Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 8, Number 1, January 2024 e-ISSN : 2541-2019
DOI : https://doi.org/10.33395/sinkron.v9i1.13256 p-ISSN : 2541-044X

Optimizing Automotive Manufacturing Systems through TOGAF Modelling

Sabrina Fajrul Afarah[1], Djarot Hindarto[2)*], Mohammad Iwan Wahyuddin[3)]
[1)]Prodi System Informasi, Universitas Multimedia Nasional, Tangerang, Indonesia
[2,3)]Prodi Informatika, Fakultas Teknologi Komunikasi dan Informatika, Universitas Nasional, Jakarta, Indonesia
[1)]sabrina.fajrulafarah@gmail.com,[2)]djarot.hindarto@civitas.unas.ac.id,
[3)]iwan.wahyuddi@civitas.unas.ac.id

Submitted: Dec 19, 2023 | **Accepted** : Dec 22, 2023 | **Published** : Jan 1, 2024

Abstract: The objective of this research is to examine the viability of implementing the Open Group Architecture Framework to enhance the efficiency and performance of automotive manufacturing systems. The automotive industry remains confronted with challenges pertaining to the enhancement of manufacturing processes, the reduction of product development time, and the adjustment to swift technological progressions. The primary obstacles encountered in implementing process innovation, the complexity of the IT infrastructure, and the absence of system integration constitute the most significant challenges. The primary aim of this study is to present a resolution through the application of the TOGAF framework. By implementing this strategy, system synchronization will be enhanced, IT infrastructure will be simplified, and process innovation will be able to respond to market fluctuations more rapidly. The existing business processes are streamlined and consistent with the strategic progress of vehicle manufacturing firms. Nonetheless, business processes involving architectural applications continue to diverge from market demands and fail to align with evolving business requirements. In the context of automotive manufacturing, the TOGAF modeling methodology will be applied to analyze the data architecture, application architecture, strategic elements, and information technology infrastructure. Advise stakeholders in the automotive industry, facilitating the integration of TOGAF principles into endeavors to redesign systems. This will reduce the attainment of innovation, adaptability, and efficiency, all of which are critical for sustaining competitiveness in a dynamic marketplace. By applying TOGAF principles to the automotive manufacturing system, Enterprise Architecture can support ever more complex business requirements.

Keywords: Automotive Sector; Enterprise Architecture; Manufacturing; Information Technology Infrastructure; TOGAF

INTRODUCTION

Technological advancements and market forces are the primary catalysts driving substantial changes in the automotive industry. Automobile manufacturers are currently under mounting pressure to overhaul their manufacturing systems to keep up with technological advancements and satisfy the growing range of consumer preferences. Advancements in technology, such as self-driving cars, the use of electricity, and enhanced connectivity, have fundamentally transformed the automotive industry. Given the circumstances, it is crucial to investigate the feasibility of adopting the Open Group Architecture Framework (TOGAF) (Hindarto et al., 2021) to facilitate this change. Although there have

*name of corresponding author

been significant advancements in automotive manufacturing technology, the challenges that the industry continues to encounter are intricate. The automotive industry faces challenges in adapting promptly and efficiently due to the fast rate of change in the global environment. To sustain competitiveness, one must overcome obstacles such as shifts in consumer preferences, evolving regulations, and technological advancements. Hence, it is crucial to conduct research that enhances the comprehension of how TOGAF (Hindarto, 2023b) can serve as a pivotal tool in the restructuring of automotive manufacturing systems. TOGAF's integration as a framework capable of orchestrating disparate systems, streamlining IT infrastructure, and fostering process innovation is anticipated to address the current challenges encountered by the automotive industry. The application of TOGAF (Amanda et al., 2023), (Hindarto, 2023a) is expected to serve as a robust basis for future advancements in the automotive industry, focusing on adaptability, efficiency, and responsiveness to market changes.

The automotive manufacturing sector is confronted with significant obstacles that impede its capacity to function effectively and adjust to swift market changes. A considerable challenge facing this sector pertains to the need for more integration of various systems. The lack of effective interaction between systems that operate independently frequently impedes the ability of automotive businesses to streamline their supply chains and manufacturing procedures. This constrains their capacity to adjust to evolving market demands. Additionally, the intricacy of information technology infrastructure poses a significant barrier. Infrastructure that needs to be more cohesive is necessary for an organization's ability to adapt to continuously evolving technological developments. The inability of organizations to adapt and integrate complex IT infrastructure hinders their capacity to respond to emerging technologies effectively rapidly and effectively.

Furthermore, process innovation plays a critical role in enhancing operational efficiency and satisfying the ever-changing demands of consumers. Nonetheless, a substantial obstacle in this sector pertains to the efficient and prompt implementation of process innovations. A company's competitiveness in a highly competitive market may be impeded by its inability to adapt production processes swiftly to the changing demands of consumers. When confronted with these obstacles, it is critical to contemplate holistic and cohesive resolutions. Considering continuous transformations, enhancing the competitiveness of the automotive manufacturing sector requires system integration, IT infrastructure simplification, and the capability to implement process innovations swiftly and efficiently.

Numerous approaches and solutions have been implemented to surmount these obstacles. Nevertheless, a comprehensive and efficacious methodology to integrate disparate systems within the automotive sector is presently nonexistent. This serves as the foundation for the study's research question: In what ways can the integration of TOGAF into automotive manufacturing systems facilitate process innovation in response to rapid market changes, enhance intersystem coordination, and simplify IT infrastructure? (RQ 1).

What are the effects of integrating the TOGAF framework into the information technology infrastructure, data architecture, application architecture, and business architecture of automotive manufacturing systems? Specifically, how does this integration affect the adaptability of these systems to evolving technological demands and consumer preferences? (RQ 2).

