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Developing an AI-Enhanced Enterprise Architecture Model for Strategic Decision-Making in Malaysia's Railway Industry

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ABSTRACT

Most developing nations, including Malaysia, still lack a model for the decision-making process that is comprehensive enough to account for a wide variety of potential effects and failures. The implementation of this investigation is crucial for Enterprise Architecture (EA) parameters for Railway Industry (RI) supplier performance that emphasize strategic decision-making processes to help the organizations become more competitive. In response to this need, the research integrates Artificial Intelligence (AI) as an enabler within the EA model to support intelligent and data-driven decision-making. This research has implemented a strategic decision-making process in the RI context and conducted it from a developing country perspective. The study identifies several elements of the decision-making process faced and experienced by the RI and the potential gaps for further observations in adopting the EA model. As a result, a fresh conceptual model enhanced with AI-driven analytics and intelligent decision support was created and assessed. By fulfilling the aims of the study, this research makes important contributions to the RI in terms of the use of EA, aligned with the worldwide standard of the four fundamental EA criteria, and explores the transformative potential of AI integration to accelerate EA adoption. The study's findings will impact both theory and practice, providing a pathway for developing nations to harness AI for strategic advantage and digital maturity.

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1. INTRODUCTION

Enterprise Architecture (EA) performs several vital roles in any type of contemporary industry, such as managerial decision-making, supporting industry operations, and competitive advantage. It's crucial to keep in mind that EA was bought to handle jobs and issues within a business [1]. EA contributes to the information distribution within an industry, grounded on the divergent levels of hierarchy in the industry. Consequently, it has become crucial to properly disseminate EA at all levels of management in the sector [2]. Organizations require an EA that could change the fundamentals of an organization in several ways through data analysis [3]. To develop an EA model, discover the contradictory pressures, and explain the practical technique for designing systems and considering their

application using big data analytics and an EA engine, improve the organization's strategic performance. This can be observed using different EA models that clarify a multiplex impact through development and avoiding organizational failures. Artificial Intelligence (AI) and EA have enabled the organization to derive better knowledge creation and decision-making to changes in the industry environment [4]. Compared to studies done in developed or Western countries, the EA model is more applicable to other developing countries [5]. Fundamentally, there are inconsistent findings on the organizational decision-making process to adopt EA innovations, a lack of investigation on the EA model for decision-making, and its performance implications. The majority of the issues surround strategic decision-making for EA measures from a multiple-perspective approach, which travels outside the organization's artifacts into the organization's context [6]. The rate of industry failure is still high since businesses don't research and use EA in their systems as a formalized technology-enabled process. Besides industry needs to address the gaps in the organization through data errors, information bottlenecks, and data silos. The EA revolution will be a transformation for perceiving a new model that emphasizes the tools at various levels and strategized decision-making perspectives [7].

According to [8], the EA model is categorized as an integrated model that focuses on the informational scenario and the planned performance. EA has a meaning and is used as a recipient context that generates an intelligent environment that can mobilize the information within the organization to enhance performance. Therefore, the organization needs an EA model that displays the organization's performance indicators in a way that relates to the present big data analytics and EA stages of strategy adoption and implementation. Moreover, this strategic performance model provides an example of a strategic application that would be used to describe the knowledge to make necessary decision-making. The EA model can elevate the operational performance of the industry and improve its operational levels through a technology revolution that has been monitored and strategized accordingly. The EA model must encourage businesses to comprehend the dynamics of the shift to the acquisition technology context for Railway Supplier Performance.

Besides, the integration of EA and AI will shape the organization's future through interactive learning that will improve decision-making through data analysis and provide valuable insights. AI can handle predictive and prescriptive analytics that will derive strategic decision-making for Railway Supplier Performance. Predictive analytics focuses on forecasting supplier performance outcomes to help the Railway Industry (RI) make strategic decisions, while prescriptive analytics takes the extra step to recommend the specific, optimal course of action or strategy for supplier performance. Both types of advanced analytics simplify complex situations and help RI make better, data-driven decisions. Moreover, AI technologies will be an essential tool for processing large datasets, identifying trends, and simulating various decision-making scenarios [9]. These AI tools allow RI to improve forecasting accuracy, optimize resource allocation, and enhance strategic planning for Railway Supplier Performance.

Therefore, the study intends to develop an AI-enhanced EA model for strategic decision-making in RI by reviewing some theoretical frameworks, where creating a research design framework on understanding, commitment, practice, and behavior toward new strategic analysis and a model from EA on how to avoid RI failure due to poor digital managing in Railway Supplier Performance. Yet, a new conceptual model and adoption of the EA model to assess the accuracy of information provided as the Railway Supplier Performance from a working perspective in Malaysia will be able to realize the full benefits of the EA model to be realized. While EA focuses on having performance indicators, that will help organizations to focus on the strategies formulated and align every component and activity of the organization around the strategy. This research will answer the level of EA adoption and the High Technology High Value (HTHV) of AI innovation elements, and the focus on a transformation guide for managing strategy, particularly in Railway Supplier Performance. The value of this research can be interpreted as: (1) it explores the level of EA adoption in Railway Supplier Performance, which earlier research has not concentrated on; (2) it analyzes the AI-enhanced RI supply chain indicators for Malaysia, where no study possesses formerly; (3) it develops the EA model for HTHV among Railway Supplier Performance in Malaysia that this research could be essential; (4) lastly, it validates the perception and accuracy of the AI-enhanced EA model for HTHV among Railway Supplier Performance in Malaysia.

