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# Application and Data Integration Based on Services Oriented Architecture in Enterprise

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**Abstract**

Business process changes occurred very often in organizations to maintain business continuity, which had an impact on information changes and process flow improvements. There are numerous companies that have problems managing data, information, and software applications, especially with the constant demands for employee information. This research objective is to integrate data and applications based on service-oriented architecture (SOA) by using the service-oriented modelling architecture (SOMA) software development method to solve the problem of producing updated and real-time information practically required by organization functions. This research result shows this implementation can help analyze the company's business model by generating information needs and service candidates that refer to SOA concepts. This implementation also gives a solid integration of in-house applications with different platforms and data sources from different databases with real time information. From a technical point of view, this implementation also reduces the duplication of business process functions and in-house application management, as well as simplifying and accelerating the creation of new or updating in-house applications related to new information requirements of the company. It was found that the SOMA framework can also be employed as a reference for companies developing future applications with SOA basics.

**Keywords:**
Service Oriented Architecture;
Implementation;
SOMA Framework;
In-house Application;
Oil and Gas Company.

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## 1- Introduction

The company has always tried to develop business with various strategies, one of which is information system implementation to support the company in achieving its target. Enterprise information system (EIS) as an information system that has a common central database and supports activities in multiple departments of the enterprise through integrating the functional information systems to improve their business performance and decision making by enabling them to seamlessly share data among departments and with external business partners [1]. Organizations on the scale of large enterprises cannot run efficiently without the support of information systems and usually experience problems related to managing data, information, and application software. With the addition of new business units and various kinds of business process activities, the information needs of the organization will also follow the update with various application function needs. Activities and data that continue to increase in each business unit were triggering problems in managing data and application software. The differences between internal application technology causes applications cannot exchange data in real time, information is outdated and often duplicated, so it became difficulties to make decisions in data processing.

Automation occurs as a decision-making requires fast time to get benefit from every opportunity. Operating in the business world necessitates agility, time, resources, and the ability to turn a company into one that is flexible and real-time online [2]. Service-Oriented Architecture (SOA) design for decision-aware information systems, enhancing the

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modeling of decisions and processes, improves integrated process-decision modeling in terms of scalability, maintainability, flexibility, and understandability of the decisions [3].

Besides the importance of IT for companies, IT can also give negatively company productivity impact by creating a silo. Mistakes in the use of IT can build a large silo system between leaders and employees that leads to business failure. Silos occur owing to a lack of interaction and communication that occurs within groups or parts of the organization [4]. One type of application development is the concept of monolithic development. The concept of monolithic development is a traditional way of developing applications that have a single code-based / repository database and have dozens or hundreds of services [5]. Applications developed in a monolithic way would be difficult to integrate with other systems and lack coordination in development. Business process development in this way has failed to meet the rapidly changing business needs. Besides that, the silo and monolithic development is not able to adapt to market changes and keep up with business changes [6].

Based on that explanation and the data in the field, the company currently has the same condition, where the application development is still silo and monolithic with different technologies. These conditions have an impact as problems for the company. The difference between internal application technologies that cause applications not to be able to exchange data in real time due to differences in technology used where there are the same data requirements. Information was not synchronized and duplicated between one application and another. This is because applications in the company still use a single data source. There are duplicate functions in several applications. Application development that is rigid towards changes in business processes. If there are changes in business regulations, the function in each application must be changed one by one. Each application has its own management.

The problems of each application arise when the entire application starts to grow large, so it takes a large and difficult effort when a department wants to make additions, change business processes, and provide data in real time. In this study, the authors implemented and analyzed changes in the concept of application development that currently exists for application development using the SOA approach. SOA is a form of technology architecture that adheres to the principle of service orientation. When realized through a web service technology platform, SOA establishes the potential to support and promote these principles throughout the business processes and domain automation of a company. SOA is a term that represents a model in which automation logic is decomposed into smaller and more distinct logic units. SOA is a design principle that represents heterogeneous and distributed capabilities, like methods or applications, as services that are platform- and application-independent [7]. SOA encourages individual logic units to exist independently but not in isolation [8]. In SOA, logic units are known as services. These services can be used by various application platforms, can be used repeatedly, and are easier to maintain because of their independent nature. The services provided will be in the form of a web service. The SOA paradigm allows for configuration at startup or run-time. When the subscription to a service is specified at design time, the communication path is instantiated at startup by just subscribing to the well-known server(s) that provide the service [9].

The objectives of this study are that the authors analyze and integrate data from various separate application software in various units with changes to the current concept of application development using the SOA approach to analyzing the application business model to get information needs and service candidates using the service-oriented modeling architecture (SOMA) software development method to resolve the problems for the company. This research was conducted on oil and gas companies owned by the government that were previously owned and managed by foreign companies.