The primary aim of this research is to investigate the potential utilization of TOGAF as a framework that can enhance inter-system coordination, streamline IT infrastructure, and enable process innovation in the automotive manufacturing sector. This research will utilize the TOGAF modeling approach to examine several crucial elements, such as strategic, business architecture, data architecture, application architecture, and information technology infrastructure. This research aims to investigate the integration of TOGAF into automotive manufacturing systems. Its objective is to offer practical guidance to industry stakeholders, enabling them to implement TOGAF effectively. The desired outcomes include improved operational efficiency and more agility to adjust to shifting market conditions and meet customer demands accurately and in a shorter amount of time. This research aims to improve the theoretical and practical underpinnings of the TOGAF Framework within the automotive manufacturing industry. Its objective is to make a substantial contribution to the advancement of production systems and processes in this dynamic industry.

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 8, Number 1, January 2024 e-ISSN : 2541-2019
DOI : https://doi.org/10.33395/sinkron.v9i1.13256 p-ISSN : 2541-044X

LITERATURE REVIEW

In greenfield environments, especially smart manufacturing, enterprise IT architecture must match business goals and strategy. The Fraunhofer battery manufacturing research line's enterprise IT architecture is designed using TOGAF and IEC 62264 manufacturing operations management standards (Oberle et al., 2023). Smart Manufacturing's data sharing and product integration issues led to Intelligent Digital Mesh. Integrating platform-, system-, and enterprise-specific solutions while addressing mass customization and variability is not covered in the literature. Using IDM, Enterprise Architecture, and Software Product Line Engineering, a two-phase mixed research approach creates a Smart Manufacturing Development Framework (SMDF) to improve SM and information integration knowledge (Pasa & Mergen, 2021). This paper examines how cyber-physical systems (CPS) can improve energy distribution. Customers and microgrids can sell services, which can improve environmental responsiveness and create a customer-driven, distributed scheme that reduces the operator-centric hierarchy of modern systems (David, 2023). From 2000 to 2012, this study examines how digital inputs reduced pollution in Chinese manufacturing enterprises. It found that foreign digital factor inputs and digital software significantly reduce pollution. Improved energy efficiency, technology, sterilization, and pollution control investment are responsible. Higher environmental regulations, digitization-unrelated industries, non-state-owned firms, and financing constraints have a more significant impact. These findings support China's digital transformation and green economic development (Li et al., 2023). Industry 4.0 and IoT adoption make production process heterogeneity a significant issue for international manufacturers. Current enterprise architecture (EA) cannot fix this. AMA4EA extends automated modeling with abstraction for EA to address this. This method generates EA models that compare production processes from different sites, extracting value from heterogeneous data and visualizing it. This advances EA research and identifies production site improvements (Nardello et al., 2020).

METHOD

Business Architecture

Within the automotive manufacturing sector, business architecture refers to a comprehensive framework that delineates the organization's structure, processes, objectives, and interactions with the purpose of accomplishing its business goals. Within the automotive industry, Business Architecture (Hirota et al., 2023) refers to a cohesive framework that encompasses critical elements, including product design, supply chain management, production processes, and marketing and sales strategies. As demonstrated by product design, concepts for automobiles are evaluated, conceived, and incorporated into manufacturing. As described in Business Architecture, the supply chain outlines the movement of materials, components, and data necessary for the fabrication of a vehicle. A series of stages illustrate the production process, beginning with the raw materials and concluding with the completed car. Business Architecture incorporates marketing and sales strategies by describing the methods by which organizations introduce their products to consumers and the approaches taken to market and sell vehicles to prospective clients.

Business Architecture (Gill et al., 2011), (Titi et al., 2023) is not merely an internal description of company operations in the automotive industry. Additionally, it necessitates meticulous market analysis, wherein ongoing market trends, consumer behavior, and customer needs and preferences are duly considered. Within this framework, business architecture serves as a lens through which automotive companies can perceive the intricacies of the market at large. By identifying significant shifts in consumer preferences and emerging technologies, market trend analysis empowers organizations to adapt their business strategies proactively. Furthermore, automotive companies can track competitors, analyze their strengths and weaknesses, and discern the tactics they are employing by utilizing Business Architecture. This analysis offers a crucial perception of a firm's comparative standing within the industry and enables it to adapt its strategic initiatives to sustain competitiveness. In general, the contribution of Business Architecture to market analysis, competitor monitoring, and consumer behavior is not merely an observation but rather a critical cornerstone in the formulation of adaptable and responsive business strategies in response to shifting market dynamics. This enables automotive companies to maintain their relevance and competitiveness in a dynamic and demanding sector.

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 8, Number 1, January 2024 e-ISSN : 2541-2019
DOI : https://doi.org/10.33395/sinkron.v9i1.13256 p-ISSN : 2541-044X