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2. DEVELOPMENT EA-AI MODEL METHOD

Enterprise Architecture (EA) addressed the ideal thinking of being analytics using big data analytics as analytical tools for analyzing data sets using charts, statistical quantities techniques, and applications [10], [11]. The EA structure of content analysis implements the EA model that focuses on the alignment with designing the relevant generic model on implementing the integrated strategic planning and operational planning [12]. The EA model will be determining and discovering data analytics on the relevant operational data for strategic performance diagnostics, and yet scrutinizing and collecting socio-technical perspective and human behavior data [13]. A good EA model will analyze and review the complexity and inefficiency of the relevant socio-technical perspective and human behavior data from the railway context [14]. This can be achieved by implementing the role of big data analytics in identifying underlying gaps or issues that occur in these big data scenarios and providing key determinants of competitive decision-making promptly [15]. According to [16], EA is defined as an analytical technique for evaluating the critical factors of an organization's decision-making context and effectiveness within an organization by integrating the process and tools in data management for simulation.

Moreover, Artificial Intelligence (AI) integration will be a key growth in adapting dynamic markets for the strategic planning process for an EA model. Besides, AI enhances evidence-based decision-making that provides actionable intelligence regarding future scenarios. Integrating AI into the ideation process for the EA model amplifies creativity that allows decision-makers to brainstorm ideas collaboratively with machine intelligence [17]. An AI-enhanced EA model can identify the game-winning strategies to move forward in the Railway Supplier Performance. EA's transfiguration of data into knowledge is the goal. Given these criteria, EA continues to progressively disburse attention to the conception of the model that surges effectiveness and competitive advantage for the decision-making perspective within a business, as depicted in Table 1.

Table 1. The Enterprise Architecture Interrelated Components with AI-Enhanced.

EA Parameters	Justification	Components	AI-Enhanced
Business Architecture	Directed to the practicality, reliability, and importance of the business, its criteria, indicators, and weightage.	 Strategy, Business Processes, and Organization Functions	 Expert Knowledge Capture
Data Architecture	Collected from the selected operations, the practicality, reliability, and importance of the data will be reviewed again.	 Business Entities and Data	 Data Lake or Data Warehouse
Application Architecture	Information collected from the selected category will be used to calibrate the decision-making.	Applications Component and Architecture	 Intelligence Search
Technology Architecture	The process of ensuring that the benchmark values and the marks proportion are aligned with the targeted levels of achievement.	 Hardware architecture and Deployment	 Operational Intelligence

Table 1 summarizes the EA's interconnected infrastructure components with AI-enhanced features and reviews the information and analysis that helps the Railway Industry (RI) understand how to leverage the value. In general, EA is the legacy of information resident in the line of organization applications for adoption and adherence to guiding principles with the AI indicators and the components associated that are adequately sensitive to differentiate different levels of achievement. The composition of the EA arises due to the technology revolution and strategy complexity in its level of decision-making perspective [18]. EA can achieve the industry performance through heuristic in-depth investigation that analyzes the performance within the industry operational levels. Moreover, EA reviews the strategic approach and the value in selecting the right decisions for certain scenarios [19]. Besides, it provides the

rationale for strategies for situations on imbalanced data, information change, and socio-technical scenarios due to a human behavior perspective that impacts the industry performance in general. Thus, the RI also encounters data silos that create information errors and bottleneck situations from the operation perspective. Moreover, this situation occurs due to humans lacking knowledge in emphasizing the proper level of information analysis that focuses on model analysis for effective response in the context of scenarios. Furthermore, the RI is in deluge scenarios where information analysis is under technology implementation for strategic decision-making context for monitoring and analysis. EA can be defined as the capacity to create a future adaptive learning environment through its model that emphasizes the system thinking concept and analyzes critical scenarios for an industry operation function. Therefore, an AI-enhanced EA model can personalize and analyze the Railway Supplier Performance from structured data or generalization of attributes within its domain. AI can be used as an analytics tool for measuring performance growth in implementing and achieving significant outcomes for global compatibility scenarios [20]. Thus, this study adopted the TOGAF indicators as the baseline of the EA model for AI-enhanced operational and strategic thinking for Railway Supplier Performance, which is among the top-used frameworks by government entities in Malaysia, as presented in Table 2.

Table 2. The TOGAF Indicators for the AI-enhanced EA model.

