characteristics of research objects supported by these qualitative findings include:

- Type of service: Sales of football match tickets, with high expectations for the transition to a comprehensive electronic system.
- User Volume: The perception of a large user volume, averaging 10,000 to 20,000 spectators per match, reinforces the urgency of an efficient system.

c. Explanation of the Framework (Zachman Framework) Based on Qualitative Findings

The main framework used for designing enterprise architecture in this study is the Zachman Framework. Input for each cell in the Zachman Framework comes from the interpretation and synthesis of identified qualitative themes. The framework is filled in as shown in Table 1, and the perspectives are further elaborated below by answering the 5W1H.

Table 1: Zachman Framework for Kanjuruhan Stadium E-Ticketing System

Perspective	What (Data)	How (Function/ Process)	Where (Network/ Location)	Who (Person/ Role)	When (Time/ Event)	Why (Motivation/Goal)
Planner (Scope)	Scope of e-ticketing, Stakeholders (Fans, Mgn)	High-level goals (Fan Experience↑, Efficiency↑, Security↑)	Kanjuruhan Stadium, Online Platform	Mgn Stadium, Organizer, Fan Representative	Match schedule, Sales period, Event cycle	Overcoming manual process frustrations, Meeting digital expectations
Owner (Business Model)	Entities (Tickets, Matches, Users, Payments)	Key processes (Purchase, Validation, Info Dissemination))	Online portal/application, Stadium entrance, Back-office	Ticket staff, IT Admin, Security, Fans	Pre-match sales, D-day operations, Post-match reporting	Simplify operations, Secure transactions, Reliable information
Designer (System Model)	Logical data model (ERD), DFD	System functions (Authentication, Seat logic, QR generation)	System functions (Authentication, Seat logic, QR generation)	Systems Analyst, UI/UX Designer	System event triggers, Transaction processing time	Ensuring usability, integrity, security, performance based on user needs
Builder (Technology Model)	DB Schema, Data format (JSON)	Software modules (Frontend, Backend API))	Server specifications, Cloud infrastructure, Scanner	Developer (FE, BE, DB), Engineer QA	Implementation schedule, Batch processing, Backup	Translating designs into functional, reliable, scalable systems
Sub-Contractor (Detailed Representation)	Data field definition, Validation rules	Component specifications, API endpoints, Algorithms	Network configuration, Security protocols (SSL)	Specialist Developer, Security Expert	Component interaction time, API call sequence	Ensure components are built & integrated correctly
User (End User)	Live transaction data, Real-time availability	System operates (User purchases, Staff validates)	User device, Stadium scanner, Live server	End users (Fans), Operational staff	Real-time interaction, D-day validation	Meet user needs, Enable efficient stadium operations

- **Planner Perspective (Scope/Contextual):** This perspective sets the stage by defining the project boundaries and strategic intent.
 - **What:** Identify the broad scope of the e-ticketing system and the key stakeholders involved, such as fans, stadium management and event organizers.
 - **How:** Outlines the high-level operational objectives, primarily to enhance the fan experience, improve operational efficiency, and enhance security.
 - **Where:** The system will operate within Kanjuruhan Stadium and extend to an online platform accessible to users.
 - **Who:** The key stakeholders at this level are stadium management, event organizers, and fan base representatives whose needs initiated the project.
 - **When:** The relevance of the system in relation to the match schedule, the designated ticket sales period, and the overall event lifecycle.
 - **Why:** The underlying motivation, derived from qualitative Theme 1 (Frustration with Manual Processes) and Theme 2 (High Expectations for Ease of Access), is to address significant frustrations with the current manual process and meet users' strong digital expectations for a modern ticketing solution.
- **Owner Perspective (Business Model/Conceptual):** This view details the company from a business or owner's perspective, with a focus on the operational model.
 - **What:** Defines the key business entities that the system will manage, including tickets, match details, user accounts, and payment records.
 - **How:** Describes the core business processes, such as online ticket purchasing, digital ticket validation at entry points, and dissemination of match-related information.
 - **Where:** These processes occur via an online portal or mobile app, at stadium entrances, and in back-office administration systems.
 - **Who:** The individuals involved include ticket sales staff, IT administrators, security personnel, and fans who interact with the system.
 - **When:** The system operates in different time frames: pre-match sales windows, intensive match-day operations, and post-match reporting and reconciliation.
 - **Why:** The objectives, heavily influenced by Theme 2 (High Expectations for Accessibility and Transparency of Information) and Theme 3 (Prioritization of Transaction Security), are to streamline operations, ensure secure financial transactions, and provide reliable and transparent information to all users.
- **Designer Perspective (System/Logical Model):** This perspective translates the owner's business requirements into a logical, technology-agnostic system model.
 - **What:** Involves creating a logical data model (e.g., Entity Relationship Diagram) to define the structure and relationships of the data, and a process model (e.g., Data Flow Diagram) to illustrate the movement and transformation of data.
 - **How:** Defines the core functionality of the system, such as user authentication, seat selection algorithms, QR code generation for tickets, and integration points with payment gateways.
 - **Where:** This logical design describes the overall system architecture, including the conceptual web server, application servers, and database servers, and how they relate to each other.
 - **Who:** Systems analysts and UI/UX designers are key roles, translating business requirements into detailed system specifications and user-friendly interfaces.
 - **When:** Considers system event triggers (e.g., a ticket purchase initiating a confirmation email) and target transaction processing times to ensure responsiveness.
 - **Why:** The focus is on ensuring system reusability, data integrity, robust security mechanisms, and adequate performance, directly addressing user needs for an intuitive and secure experience as highlighted in Theme 2, Theme 3, and Theme 4 (Need for Responsive Customer Service and Support).
- **Builder Perspective (Technology/Physical Model):** The builder's view details the physical implementation, specifying the actual technology selected to realize the logical design.
 - **What:** Defines the physical database schema (tables, fields, types) and data exchange formats such as JSON for APIs.
 - **How:** Describes the specific software modules and components to be built, such as the front-end user interface, back-end APIs for business logic, and the database interaction layer.