In the automotive industry, the implementation of a robust Business Architecture not only furnishes a comprehensive outline but also establishes a firm groundwork for overseeing every facet associated with operating a vehicle manufacturing enterprise. Business Architecture offers a comprehensive comprehension of every phase of the business process, the interdependencies among components, and the executed strategies through this organized perspective. By leveraging this extensive comprehension, automotive corporations have the potential to enhance their operational efficacy. They can recognize and modify established procedures, removing superfluous elements, and fostering greater interdepartmental cooperation—all of which contribute to enhanced overall performance. In addition to this, Business Architecture (Tutaj et al., 2021) empowers automotive companies to improve their responsiveness to shifts in the market. Companies can swiftly adjust their strategies by acquiring a comprehensive understanding of business processes and discerning the value of every component involved. This includes expediting the development and marketing of new products, responding to consumer demands with incredible speed and accuracy, and accelerating the cycle of product development. An additional benefit of Business Architecture within the automotive sector is that it enables organizations to maintain their competitive edge amidst a dynamic environment. They can more effectively schedule subsequent actions by employing a methodical approach. Their ability to anticipate and react to shifts in technological developments and market trends is critical for sustaining a competitive edge in this highly competitive sector. Business Architecture is not merely a framework; it is a potent instrument that enables automotive companies to enhance performance, adapt more quickly to market demands, and maintain competitiveness in an industry that is constantly evolving. Possessing an extensive comprehension of each facet of the enterprise empowers individuals to confront obstacles with enhanced assurance and flexibility, thereby positioning themselves more favorably to flourish and achieve success.

Data Architecture

Data Architecture (Cao & Iansiti, 2022), (Afarini & Hindarto, 2023) is an essential underpinning in the automotive manufacturing sector as it facilitates the management, organization, and integration of data across the entirety of the vehicle production ecosystem. Data Architecture functions as a structural framework that governs the collection, storage, processing, and utilization of data across the entirety of the manufacturing process. It includes a lot of different things, like information about production and the supply chain, as well as product design. The standardization of data formats is facilitated by data architecture to guarantee interoperability and consistency across systems. By doing so, automotive companies can consolidate data from various sources—such as engineering team design information, customer data from multiple platforms, and factory sensors—into a unified entity. This integration facilitates more comprehensive analysis and enables more informed decision making.

Data Architecture (Yang et al., 2023), (Carrera et al., 2024) in the automotive sector encompasses not only the organization and integration of data but also emphasizes critical security and availability considerations. In a time when data is an invaluable commodity, data availability and protection are the fundamental pillars. A practical Data Architecture is of utmost importance in safeguarding sensitive data, including customer information and confidential designs, against cyber threats. Automotive companies can effectively enforce pertinent security protocols, including data encryption, stringent access controls, and ongoing monitoring, by establishing a resilient framework. These objectives are to safeguard against unauthorized access, maintain data confidentiality, and prevent data leaks. Data availability, in addition to data protection, is the primary concern of data architecture. Unavailable data or a compromised system can have catastrophic effects on the automotive manufacturing process. Data Architecture strives to guarantee the availability of consistent and accessible data when confronted with these challenges. By constructing infrastructure that is redundant, backup, and dependable, the automotive industry can proactively detect and surmount system failures, thereby guaranteeing uninterrupted operations. Data availability and security are fundamental aspects of data architecture, as data serves as the basis for intelligent decision-making. In an ever more interconnected marketplace, automotive companies can preserve a competitive edge, safeguard their reputation, and guarantee uninterrupted operations by implementing robust data protection measures. Therefore, the existence of a dependable Data Architecture ensures not only the facilitation of organized data administration but

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 8, Number 1, January 2024 e-ISSN : 2541-2019
DOI : https://doi.org/10.33395/sinkron.v9i1.13256 p-ISSN : 2541-044X

also the transformation of data into a reliable and secure instrument for the advancement of the automotive sector.

The implementation of emerging technologies, including Big Data Analytics and the Internet of Things (IoT), is also facilitated by Data Architecture. This integration enables the collection of real-time data from sensors within the factory. This data can subsequently be subjected to analysis to obtain profound insights pertaining to equipment maintenance, production performance, and consumer preferences. By doing so, Data Architecture facilitates the reinforcement of the underpinnings for decision-making that is driven by data. This empowers automotive companies to enhance operational efficiency, minimize expenses, and react with greater accuracy to market demands.

In the automotive industry, Data Architecture covers more than mere data preparation; it serves as the fundamental framework that supports every facet of vehicle manufacturing. Through using a structured and organized method for managing data, organizations can harness this information to their advantage to foster innovation, enhance overall performance, and promptly adapt to market dynamics.

Application Architecture

Application architecture is a vital framework in the automotive manufacturing industry that governs the design, development, and interaction of applications throughout the entire vehicle production process. Application Architecture, in this context, refers to the arrangement and interconnections of different applications employed within a manufacturing setting. The scope encompasses applications for product design, manufacturing, supply chain management, production management, data analysis, and after-sales service. The primary emphasis in Application Architecture is on product design, utilizing design and simulation applications to create new vehicles, assess their performance, and verify the design prior to commencing production. When it comes to the production domain of the automotive manufacturing industry, Application Architecture is crucial for the integration of various factory-floor applications. This integration encompasses diverse systems that oversee critical functions such as automated machinery, quality assurance, inventory control, and live monitoring of production processes. This integration facilitates seamless information flow between these applications, facilitating rapid and precise data exchange throughout the production line. Automation equipment, such as robotics and automated drive systems, are directly linked to control systems that oversee crucial production functions. This facilitates effective synchronization among diverse machinery and equipment to optimize production processes, enhance efficiency, and minimize production duration. Furthermore, the implementation of an integrated quality control system enables real-time monitoring and testing of products directly from the production line, thereby guaranteeing strict adherence to quality standards.