EA Parameters	**Justification**	**TOGAF Indicators**	 **AI-Enhanced Operational Thinking**	 **AI-Enhanced Strategic Thinking**	**Decision-Making Scenarios**	**Strategic Decision-Making Objectives**	**Malaysia's Railway Industry Outcomes**
Business Architecture	The holistic model of business information and resources for decision making.	➢ Information resources in action. ➢ Ensure task effectiveness. ➢ Functional evolving complex.	➢ Immediate term. ➢ Concrete.	➢ Longer term. ➢ Conceptual.	Lacking information that was needed and accuracy in the data collected.	Identifying, defining, and determining the strategic theme of the decision-making process in the railway supplier selection.	Requirement elicitation and supplier selection activity in terms of strategic goals in ensuring the growth and competitive advantage that enhances the selection process.
Data Architecture	The data environment for behavior, policy, and strategy.	➢ Knowledge obtained from experts. ➢ Promotes operational efficiency and control. ➢ Standard operating procedure.	➢ Action and doing.	➢ Reflective learning.			
Application Architecture	Core information is the central point in the analysis of the data for decision-making.	➢ Managing information. ➢ Supporting business functions. ➢ Encoded in programs.	➢ Resolution of existing performance.	➢ Identify key issues.	Lacking consistency and complexity of the existing manual systems.	Implementing an AI-enhanced EA model for the Railway Supplier Information System.	Supplier selection activity objectives that indicate value-oriented.
Technology Architecture	Consists of scenarios that need technology arrangement for analyzing them.	➢ Instills commitment through shared meaning. ➢ Expressed in texts. ➢ Visions or scenarios.	➢ On the ground perspective.	➢ Helicopter perspective.	Lacking quality criteria of the existing information system and using the information system.	Evaluating and monitoring the acceptance and effectiveness of the AI-enhanced EA model.	Key performance and supplier selection indicators of a decision-making strategy.

Table 2 summarizes the TOGAF indicators for the AI-enhanced EA model on learning about EA in RI as an appropriate strategy for critical analysis success and capitalizing on its specialties for

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competitive advantages. Strategy planning and creation is a general effort for a complex process that involves the setting of an EA model for achieving the strategic aims and an AI analysis tool for decision-making perspectives. The evaluation and prioritization emphasize the high deductive capacity of aggregating challenges of the human mind. Therefore, the success of the RI depends on the performance aspects that emphasize the latest technology for the largest term of wealth. However, the level of analysis plays a major role in managing the RI from an enterprise perspective. The most significant elements are the process and management tasks for making better decisions in certain scenarios or performances. AI-enhanced EA model has reached an amazing level that enhances its ventures for commercial and training the nature of the RI environment. The principle of EA in an organization should be acknowledged and support the EA model by organizing individual knowledge paired with other individuals in an organization for available knowledge reflection that enables the RI to interact with the environmental factors for prosperity. Therefore, adopting TOGAF indicators combined with the RI supply chain as management concepts for improving the decision-making process in Malaysia.

3. RAILWAY SUPPLY CHAIN INDICATOR RESULT

Currently, 97 percent of the country's 660,000 businesses, or 645,000, are in the Railway Industry (RI) supply chain context [21]. Notably, developing nations like Malaysia are increasingly concentrating on having an effective RI process and managing it strategically as their long-term goal [22]. Electric Train Service (ETS), Monorail, Express Rail Link (ERL), and Light Rapid Transit (LRT) are the four types into which RI in Malaysia can be divided [23]. Heavy train service sectors make up the four primary sectors. The categories are based on daily usage in Malaysia and emphasize urbanization and population expansion, oil shortage and energy pricing, congestion that wastes time and energy, and climate change as the greener transportation option [24]. The RI leadership will internalize the essence of the strategic document and work closely by guiding the core values to success as a strategy-focused RI context, and make the 2030 destiny a reality. RI is one of the crucial components in the organization that provides several benefits that the country needs for many economic benefits, and reducing costs and expenses over regular economic mistakes and deliberate lapses. The primary advantage of RI is improving the economy through comprehensive human resource analysis and reporting the growth of the country. RI assists in developing the general workforce for solutions in economic capabilities. Therefore, the RI can be categorized into four baseline categories as presented in Table 3.

Table 3. The Railway Industry Baseline Percentage Category.

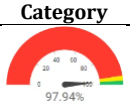
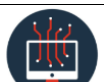
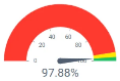
Percentage Category	Justification	Rail Baseline	Railway Supply Chain AI Indicator
 Attention (97.94%)	Must be obtained, sustained, and directed to relevant stimuli that analyze the broader perspective of information context.	Stimulates curiosity of business interconnected for information link that niches the industry by knowledge-seeking behavior.	 System Complexities.
 Relevance (97.83%)	The importance of understanding and motivation on a given task by perceiving the business potential for development and characterizing the information.	Express the diversity of information for processing and interests in new learning skills.	 The Scalability Factor.
 Confidence (97.88%)	Understand the ability to succeed by focusing on objectives and prerequisites on performance requirements, and evaluation criteria by possessing prerequisite abilities for the task.	Manifests the information for the integration of industry structures and processes for success.	 The Cost of Training.
 Satisfaction (97.94%)	Learning must contribute to the feeling of satisfaction in some way, from a sense of achievement by performing a challenging task that requires newly acquired skills.	Provide principles in highly competitive situations.	 The Operational Costs Involved.