- Where: This includes specifications for server hardware or cloud infrastructure, database server configuration, and physical scanners for QR code validation at stadiums.
- Who: Developers (front-end, back-end, database specialists) and Quality Assurance (QA) engineers are responsible for building and testing the system.
- When: Addresses the implementation schedule, batch processing requirements (e.g., for reporting), and data backup and recovery schedules.
- Why: The primary goal is to translate the logical design into a real, functioning, reliable, and scalable system, directly addressing the need for robust performance to handle high user volumes (User Volume findings) and secure transactions (Theme 3).
- Sub-Contractor Perspective (Detailed Representation/Components Out of Context): This provides the most detailed specifications for individual system components, often for custom development.
 - What: Includes precise definition of data fields, input validation rules, and constraints for database integrity.
 - How: Details component specifications, API endpoint contracts (request/response structures), and specific algorithms for complex functions.
 - Where: This includes details of network configuration, security protocols such as SSL/TLS implementation, and firewall rules.
 - Who: Specialized developers focused on a specific module (e.g., payment gateway integration) or security experts implementing protection measures.
 - When: Defines component interaction timing, API call sequences, and expected response times for individual services.
 - Why: The goal is to ensure that all individual components are built correctly according to detailed specifications and can be seamlessly and securely integrated into the larger system, which is critical for aspects such as transaction security (Theme 3).
- User/Functioning System Perspective (Operation/Instance): This final perspective describes the live operational system as experienced and used by actual users.
 - What: Deals with the live transaction data flowing through the system and the real-time information, such as ticket availability, that is displayed to the user.
 - How: Describes the system in action: a fan successfully purchases a ticket online, staff efficiently validates the e-ticket at the gate, and an administrator generates an operational report.
 - Where: The system functions across user devices (smartphones, computers), physical stadium scanners, and a live server environment.
 - Who: The primary actors are the end users (fans) who interact with the system for ticketing and the operational staff who use it for management and validation.
 - When: This perspective focuses on real-time interactions, such as instant purchase confirmation and on-site game-day ticket validation.
 - Why: The primary goal is to effectively meet all identified user needs related to ease of access, security, reliable information, and responsive support (Themes 1, 2, 3, 4, and 5), and to enable efficient and smooth stadium operations on event days. Success here is directly measured by user satisfaction and operational effectiveness.

5. Discussion

This section discusses the key qualitative findings and interprets how these insights shaped the design of architectural artifacts using the Zachman Framework.

a. Alignment between business needs and framework

The results of the thematic analysis indicate that the Zachman Framework can accommodate the complexity of needs and expectations expressed by stakeholders of Kanjuruhan Stadium. For example, from the perspective of the Planner and Owner, the themes of frustration with manual processes and expectations for efficiency and better service provide a strong foundation for defining strategic objectives (Why) and system scope (What, How).

b. Findings of weaknesses in the current system/process

Interviews and observations clearly revealed significant weaknesses in the manual ticketing process. Themes of long queues, uncertainty, and security risks were not just surface complaints but reflected operational inefficiencies and negative impacts on user experience. The lack of a centralized data system was also a real management constraint.

c. The advantages of the Zachman approach for this context

The Zachman approach, informed by rich qualitative data, helped develop a comprehensive and contextual e-ticketing system architecture. Its ability to map each element from multiple perspectives ensured that the nuances of user needs revealed from interviews (e.g. specific expectations related to the interface or type of notification) could be considered in the design.

d. Implications for e-ticketing system design

The direct impact of mapping qualitative findings into the Zachman Framework is the creation of an architectural design that is truly rooted in a deep understanding of the users and operational context of Kanjuruhan Stadium. Stadium management received guidance that was more than just a list of technical features; it was a blueprint that considered the "why" behind each design decision, derived from the aspirations and concerns of stakeholders.

6. Conclusion

- Results/efforts made to achieve the objectives

This study successfully applied the Zachman Framework as a tool to design the enterprise architecture of the electronic ticket sales information system at Kanjuruhan Stadium, with the main input from thematic analysis of qualitative data collected through in-depth interviews, observations, and document studies. Through this approach, a deep understanding of the needs, expectations, constraints, and perceptions of stakeholders can be systematically mapped into various perspectives and focuses of the Zachman framework, resulting in a contextual and user-centered design.

- Practical implications of the design

The architectural design based on qualitative findings has positive practical implications, including:

1. Identification of richer and deeper user needs, beyond the standard feature list.
2. Recommendations for design and technology that are more in line with the cultural and operational context of Kanjuruhan Stadium.
3. Guidance for stadium management in developing a system that is not only functional but also provides a positive user experience, based on an understanding of "what really matters" to them.
4. Increased potential for user adoption and satisfaction because the system is designed based on their voice.

- Research Limitations

This qualitative research has limitations in terms of:

1. The findings are not intended for statistical generalization to all stadiums but provide an in-depth understanding in the context of Kanjuruhan Stadium.
2. The subjectivity of the researcher in interpreting qualitative data is an inherent aspect, which is minimized through triangulation (if done) and a systematic analysis process.
3. The research only focuses on architectural design and does not include direct system implementation and evaluation.
4. Further research is recommended to test this design through prototype development, direct implementation, and evaluation of its effectiveness with participatory user involvement.

Acknowledgments

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