The Application Architecture includes integrated inventory management, which guarantees the timely availability of appropriate raw materials and components. This aids in the optimization of inventory and the prevention of material shortages that have the potential to disrupt seamless production. Implementing application integration on the factory floor, supported by a robust application architecture, not only enhances operational efficiency but also enables quick adaptation to change in the production environment. Integrated systems facilitate expedited and precise decision-making when faced with changes or issues, thereby reducing disruptions in the production process, and allowing automotive companies to adapt to dynamic market demands promptly. In addition, Application Architecture also facilitates post-purchase service and customer management systems. This encompasses applications utilized for post-sales service, warranty administration, maintenance, and repairs, as well as customer engagement for the purpose of gathering feedback. By implementing a resilient application architecture, automotive companies can enhance customer service, optimize customer experience, and enhance their ability to address service requests promptly. Application Architecture encompasses more than just application design; it serves as the fundamental framework that structures the application ecosystem within the automotive manufacturing industry. Application Architecture is crucial for enhancing productivity, quality, and service in the vehicle production process. This is achieved through effective coordination between applications, smooth integration, and a strong emphasis on efficiency and responsiveness.

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 8, Number 1, January 2024
DOI : https://doi.org/10.33395/sinkron.v9i1.13256
e-ISSN : 2541-2019
p-ISSN : 2541-044X

Information Technology

Information Technology (IT) serves as the foundational infrastructure that sustains and enables innovation, management, and production across the entire value chain within the automotive manufacturing sector. Information Technology comprises the systems, applications, infrastructure, and software that serve as the bedrock for automotive business operations. It enables the seamless integration of all facets of production, from the use of IoT sensors in factories to monitor operations to supply chain management systems that compile data from multiple suppliers and distributors. It facilitates digital modeling and simulation throughout the design process, allowing the design team to test vehicles prior to the commencement of physical production. Furthermore, IT assumes a critical function in production management by facilitating process automation via control systems that oversee machinery and production workflows.

Moreover, IT serves as the foundation for automotive industry innovation. Big Data Analytics facilitates the comprehensive examination of consumer and production data, furnishing the knowledge required for more informed decision-making. Automation and robotics technologies enhance operational effectiveness within manufacturing facilities, whereas artificial intelligence holds promise in facilitating the advancement of self-driving automobiles. Furthermore, information technology serves as the underpinning for post-purchase support, encompassing the monitoring and upkeep of vehicles, the management of inventories of spare parts, and customer engagement through digital platforms. Automotive companies can become more responsive to market shifts, boost production efficiency, and gain a competitive edge by implementing the appropriate IT. Strategic allocations of resources towards information technology within the automotive sector have the potential to yield favorable outcomes such as heightened product innovation, improved consumer experiences, and streamlined production processes—all of which are constructive developments in this perpetually evolving industry.

RESULT

Business Architecture

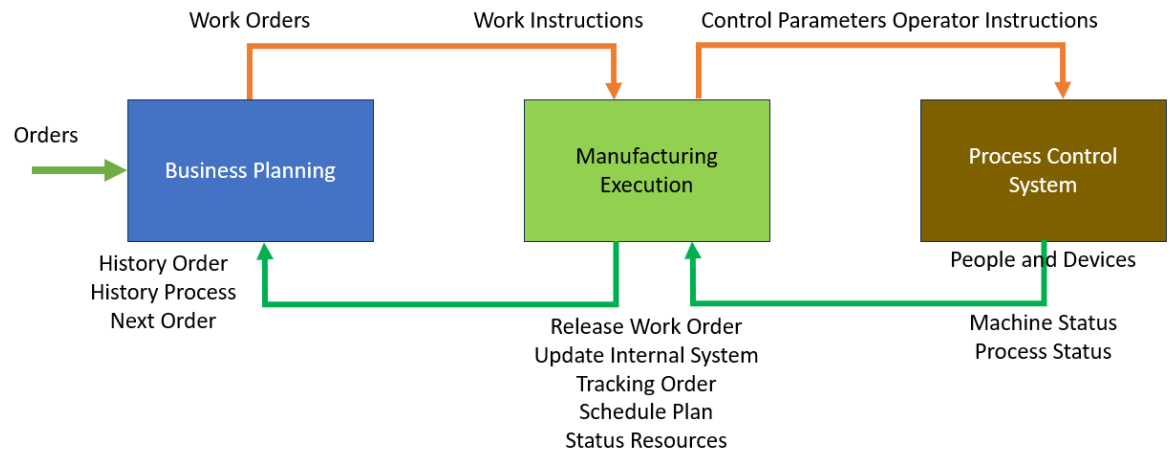

Figure 1. Business Architecture
Source: Researcher Property

Figure 1 illustrates three primary domains that are integral to the functioning of an organization. The business planning process is managed by the subprocesses Orders, Work Orders, History Orders, History Processes, and Next orders, which comprise the first domain, Business Planning. Orders are formal requests that the organization has received, whereas Work Orders are specific directives for the execution of operations or manufacturing. The Order History and Process History contains evaluation and reference records of previous orders and processes, respectively. The following Order emphasizes preparations for the execution of the subsequent Order. Manufacture Execution, the second domain, encompasses tasks such as Work Instructions, Release Work Orders, Internal System Updates, Order Tracking, Schedule Plans, and Resource Status. Its primary objective is the implementation of production. A Release Work Order commences the execution of a work instruction, whereas an Internal

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 8, Number 1, January 2024 e-ISSN : 2541-2019
DOI : https://doi.org/10.33395/sinkron.v9i1.13256 p-ISSN : 2541-044X

System Update documents internal system modifications or advancements. Tracking Order oversees the development of processed orders, whereas the Schedule Plan is responsible for managing the production schedule. Resource Status furnishes details pertaining to the accessibility and utilization of resources, whereas Work Instructions deliver operational guidelines or instructions for executing tasks. Process Control System, the third domain, oversees the control of production processes with an emphasis on People and Devices, Machine Status, and Process Status. Personnel and Devices pertain to the supervision of the devices and personnel engaged in the manufacturing procedure. Process Status monitors the overall status of the production process, whereas Machine Status observes the condition of the production machines. By effectively integrating and managing these three domains, organizations can efficiently strategize, implement, and regulate their production and business processes to accomplish operational and strategic objectives.