Table 3 presents the RI baseline percentage category in a synthesis of motivational influences from behavioral contingency design and management perspective. This RI baseline category generates a large list of motivational strategies for future development stages. In the year 2013, the electrified double-tracking project and line extension projects were implemented, followed by high-speed rail systems in the year 2018. In the year 2020, the MRT2 and MRT3 with Putrajaya Monorail were planned, and the Sarawak Railway Track from Similajau to Tanjung Manis will begin in the year 2030 [25]. The operation of rail transport in Malaysia has been monitored by the Railway Asset Corporation and operated through the use of a dashboard system that reduces time in managing performance. Yet it is easy to access through the web-based system that keeps the performance up to date and available when needed from a decision-making perspective [26]. Moreover, RI keeps their information confidential by tracking the performance change and availability in an instant scenario that has a multi-level management approach, and easier to view the summarized performance of their operations. The RI management gives a glance at applications that have proper management through the EA model managing them effectively [27]. The RI operation units are shown in Table 4.

Table 4. The Railway Industry Operation Units.

Operation Unit	RI Category	Rail Operation Units	Rail Segments	Car Configuration	Service Status
KTM	ETS	34 units	Intercity, subway, and commuter.	6-car sets	In Service (97% good condition)
Rapid Rail	Monorail	12 units	Suburban and regional. Light rail.	4-car sets	In Service (96% good condition)
	LRT	65 units		6-car sets	In Service (95% good condition)
Sabah State Railway	ETS	2 units	Suburban and regional.	6-car sets	In Service (97% good condition)
Express Rail Link	ERL	12 units	High speed.	4-car sets	In Service (98% good condition)

Table 4 summarizes the RI operation units that investigate operations respectively through a constant change of information that needs qualified decision-making for a flexible structure with an AI context. Moreover, disruptive digitalization is needed for an AI value proposition that will observe the potential approaches of big data analytics and EA for retrieving information quickly emphasizing the performance regulation with advantages that increase productivity and reduce financial costs with an increase in information accuracy. Yet, a comprehensive analysis is needed to analyze the high quality of Railway Supplier Performance by investigating the capacities of sophisticated reports. Besides the community approach to the continuous classification of the workforce, occasion, or instrument of scrutiny that the researcher desires to explore. Thus, understanding the RI supply chain indicators from the areas of design, production, and assembly in Malaysia will aid in the improvements in the sector. Table 5 shows the RI supply chain indicators results.

Table 5. The Railway Supply Chain Indicators Result.

RI Areas	RI Supply Chain	Supply Chain Indicators	Key Players Result
Design (Competitive, agile, and relevant components)	Modification or Upgrade	➢ Train Builders, Suppliers, and Manufacturers ➢ Coaches Builders, Suppliers, and Manufacturers ➢ High-Speed Train Builders, Suppliers, and Manufacturers	▲14.6% 14.6% increase in key players on modification or upgrade of existing lines and trains for modern facilities on high-value components and high economy complexity.
Production	Component and Propulsion Maintenance	➢ Rail Vehicle Accessibility Equipment Suppliers	▲34.1%

RI Areas	RI Supply Chain	Supply Chain Indicators	Key Players Result
(Produce the complete train system for rail operators) Assembly (Integrate major systems and sub-systems)	System Integration	➢ Rail Vehicle Body and Interior Suppliers ➢ Rail Mechatronics Equipment Suppliers ➢ Rail Electrification Equipment Suppliers ➢ Manufacturers and Suppliers Product Performance ➢ Materials and Components Part Manufacturers and Suppliers ➢ Equipment and Accreditation Specification of Manufacturers and Suppliers. ➢ Rail Electrification Manufacturers and Suppliers	34.1% increase in key players on components and propulsion maintenance for strong value-added and productivity measures on rail operators. ▲52.4% 52.4% increase in key players on system integration for value chain on the complete train systems for rail operators and safeguarding the interest of the major systems.

Table 5 summarizes the RI supply chain indicators result that play an important role in industry dynamically that changes the interaction of developed countries. Understanding the needs of Railway Supplier Performance is necessary for this first stage of the industrial economics role. One significant aspect of suppliers' roles in developing economies is to increase labor productivity and conditional for the long-term by joining the scopes and description of changes that emphasize complexity. RI empowers the industry to use competitive advantages to maintain its standards and quality by measuring its indicators of performance. Infrastructure accessibility, performance systems, and administrative practices adopted by organizations could all have an impact on RI quality. It's crucial to watch over and rein in RI's growth of subpar products. A sophisticated tiered process is used to guarantee the provision of quality suppliers that measure its efficiencies, performance, and success needed dashboards, a combination of related information systems and vast amounts of data that are gathered and shown straightforwardly, that can be used to visualize data in real-time and provides a picture of showing a live view of Railway Supplier Performance. EA signifies the appropriate measures for a meaningful way to model the benchmark accordingly for a better learning environment and integration approach in their planning strategies for Railway Supplier Performance growth. Besides EA utilization of information with behavior analysis and visualize Railway Supplier Performance in the dashboard perspective.