## 2- Literature Review

### *2-1- Service Oriented Architecture (SOA)*

According to Vernadat (2006) [10], SOA is based on the fundamental idea that information systems are considered as a collection of services that are easily accessible by users that can be connected and integrated dynamically to provide the desired solution [11]. The SOA approach seems to be a suitable candidate choice to address the complexities of establishing interoperability. SOA allows for more loosely coupled architectures that reflect collaboration between different autonomous systems, as opposed to tightly coupled classical systems and monolithic architectures. These autonomous systems are represented by services and have independent life cycles. Indeed, enterprise applications and internal processes can be packaged as services. A service is a key concept of the SOA paradigm. Companies need to manage the interaction between the public and the internal collaborative processes of the organization. Front and back information systems can be shared with company partners, but only a small part can be seen by the public, and most of the company's data and information systems cannot be seen by other partners due to confidentiality and strategic reasons for the company. SOA is the perfect solution to meet those expectations. SOA enables organizations to achieve the broad integration required through a software interface [12].

SOA is a form of technology architecture that adheres to the principle of service orientation. When realized through a web service technology platform, SOA establishes the potential to support and promote these principles throughout the business processes and domain automation of a company. SOA is the result of a long series of experiments in software engineering which tried to foster a reuse component. SOA is a new way of developing systems that drive changes from writing software programs to service integration and integration [13]. A number of key aspects of these principles are [8]:

- Loose coupling, services maintain relationships that minimize dependencies and only require them to maintain each other's existence.
- Service Contract, a service complying with a communication agreement, as defined collectively by one or more service descriptions and related documents.
- Autonomy, services have control over the logic they encapsulate.
- Abstraction, beyond what is explained in the service contract, the service hides logic from the outside world.
- Reusable, logic is divided into services with the aim of promoting reuse.
- Composability, a collection of services can be coordinated and collected to form composite services.
- Statelessness, the service minimizes the storage of information specific to an activity.
- Discoverable, services are designed to be descriptive outside so that they can be found and assessed through available discovery mechanisms.

The placement of SOA components is divided into 3 layers, namely the application, service, and business process layers. The application layer consists of existing artificial applications (legacy applications), sometimes referred to as legacy systems. A system can be broken down into smaller fragments to become a component. Components are the basic building blocks of service. The service layer is located between the business process layer and the application layer. Forms of business processes are so many and varied that represented as services which is serve many business functions and play many roles. The business process layer provides business logic. Logic is generally stated in the form of business processes. In the SOA context, business processes are implemented as service sequences, usually as service sequences that govern business services. Therefore, from an IT perspective, the realization of business processes can be considered a long-term application [14].

A service is a mechanism to allow access to one or more capabilities of a process that can be accessed through the service interface. Service interfaces hide the implementation of consumer services by creating service abstractions. A service is provided by a service provider. Service providers are responsible for providing service descriptions for each service. The description is based on the service interface and determines how to request the service and how to communicate with the service. The service communicates with the environment by means of sending messages [14]. The main standards for web services are extensible mark-up language (XML), web services description language (WSDL), and simple object access protocol (SOAP). XML is a special language that allows programmers to define data in any way the program can understand. Web services can also be used to standardize the commands sent by each program. The software component works by processing an order and some data sent to it. WSDL is a special language that explains all the commands and data that must be related to them that a software component will receive from other software components. SOAP is a standard language that allows software components to talk to each other [15].

In this research, we operated SOMA as a life cycle method in software development that was created and developed by IBM to design and build SOA-based solutions. This method defines key techniques and provides prescriptive tasks and detailed normative guidelines for conducting analysis, design, implementation, testing, and dissemination of services, components, flows, information, and necessary policies to successfully design and build robust and reusable SOA solutions in a company [16]. The SOMA design reflects a form of business service model that has been compiled and a decision on how the design is composed into applications using choreography. This method was targeted to give detailed guidelines to companies so they could develop SOA within the organization. In designing SOMA, there are three general steps, namely identification, specification, and realization of service [8], as shown in Figure 1.