Application Architecture

The architectural application suggests fourteen application systems that are tailored to the requirements of the vehicle manufacturing company. Although a limited number of application systems is required to fulfil present business process requirements, that quantity is adequate. The explanation for the architectural application system, as depicted in Figure 2, is as follows:

The A1 Company Portal is an internet-based platform or website utilized by a company to grant specific employees, partners, or external entities access to a range of information and internal resources. This portal serves as a centralized gateway for allowing users to retrieve an extensive array of data, including company policies, the most recent news, crucial documents, internal systems, training materials, and team collaboration. The Company Portal serves the purpose of facilitating convenient and expeditious access to the information needed by different stakeholders associated with the company. This enables users to access up-to-date information, communicate effectively, collaborate seamlessly, and perform their tasks with greater efficiency and organization. A2 Dashboard management aims to provide comprehensive information related to all operational processes, encompassing the order, production, material requirements, and finance stages. This is for the requirements of the company's top management. A3 Product Service encompasses all forms of assistance or support offered by a company to customers following the purchase of their products. This contains various services such as repairs, maintenance, technical support, user guides, training, or any other customer service initiatives that are designed to guarantee customer satisfaction with their purchased products. The objective of product servicing is to ensure the proper functioning of the product, rectify or upgrade it as required, and offer supplementary assistance and services that enhance the user experience. Effective product service has the potential to improve customer loyalty and foster enduring relationships between companies and their customers. The objective of A4 Customer Service is to aid the organization's clients. The B1 Vendor System is a management system utilized by an organization to oversee supplier or vendor information. This system facilitates the efficient management of payments, data, contract negotiations, and supplier performance monitoring. By implementing the B1 Vendor System, organizations can enhance supplier collaboration, efficiency, and transparency. The B2 Supplier System is a manufacturing information and relationship management platform for suppliers.

The C1 Production Planning System is a framework or system that facilitates the management and organization of the production process for goods or services. The objective is to effectively oversee and enhance the utilization of resources, including labour, raw materials, machines, and time, with the purpose of efficiently satisfying customer demands. The C2 Supply Chain System enables organizations to effectively oversee and administer supply chains, enhance visibility, accelerate responsiveness to demand, optimize inventory levels, and reduce operational expenses. Supply Chain Systems have the potential to improve products' distribution and production processes in terms of quality, transparency, and efficiency through the implementation of suitable technologies and integrations. The method of managing and controlling production within an organization is referred to as C3 Production and Control. This entails the coordination, organization, implementation, and oversight of production activities to guarantee adherence to pre-established schedules. Coordination between related departments, production capacity planning, production schedule management, workflow management, production performance monitoring, quality control, and inventory management are all components of this system.

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 8, Number 1, January 2024
DOI : https://doi.org/10.33395/sinkron.v9i1.13256
e-ISSN : 2541-2019
p-ISSN : 2541-044X

The objective is to ensure that production is executed with optimal efficiency, adherence to predetermined quality standards, and timely completion. Organizations utilize C4 Policy, a platform or framework, to create, implement, and manage policies that govern a variety of organizational operations, behaviour, and decisions. The policy system may encompass various stages, such as policy determination, policy drafting, organization-wide communication, implementation monitoring, policy evaluation, and revision in response to internal and external changes. The objective is to establish guidance, oversee conduct, and ensure uniformity in decision-making across the entire organization in alignment with the vision, mission, and values of the company.

The D1 Employee System is a comprehensive platform utilized by companies to oversee and organize employee-related information and activities effectively. This encompasses personal information, work experience, job performance, frequency of absence, salary administration, attendance, and other relevant data pertaining to human resources. This system facilitates workforce management, performance evaluations, schedule organization, employee benefits administration, and monitoring of crucial aspects of the company-employee relationship. The objective is to enhance efficacy in human resources administration and offer employees an improved work experience. The D2 Finance System is a comprehensive platform utilized by companies to oversee and control all financial operations effectively. This encompasses activities such as documenting monetary transactions, generating financial reports, overseeing budgetary matters, managing accounting processes, facilitating payments, and monitoring the flow of cash and assets. This system facilitates efficient financial management, enables financial analysis, ensures compliance with financial regulations, and supplies the necessary information for making strategic decisions regarding company finances. The objective is to guarantee the company's fiscal well-being and effective fiscal administration. The D3 KPI Employee System is a tool utilized to assess and analyse Key Performance Indicators (KPIs) or performance indicators of employees within an organization. This system enables companies to establish, monitor, and evaluate employees' attainment of pre-established objectives. The KPI Employee System enables companies to develop and oversee performance indicators aligned with the organization's strategic goals. It allows for the systematic measurement of employee performance, provision of feedback, and ongoing enhancement and advancement of employee performance. The aim is to enhance productivity, improve work quality, and augment employee contribution to the company's success. The D4 Sales and Marketing System is a platform utilized by companies to oversee and synchronize their sales and marketing endeavours effectively. This encompasses the supervision of sales procedures, execution of marketing campaigns, cultivation of customer connections, analysis of market trends, and formulation of marketing and sales tactics. This system facilitates the monitoring of sales processes, the management of customer information, the automation of marketing tasks, the evaluation of campaign performance, and the enhancement of customer interactions for companies. The objective is to enhance sales, broaden market penetration, enhance customer satisfaction, and optimize the efficiency and efficacy of sales and marketing endeavours.