4. DISCUSSION ON EA-AI MODEL DEVELOPMENT

Presently, the Railway Industry (RI) needs modeling and simulation techniques that measure the aspects of Railway Supplier Performance for the most critical aspects and its success of excellence. Generally, performance is the way to measure supplier indicators for providing results across the RI and assisting in prioritizing decision-making perspectives that align the outcomes. Compiling these performance indicators could aid RI by evaluating their supplier data and the ability to evaluate their basic important information and influential operations within the industry. AI-enhanced EA tools are utilized to measure and virtualize the Railway Supplier Performance for analyzing the performance with a model that functions as a solution. RI stemmed from the provision of an analytical tool that presents their performance in a secure condition. Besides RI is to improve the standard and accessibility of supplier data effectively in an EA context. Indeed, the main character is to deliver effective supplier information to assist decision-makers in evaluating supplier performance and to highlight aspects of the supplier's activities accordingly. Moreover, the initial concept is to provide reliable information that produces operational results that indicate the functions and processes for the Railway Supplier Performance. Besides RI need to benchmark their supplier performance in measuring the performance quality by improving the data quality and observing the RI ventures. The significance of performance data will be diagnosed through an AI-enhanced EA model that manages data quality usage and visualizes the reporting capabilities in a daily manner. EA model emphasizes the comprehensive analysis of RI data through analysis of high-quality supplier performance through the current progress of the AI technology revolution and visualizing daily Railway Supplier Performance decision support.

The data in an EA model manifests the information behavior for RI that values strategic importance in the industry. The focus of the information used is on decision-making on the market dimensions that emphasize the economic value of supplier results. EA analysts on RI interactively examine and approach the knowledge for correct supplier information that possesses higher performance perspectives. AI-enhanced EA model development will focus the top management evaluation on the Railway Supplier Performance that interacts with information for analytical and decision-making processes. This strategic key point is to keep in touch with the rapidly growing big data and changing data analytics in organizations. Moreover, the AI-enhanced EA model can be implemented to improve the strategic performance of RI, predict future changes within the organization, and strategize the proposed strategic plan. Besides that, this study will focus on a holistic approach to Railway Supplier Performance on a dynamic variability of information in associating or relating data variables obtained from adopting the EA criteria that influence the success of Railway Supplier Performance strategic plan in a predictable pattern for determining the performance for stakeholder view's purpose. Therefore, this study initiated an approach to configure the basis of observing a generic organizational socio-technical perspective and human behavior dimension using the AI-enhanced EA model with MIT90s framework that focuses on its optimization that brings certain designing strategies of Railway Supplier Performance diagnostics model for a RI.

Furthermore, in designing the relevant generic model, this study will start addressing and viewing the integrated AI-enhanced EA model with well-established techniques that change the Railway Supplier Performance with new knowledge and structure its performance strategies accordingly. The knowledge focuses on discovering Railway Supplier Performance behavior. The information obtained from the review collection will be measured and analyzed based on behavior, and procedures, and tested based on similar elements of MIT90's framework and the generic Railway Supplier Performance. Constructing EA may have to lay out the tiering and other processes of the RI supply chain are shown in the chain's structure. A vision of how Malaysia wants the RI supply chain to look is also required before creating the AI-enhanced EA model for it. The primary approach of this study is understanding the scenarios of reactive to active and focused thinking. Designing the big data analytics transfers occurs in EA spontaneously and mapping with MIT 90's framework by focusing a unique pattern of gaps for an engaging combination of personality traits with big data analytics and technical conditions for knowledge utilization for current Railway Supplier Performance action and practices context. The information obtained from the literature review will be the problem-solution for the deployment of high-impact value, in the form of justification that is accessible and flexible by determining socio-technical perspective and human behavior as measurements for a competitive edge. It appears that what architecture is depends on the purpose for which it is designed. This establishes a purpose and a scope while conceptually implying that each architectural manifestation embodies its reality. Since everything from the technical to the industry level that covered by architecture, it is crucial to think of it as a continuum. Previous studies in RI and EA are important to understand the architecture development of the RI supply chain as detailed in Table 6.

Table 6. Summary of the AI-enhanced on the Railway Industry and Enterprise Architecture Development.

AI Integration Type	Railway Industry Procedure	Enterprise Architecture Value	Development Findings
 Industry-agnostic that can be trained for AI adjustment and needs.	What model is suitable for current EA scenarios?	Integrated model	Integrating the EA model as a strategic performance diagnostic tool for decision-making as a problem-solving mechanism on data errors, data silos-isolated information repositories, and information overload.
 Highly flexible and acts based on given data and tasks.	When is the timeframe to complete the possible engine model design?	Possible Engine	Analyzing information obtained from the socio-technical perspective and human behavior from implementing the EA model in the context of big data scenarios and transforming it into strategic performance management data.
 Scalable on the data for better performance.	Where this EA model will be conducted?	EA model	Developing specific EA model design and real executive performance diagnostics tool.

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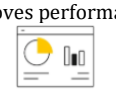
AI Integration Type	Railway Industry Procedure	Enterprise Architecture Value	Development Findings
 Industry automation using AI to streamline repetitive and routine tasks.	Who is the target organization?	EA Data Analytics	Focusing on the EA current model by implementing the role of big data analytics to identify the gaps that occur and providing key determinants of competitive decision making.
 AI-driven decision-making that forecasts market changes and improves performance.	How the integrated EA model and possible engine design will be merged for simulation?	EA Analytics	Using EA as a tool in designing and developing specific strategic performance dashboards.
 AI data analysis possibilities for valuable big data that allows data mining and analysis.	What are the EA gaps?	EA Gaps	Underlying gaps or issues occur due to phenomenal data silo, data usability, and data validity.