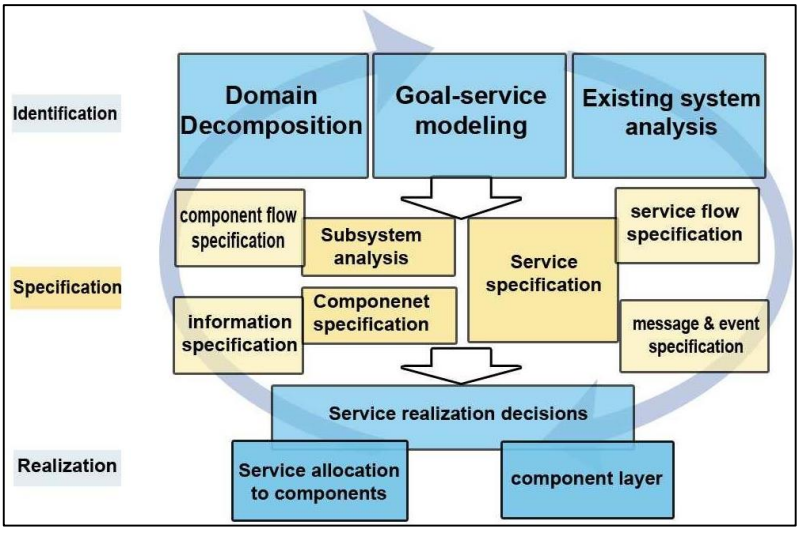



**Figure 1. SOMA Method [8]**

According to Arsanjani et al. (2008), in applying the SOMA method, there is a process life cycle that is shown in Figure 2 [16].

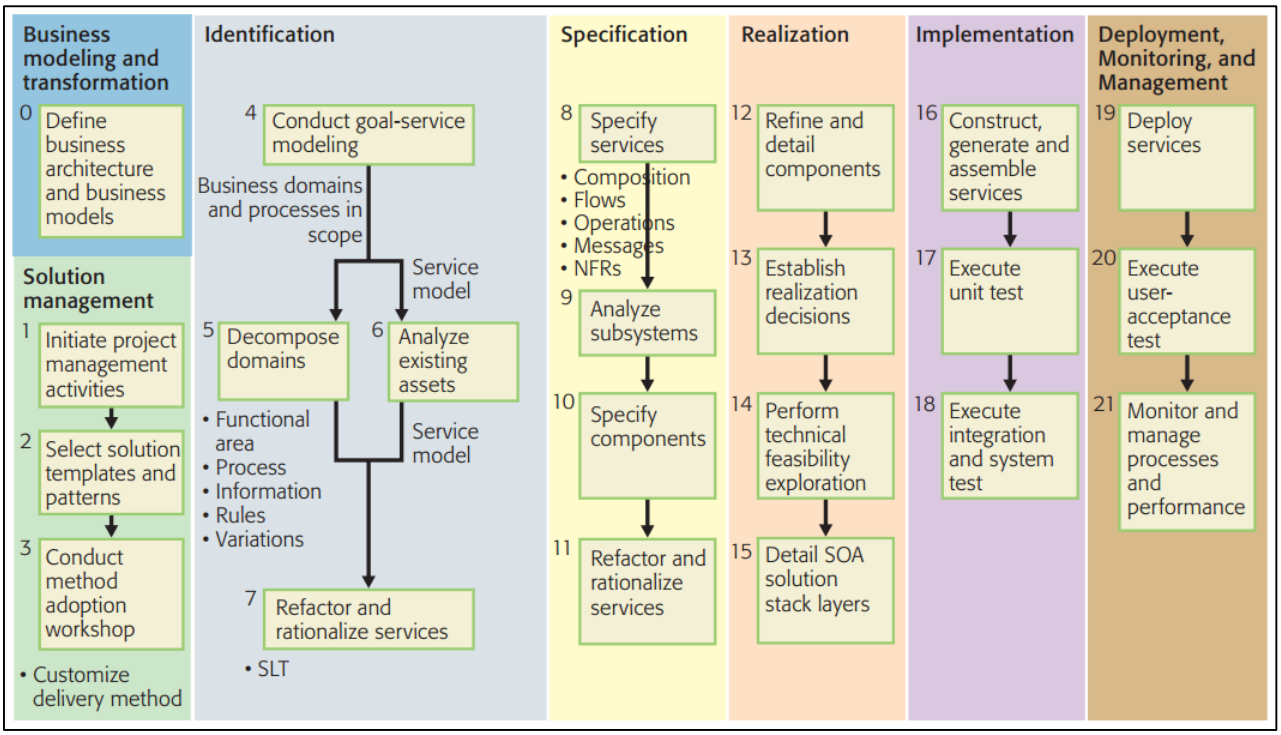



**Figure 2. SOMA life Cycle [16]**

### *2-2- Business Modelling and Transformation*

In this phase, the business is modeled, simulated, and optimized, and focus areas for change are identified that will drive the next set of processes [17]. To get an overall picture of existing business processes, the component business model (CBM) can be evaluated theoretically. CBM deconstructs business processes into business logic components based on their respective competencies that will be the focus for business process transformation [18]. The BPMN process model consists of activity nodes that show business events or work items carried out by humans or by software applications, and control nodes that capture the flow of control between activities. Activity nodes and control nodes can be connected through flow relations in a flexible way [19].