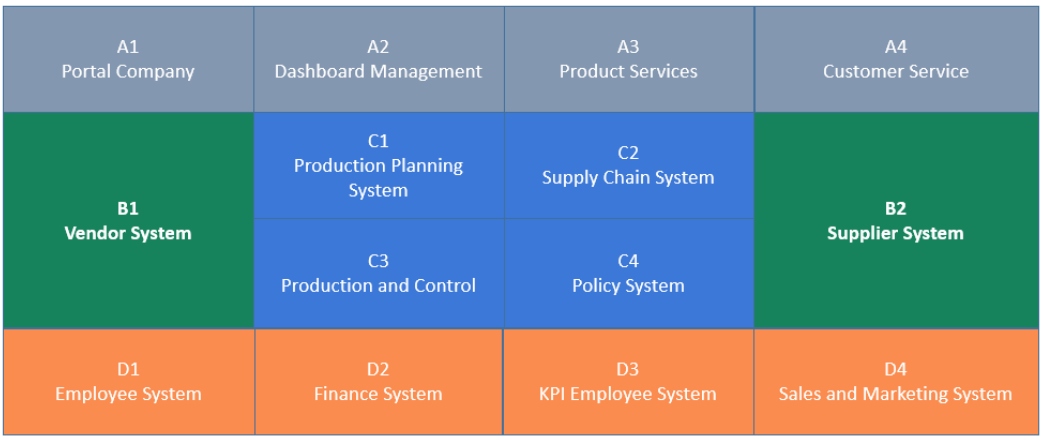

Figure 2. Application Architecture
Source: Researcher Property

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 8, Number 1, January 2024
DOI : https://doi.org/10.33395/sinkron.v9i1.13256
e-ISSN : 2541-2019
p-ISSN : 2541-044X

The application architecture, depicted in Figure 2, comprises several critical systems that fall within the focus of the organization. The Company System Portal serves as the primary entry point for the organization to engage in communication with its suppliers, customers, and other relevant stakeholders. The Dashboard Management System integrates data and metrics from various systems to provide visibility into the overall performance of the organization. The Customer Service System assists with customer service, whereas the Product Services System streamlines the administration of the organization's products and services. Vendor and supplier systems are concerned with the organization's interactions with external parties that supply it with goods or services. To ensure a streamlined production process, Supply Chain and Production Planning Systems are essential to supply chain and production management. The purpose of the Production and Control System is to ensure quality and efficiency by monitoring and controlling the production process. The Policy System is responsible for overseeing the internal policies of the organization.

In contrast, the Employee System is tasked with monitoring information pertaining to employees, including personal data, performance, and human resource management. The Finance System is concerned with the financial management of an organization. The KPI Employee System facilitates the evaluation and monitoring of employee performance in accordance with pre-established key performance indicators. Ultimately, the Sales and Marketing System serves to streamline the sales and marketing endeavors of the organization. By integrating these systems, businesses can increase the efficiency of their operations, enhance their resource management, fortify their relationships with customers and suppliers, and boost their overall performance.

Data Architecture

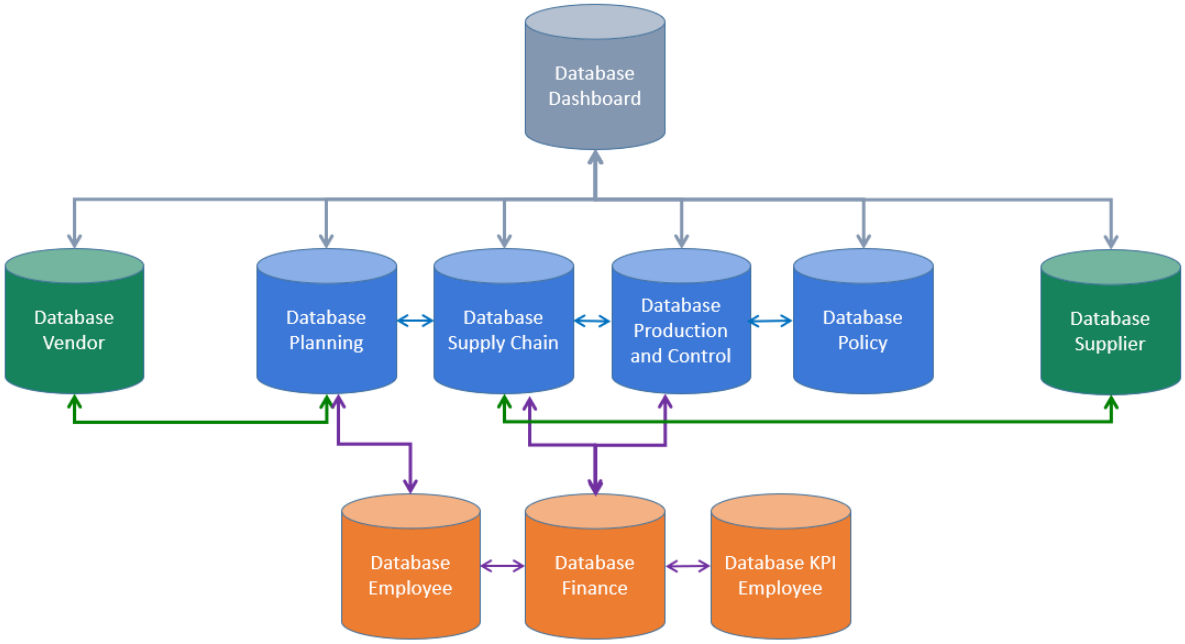

Figure 3. Data Architecture
Source: Researcher Property

Figure 3 depicts the application architecture, which is comprised of multiple databases responsible for managing crucial information within the company's domain. The Company Database Portal serves as the primary platform for accessing data and facilitating interaction among different entities within the company, including employees, customers, and suppliers. The Dashboard Management Database offers a comprehensive perspective on company performance by consolidating data from multiple sources, delivering a unified view of operational and strategic elements. The Product Services Database is