Table 6 summarizes the AI-enhanced RI and EA development. This study is evaluated from the standpoint of information enterprise and industrial research. The collection, classification, manipulation, retrieval, and distribution of information are the main goals of an information enterprise. It is a vast interdisciplinary field that includes management and the development of model-based systems. Insights into the sector and relationships between those within it are the main goals of industrial research. Numerous elements affect an industry. Industry research attempts to understand and model these factors. Like information enterprise, industry research seeks to manage, forecast, and justify. The theoretical underpinnings of models and the procedures involved in the framework context of system development are both addressed by framework-based system development. Theoretical frameworks for enterprise engineering are established in framework-based system development on a managerial approach. Therefore, the condensed version of the accepted theoretical framework connected to the study is presented in Table 7.

Table 7. A summary of the framework-based system development for Railway Supplier Performance.

Theoretical Framework	EA Model	Classification	Development Architecture	Data Storage	System Response Time	Railway Supplier Performance
MIT 90's framework	Analyzed the decision-making requirements and solutions based on the EA model	Identifying the decision-making requirements based on the EA model and providing information.	Web-based, Mobile Apps and Datacentres.	Centralized.	Fast.	A system view of an Adaptive Sustainable Organization by the dynamic model of an organizational context.
MIT 90's framework	Develop an EA model and taxonomy for the protection of data and information.	Support the categorization of EA model requirements with standards.	Web-based.	Centralized and Local.	Fast.	Proposed EA model requirements in the early phase of application development.
MIT 90's framework	Investigate the EA model for requirements engineering to help decision-	Develop a support tool and technique for the decision-making process.	Workgroup	MS Excel-based	Average	Focus on capturing the EA requirements and the

Theoretical Framework	EA Model	Classification	Development Architecture	Data Storage	System Response Time	Railway Supplier Performance
	makers understand the aspects.					application tools.

Table 7 summarizes the framework-based system development for Railway Supplier Performance connected to the study of technological advances in the EA model development. MIT90's framework acts as a driver and describes the different roles of the managerial approach by supporting the level of management and the framework mechanisms that lead to this technology model. Furthermore, MIT90's framework continues the quality of management and associated modeling processes of industry case studies, this fuels a great desire for deep comprehension of the technology act of modeling framework. Theoretically, this study, which is based on the MIT90's framework, has provided fresh information regarding the degrees of diagnostic decision-making on improving the analytical quality of decision-making for adaptive systems emphasizing the ability to respond to strategic perspectives in deciding for Railway Supplier Performance. Besides that, the development of this AI-enhanced EA model at tactical or strategic levels needs both data for positioning big data analytics and EA initiatives for optimizing the Railway Supplier Performance, as shown in Figure 1.

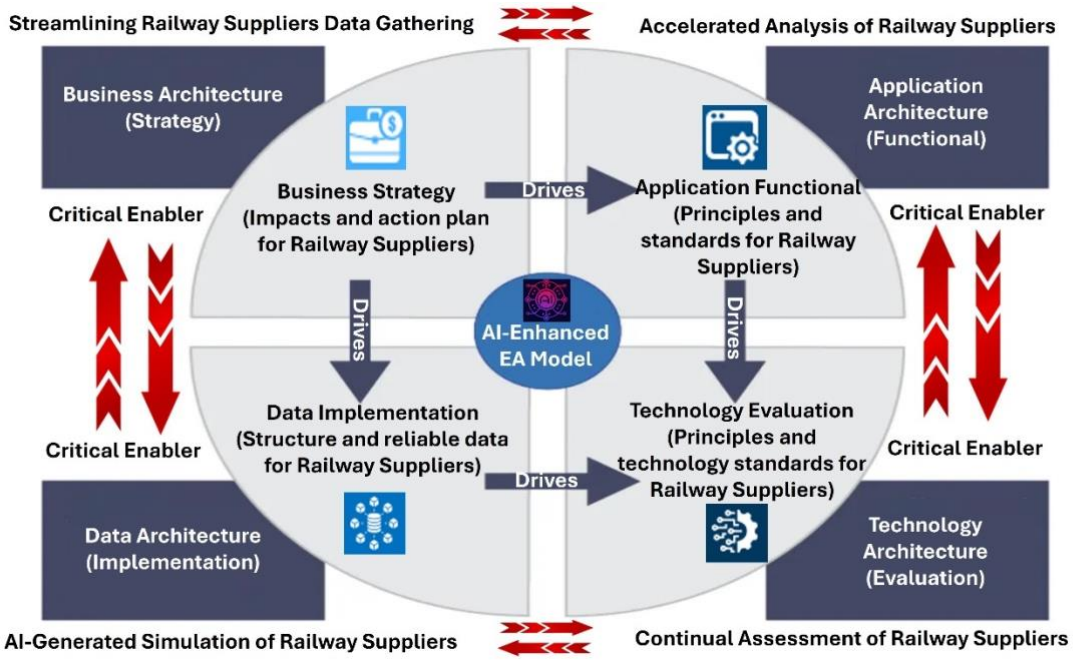


Figure 1. Finalized AI-Enhanced EA Model for Strategic Decision-Making in Malaysia's Railway Industry.

5. CONCLUSION

By fulfilling the objectives of the research, this study offers a substantial contribution to Malaysia in RI in terms of both the adoption state of AI-enhanced EA and the utilization of EA based on the global standard of the four fundamental EA characteristics. The study's findings will have an impact on both theory and practice. Theoretically, this study, which was based on the MIT90 framework, added a new understanding concerning the levels of organizational performance diagnostics adoption and the dynamics of industry faces during the model development. The RI supply chain indicators are an important element to encourage cognitive skills on applications and further contribute to competitive advantage. The degree of complexity in learning and using EA was reduced significantly. This study enhanced the existing EA parameters of the AI-enhanced EA adoption model by categorizing each parameter. The parameters of EA adoption can be identified for four categories of the RI which include Technology Architecture, Data Architecture, Business Architecture, and Application Architecture. The dynamic changes in supplier information focus on the performance complexity and reflect the process

of decision-making. Fortunately, this study provides the standardized EA transition levels for RI supply chain indicators for Malaysia.

In striving for excellence, an organization must have a specific quest for achieving its organizational excellence. This need is so prevailing that the integration challenges with multiple sources focus on the data analytical capabilities that enhance the EA model for strategizing decision-making. This AI-enhanced EA model is important to RI to analyze supplier performance which will increase productivity and opportunity for future ventures. Besides the AI-enhanced EA tool analysis, the changes in the supplier's performance level for optimizing its performance will lead to making the right decisions. The AI-enhanced EA model is a powerful analytical tool that determines the ability to manage the Railway Supplier Performance efficiently. Therefore, building an AI-enhanced EA model tool for supplier performance will emphasize the collective intelligence for strategic opportunities in reducing costs in the railway's projects that are based on the supplier performance itself based on the phenomenon and uncertainty – not knowing what is going on. Moreover, building the virtual supplier practices will cover software-enabled innovations in Railway Supplier Performance management on planning and analytics in reporting the predictive results for railway projects.

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REFERENCES

[1] S. Pathak, V. Krishnaswamy, and M. Sharma, "A dynamic capability perspective on the impact of big data analytics and enterprise architecture on innovation: an empirical study," *J. Enterp. Inf. Manag.*, vol. 38, no. 2, pp. 532–563, Feb. 2025, doi: 10.1108/JEIM-01-2024-0059.

[2] Y. I. Alzoubi and A. Mishra, "Enterprise architecture contribution in distributed agile software development," *Syst. Eng.*, vol. 27, no. 3, pp. 570–584, May 2024, doi: 10.1002/sys.21739.

[3] M. Jayakrishnan, A. K. Mohamad, and M. M. Yusof, "A Model-Driven IS 4 . 0 Development Framework for Railway Supply Chain," *J. Online Inform.*, vol. 7, no. 2, pp. 258–265, 2022, doi: 10.15575/join.v7i2.794.

[4] N. A. A. Bakar, A. H. Suib, A. Othman, A. A. Amdan, M. A. A. Hassan, and S. S. Hussein, "Artificial Intelligence in Enterprise Architecture: Innovations, Integration Challenges, and Ethics," 2024, pp. 578–588. doi: 10.2991/978-94-6463-589-8_54.

[5] M. Jayakrishnan, A. K. Mohamad, and M. M. Yusof, "Journey of an Information System in Railway Industry development approach through an enterprise framework," *Int. Rev. Appl. Sci. Eng.*, vol. 14, no. 1, pp. 35–44, 2023, doi: 10.1556/1848.2021.00408.

[6] S. Kaggwa, T. F. Eleogu, F. Okonkwo, O. A. Farayola, P. U. Uwaoma, and A. Akinoso, "AI in Decision Making: Transforming Business Strategies," *Int. J. Res. Sci. Innov.*, vol. X, no. XII, pp. 423–444, 2024, doi: 10.51244/IJRSI.2023.1012032.

[7] T. Tamm, P. B. Seddon, and G. Shanks, "How enterprise architecture leads to organisational benefits," *Int. J. Inf. Manage.*, vol. 67, p. 102554, Dec. 2022, doi: 10.1016/j.ijinfomgt.2022.102554.

[8] R. F. Calhau, J. P. A. Almeida, S. Kokkula, and G. Guizzardi, "Modeling competences in enterprise architecture: from knowledge, skills, and attitudes to organizational capabilities," *Softw. Syst. Model.*, vol. 23, no. 3, pp. 559–598, Jun. 2024, doi: 10.1007/s10270-024-01151-7.

[9] S. Kotusev and A. Alwadain, "Modeling Business Capabilities in Enterprise Architecture Practice: The Case of Business Capability Models," *Inf. Syst. Manag.*, vol. 41, no. 2, pp. 201–223, Apr. 2024, doi: 10.1080/10580530.2023.2231635.

[10] E. Atencio, M. Mancini, and G. Bustos, "Enterprise architecture approach for project-based organizations modeling, design, and analysis: An ontology-driven tool proposal," *Alexandria Eng. J.*, vol. 98, pp. 312–327, Jul. 2024, doi: 10.1016/j.aej.2024.04.052.