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 8, Number 1, January 2024 e-ISSN : 2541-2019
DOI : https://doi.org/10.33395/sinkron.v9i1.13256 p-ISSN : 2541-044X

responsible for overseeing data pertaining to the company's product and service offerings, whereas the Customer Service Database deals explicitly with information concerning customer service. The Vendor Database and Supplier Database manage data pertaining to external entities that supply products and services to the company. The Production Planning Database and Supply Chain Database significantly facilitate the oversight of production processes and supply chains. The Production and Control Database oversees and manages data pertaining to supervision and control within the production process, with the aim of ensuring optimal quality and efficiency. The Policy Database serves as a repository for internal company policies, while the Employee Database oversees employee-related information, including personal data, performance, and human resource management. The Finance Database primarily emphasizes the management of corporate finances. The KPI Employee Database facilitates the monitoring and evaluation of employee performance by utilizing predetermined key performance indicators. The Sales and Marketing Database is responsible for overseeing and organizing data pertaining to the company's sales and marketing endeavors. This database integration facilitates streamlined information management, enhances customer service, optimizes supplier coordination, and enables comprehensive monitoring and enhancement of overall company performance.

DISCUSSIONS

This serves as the foundation for the study's research question: In what ways can the integration of TOGAF into automotive manufacturing systems facilitate process innovation in response to rapid market changes, enhance intersystem coordination, and simplify IT infrastructure? (RQ 1).

The development of the research inquiry provides a solid basis for the investigation into how the Open Group Architecture Framework (TOGAF) is incorporated into automotive manufacturing systems. The primary research objective of this study is to determine how the integration of TOGAF into automotive manufacturing systems can simplify IT infrastructure, improve intersystem coordination, and facilitate process innovation in response to rapid market changes. The primary objective of this study is to determine how TOGAF, a well-established framework, can act as a catalyst for process innovation in the ever-changing automotive manufacturing industry. The dynamic nature of market demands requires organizations to adopt a flexible and inventive strategy. The incorporation of TOGAF will likely be instrumental in empowering businesses to react expeditiously and efficiently to these shifts.

Additionally, the research inquiry pertains to the critical need to improve intersystem coordination in the domain of automotive manufacturing. The structured framework of TOGAF can integrate previously dissimilar systems, thereby promoting a more unified and collaborative operational atmosphere. Anticipated results include enhanced interdepartmental collaboration, improved supply chain management, and streamlined production processes—all of which are potential contributors to a more streamlined and efficient automotive manufacturing ecosystem. Furthermore, the research inquiry explores the potential for streamlining IT infrastructure by incorporating TOGAF. Frequently, the adaptability of automotive companies to emerging technologies is hindered by the fragmentation and complexity of their current IT infrastructures. The purpose of this study is to investigate how organizations can strategically reorganize their IT environments to increase their efficiency and focus. Consequently, it is anticipated that the organizations will be more prepared to adapt to ongoing technological progress, thereby facilitating a more flexible adjustment to the ever-changing demands of the automotive sector.

Fundamentally, the research inquiry establishes an all-encompassing course of action for examining the incorporation of TOGAF into automotive manufacturing systems. The framework functions as a guide for analyzing the diverse effects of TOGAF, encompassing not only its capacity to facilitate process innovation but also its function in promoting coordination among disparate systems and streamlining complex IT infrastructures. The primary objective of this study is to provide significant contributions that can influence industry practices and, ultimately, assist automotive manufacturers in effectively managing the intricacies of a swiftly changing market.

What are the effects of integrating the TOGAF framework into the information technology infrastructure, data architecture, application architecture, and business architecture of automotive

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 8, Number 1, January 2024 e-ISSN : 2541-2019
DOI : https://doi.org/10.33395/sinkron.v9i1.13256 p-ISSN : 2541-044X

manufacturing systems? Specifically, how does this integration affect the adaptability of these systems to evolving technological demands and consumer preferences? (RQ 2).

The incorporation of the TOGAF framework into the information technology infrastructure, data architecture, application architecture, and business architecture of automotive manufacturing systems significantly affects their adaptability to shifting consumer preferences and technological demands and consumer preferences. TOGAF's integration primarily streamlines the complex IT landscape within automotive systems, which is part of the information technology infrastructure. It facilitates the establishment of a logical and organized system, allowing for quick adjustment to new technologies. The redesigned infrastructure becomes inherently more adaptable, enabling automotive manufacturers to respond to evolving technological trends promptly.

TOGAF's integration in the field of data architecture enables a more uniform and unified method for data management. It ensures uniformity and compatibility among different data sources, thereby improving the accessibility and usability of important information. The implementation of this standardized data architecture enables automotive systems to quickly adjust to emerging data-driven technologies and analytics, allowing them to extract valuable insights and respond proactively to market fluctuations. Similarly, the incorporation of TOGAF into application architecture promotes a method of application development and deployment that is both modular and scalable. The modular structure facilitates the seamless incorporation of new applications and functionalities, allowing automotive manufacturers to embrace and customize cutting-edge technologies quickly. Furthermore, it improves the compatibility of various applications, facilitating smooth cooperation and adaptability to evolving consumer preferences.

Furthermore, TOGAF's integration lies at the heart of the business architecture, resulting in strategic alignment and enhanced clarity in business processes. It offers a comprehensive perspective on the organization's goals, activities, and assets, facilitating better-informed and adaptable decision-making. The organized business framework guarantees that the automotive manufacturing systems are well-positioned to quickly adapt and synchronize their strategies with changing consumer preferences and market demands. The incorporation of TOGAF in the critical areas of information technology infrastructure, data architecture, application architecture, and business architecture enhance the flexibility of automotive manufacturing systems. It promotes agility by establishing a unified structure, standardizing procedures, and improving compatibility. This strategic integration enables automotive manufacturers to foresee, embrace, and efficiently adapt to technological changes and evolving consumer preferences, ensuring their significance and competitiveness in a dynamic market environment.

CONCLUSION

Orders, Work Orders, History Orders, History Processes, and Next Orders manage business planning. Work Instructions, Release Work Orders, Internal System Updates, Order Tracking, Schedule Plans, and Resource Status are manufacturing execution tasks. The Process Control System controls production processes by focusing on People, Devices, Machine Status, and Process Status. Critical systems in the application architecture include the Company System Portal, Dashboard Management System, Customer Service System, Product Services System, Vendor and Supplier Systems, Supply Chain and Production Planning Systems, Production and Control System, Policy System, Employee System, Finance System, KPI Employee System, and Sales and Marketing System. Businesses can improve efficiency, resource management, customer and supplier relations, and performance by integrating these systems. Multiple databases manage critical company data in the data architecture. The Company Database Portal allows collaboration, while the Dashboard Management Database shows company performance. The product Services Database contains company product and service data, while the Customer Service Database handles customer service. The Vendor and Supplier Database handles external data. The Production Planning and Supply Chain Database aids production and supply chain management. The KPI Employee Database helps assess and track employee performance.

*name of corresponding author

REFERENCES

Afarini, N., & Hindarto, D. (2023). *The Proposed Implementation of Enterprise Architecture in E-Government Development and Services*. *3*(December), 219–229.

Amanda, D., Hindarto, D., Indrajit, E., & Dazki, E. (2023). Proposed use of TOGAF-Based Enterprise Architecture in Drinking Water Companies. *Sinkron*, *8*(3), 1265–1277. https://doi.org/10.33395/sinkron.v8i3.12477

Cao, R., & Iansiti, M. (2022). Digital transformation, data architecture, and legacy systems. *Journal of Digital Economy*, *1*(1), 1–19. https://doi.org/10.1016/j.jdec.2022.07.001

Carrera, L., Brullet, N., Capomaggi, J., Santacana, A., & Devesa, R. (2024). *The impact of architecturally qualified data in deep learning methods for the automatic generation of social housing layouts*. *158*(July 2023).

David, H. (2023). *Electricity System Built on Cyber-physical Enterprise: Architecture Analysis*.

Gill, A. Q., Bunker, D., & Seltsikas, P. (2011). An empirical analysis of cloud, mobile, social and green computing: Financial services it strategy and enterprise architecture. *Proceedings - IEEE 9th International Conference on Dependable, Autonomic and Secure Computing, DASC 2011*, 697–704. https://doi.org/10.1109/DASC.2011.122

Hindarto, D. (2023a). *Blockchain-Based Academic Identity and Transcript Management in University Enterprise Architecture*. *8*(4), 2547–2559.

Hindarto, D. (2023b). The Management of Projects is Improved Through Enterprise Architecture on Project Management Application Systems. *International Journal Software Engineering and Computer Science (IJSECS)*, *3*(2 SE-Articles), 151–161. https://doi.org/10.35870/ijsecs.v3i2.1512

Hindarto, D., Indrajit, R. E., & Dazki, E. (2021). Sustainability of Implementing Enterprise Architecture in the Solar Power Generation Manufacturing Industry. *Sinkron*, *6*(1), 13–24. https://jurnal.polgan.ac.id/index.php/sinkron/article/view/11115

Hirota, T., Kishita, Y., Tsunezawa, M., & Sugiyama, K. (2023). *Developing Architecture for Platform-based Circular Economy Business : An Exploratory Study*. *105*(March), 642–647.

Li, H., Zhang, Y., & Li, Y. (2023). *The impact of digital inputs on pollution reduction in Chinese manufacturing enterprises*. *428*(February).

Nardello, M., Han, S., Møller, C., & Gøtze, J. (2020). *Incorporating process and data heterogeneity in enterprise architecture: Extended AMA4EA in an international manufacturing company*. *115*.

Oberle, M., Yesilyurt, O., Schlereth, A., Risling, M., & Schel, D. (2023). Enterprise IT Architecture Greenfield Design Combining IEC 62264 and TOGAF by Example of Battery Manufacturing. *Procedia Computer Science*, *217*(2022), 136–146. https://doi.org/10.1016/j.procs.2022.12.209

Pasa, M., & Mergen, A. E. (2021). *Smart manufacturing in intelligent digital mesh: Integration of enterprise architecture and software product line engineering*. *22*(November 2019).

Titi, R., Sari, K., Hindarto, D., & Nasional, U. (2023). *Implementation of Cyber-Security Enterprise Architecture Food Industry in Society 5 . 0 Era*. *8*(2), 1074–1084.

Tutaj, J., Rutkowska, M., & Bartoszczuk, P. (2021). Enterprise business architecture as a tool for sustainable development in an enterprise - Case study. *Procedia Computer Science*, *192*, 5050–5057. https://doi.org/10.1016/j.procs.2021.09.283

Yang, L., Wang, T., Sun, B., Guo, J., Li, H., Wang, T., Sun, B., Guo, J., & Li, H. (2023). *Big Data Architecture Design of Smart Grid Based On Big Data Platform*. *00*.

*name of corresponding author