[11] A. K. Mohamad, M. Jayakrishnan, and M. M. Yusof, "Thriving information system through business intelligence knowledge management excellence framework," *Int. J. Electr. Comput. Eng.*, vol. 12, no. 1, pp. 506–514, 2022, doi: 10.11591/ijece.v12i1.pp506-514.

[12] H. Alghamdi, "Assessing the Impact of Enterprise Architecture on Digital Transformation Success: A Global Perspective," *Sustainability*, vol. 16, no. 20, p. 8865, Oct. 2024, doi: 10.3390/su16208865.

[13] R. F. Calhau, C. L. B. Azevedo, and J. P. A. Almeida, "Towards Ontology-based Competence Modeling in Enterprise Architecture," in *2021 IEEE 25th International Enterprise Distributed Object Computing Conference (EDOC)*, IEEE, Oct. 2021, pp. 71–81. doi: 10.1109/EDOC52215.2021.00018.

[14] A. W. Qurashi, Z. A. Farhat, V. Holmes, and A. P. Johnson, "New Avenues for Automated Railway Safety Information

Processing in Enterprise Architecture: An NLP Approach," *IEEE Access*, vol. 11, pp. 44413–44424, 2023, doi: 10.1109/ACCESS.2023.3272610.

[15] M. Jayakrishnan, A. Karim, and M. Mohd, "Railway supply chain excellence through the mediator role of business intelligence : Knowledge management approach towards information system," *Uncertain Supply Chain Manag.*, vol. 10, no. 1, pp. 125–136, 2022, doi: 10.5267/j.uscm.2021.10.003.

[16] N. R. Busch and A. Zalewski, "A Systematic Literature Review of Enterprise Architecture Evaluation Methods," *ACM Comput. Surv.*, vol. 57, no. 5, pp. 1–36, May 2025, doi: 10.1145/3706582.

[17] J. Li, H. Cao, L. Lin, Y. Hou, R. Zhu, and A. El Ali, "User Experience Design Professionals' Perceptions of Generative Artificial Intelligence," in *Proceedings of the CHI Conference on Human Factors in Computing Systems*, New York, NY, USA: ACM, May 2024, pp. 1–18. doi: 10.1145/3613904.3642114.

[18] M. Jayakrishnan, A. K. Mohamad, and M. M. Yusof, "Developing railway supplier selection excellence using business intelligence knowledge management framework," *Int. Rev. Appl. Sci. Eng.*, vol. 12, no. 3, pp. 257–268, Jul. 2021, doi: 10.1556/1848.2021.00267.

[19] D. M. Khairina, P. Purwanto, and D. M. Kusumo Nugraheni, "Systematic literature review on evaluation models and methods in enterprise architecture research," *Bull. Electr. Eng. Informatics*, vol. 13, no. 4, pp. 2851–2864, Aug. 2024, doi: 10.11591/eei.v13i4.6943.

[20] Z. Zong and Y. Guan, "AI-Driven Intelligent Data Analytics and Predictive Analysis in Industry 4.0: Transforming Knowledge, Innovation, and Efficiency," *J. Knowl. Econ.*, vol. 16, no. 1, pp. 864–903, May 2024, doi: 10.1007/s13132-024-02001-z.

[21] MIGHT, *Malaysian Rail Supporting Industry Roadmap 2030*. 2024.

[22] M. Jayakrishnan, A. K. Mohamad, and M. M. Yusof, "Business Architecture Model in Strategic Information System Management for Effective Railway Supply Chain Perspective," *Int. J. Eng. Res. Technol.*, vol. 13, no. 11, pp. 3927–3933, 2020.

[23] D. Syamsunur *et al.*, "MASS RAPID TRANSIT (MRT) DEMAND AND CAPACITY ASSESSMENT FOR RAIL TRANSPORT IN MALAYSIA," *Indones. J. Constr. Eng. Sustain. Dev.*, vol. 7, no. 1, pp. 7–21, Jun. 2024, doi: 10.25105/cesd.v7i1.20230.

[24] A. N. H. Ibrahim, M. N. Borhan, M. R. Mat Yazid, R. A. Rahmat, and S. Yukawa, "Factors Influencing Passengers' Satisfaction with the Light Rail Transit Service in Alpha Cities: Evidence from Kuala Lumpur, Malaysia Using Structural Equation Modelling," *Mathematics*, vol. 9, no. 16, p. 1954, Aug. 2021, doi: 10.3390/math9161954.

[25] I. Landscape and W. H. List, "Industrial landscape," 2024.

[26] W. Omar, "Transformation Plan 2015-2020," *Dep. Stat. Malaysia*, vol. 1, no. 1, p. 79, 2017, [Online]. Available: www.statistics.gov.my

[27] M. Jayakrishnan, A. K. Mohamad, and A. Abdullah, "The Taxonomy of Enterprise Architecture towards High Technology High Value Approach In Malaysian Transportation Industry," *Int. J. Civ. Eng. Technol.*, vol. 9, no. 11, pp. 351–368, 2018, [Online]. Available: http://www.iaeme.com/IJCIET/index.asp