### *2-3- Solution Management*

We are gathering solutions during this phase. In the SOMA method, all types of SOA solutions are separated from the contents of variable methods that are dependent on the type of specific solution. Specifically, for each type of solution, a method template called a solution template is defined and externalized [17].

### *2-4- Identification*

This process consists of a combination of top-down, bottom-up, and middle-out domain decomposition techniques, analysis of existing assets, and modeling of service objectives in the goal-service modeling section to sharpen the focus of service creation [17].

### *2-5- Specification*

This activity starts when the service has been identified. It is important to start classifying services into a hierarchy that reflects the combined or fractal nature of services. The business services that have been modeled are further described based on service dependencies, flow and composition, operations, messages, and non-functional requirements. Classification helps determine composition and layering and regulates the construction of interdependent services based on a hierarchy. Classification also helps alleviate the "service proliferation syndrome," where an increase in the number of small-grained services can be defined, designed, and used with very little governance, resulting in large performance, scalability, and management problems. More importantly, service proliferation failed to provide useful services for businesses that made it possible for economies of scale to be achieved [17].

### *2-6- Realization*

This step determines the services provided must be selected or made specifically. Other options available include integration, transformation, subscription, and outsourcing as well as parts of functions that use web service [17].

### *2-7- Implementation and Deployment, Monitoring, and Management Phases*

This phase is the phase of building, producing, and assembling service, functional, and technical components that create services, components, and flow. In the deployment, monitoring, and management phases, the focus is on packaging, providing, carrying out user acceptance testing, and service deployment in the production environment [17].

### *2-8- Enterprise Information Systems*

EIS have been implemented or adopted in a lot of companies in general to achieve superior company performance and can be used for decision making over the last few decades, EIS is widely applied to companies listed as large companies. Is growing. EIS includes various application systems, mainly consisting of enterprise resource planning (ERP), supply chain management (SCM), customer relationship management (CRM), and knowledge management (KM) systems [20].

EIS as a discussion issue has attracted increasing attention in the corporate, organizational, and academic worlds in recent times. EIS refers to enterprise software, which is based on a suite of integrated software modules and a centralized database. EIS as a discussion issue has attracted increasing attention in the corporate, organizational, and academic worlds in recent times. EIS refers to enterprise software, which is based on a suite of integrated software modules and a centralized database [21]. EIS refers to a system that helps managers and companies improve company performance by enabling them to share data seamlessly between departments and with external business partners. Data analytics applied to the Internet and the Web is called Web analytics, which is a common form of website analysis. Web analytics focuses on the collection, analysis, and reporting of exchanged data on the internet and online customer behavior on a website by providing business solutions [22].

EIS as an enterprise system that can integrate functional systems such as accounting, finance, and marketing as well as operations [23]. Information systems can support activities in several departments at enterprises [24]. Referring to the definition of EIS, previous research can further define EIS as an information system that has a centralized database and can support activities in several company departments through the integration of functional information systems such as financial information systems, accounting, finance, marketing, and information systems for operational activities at companies [1].

### *2-9- Enterprise Architecture—with a Top-Down Approach to SOA*

IBM's enterprise architecture was developed to ensure an effective relationship between the company's business and the results of implementing Information Technology and the desired IT outputs. This analysis is a means to integrate business strategy, business processes, data, application software, and IT infrastructure. Enterprise architectural governance establishes rules and regulations to unify a design approach with a standardly published set of principles, architectural criteria, standards, and guidelines. SOA is integrated directly into the architecture system management process within IBM. IBM's enterprise architecture provides a top-down approach to IT that supports the alignment of IT with business objectives and combines SOA with enterprise architecture that allows SOA to share a top-down and business-aligned approach [25].

### *2-10- SOA in Supporting Business Transformation*

Business driving factors, such as customer satisfaction, changing market conditions, competitive threats, government regulations, and IT cost management, increase the need for increased responsiveness, speed, and flexibility of IT. Other overarching business objectives, such as creating "business on demand" and rapidly diverting resources to growth opportunities, were also important elements influencing IBM's internal SOA strategy [25].

## 3- Research Model

This research is going to use a framework based on the SOMA. Figure 3 is a series of frameworks that are used to build SOA in company. Field data collection activity consisting of background problems and business processes definition in the company. This data collection is done by interviewing IT leaders, business analysts, and application developers and participatory observation, which is the writer went directly to the field with business analysts in reviewing the conditions of business processes and IT development in company. Obtained data are the company's vision and mission, the company's organizational structure, the functions of each organization within the company, the business process, the application development cycle, and the system that is running.

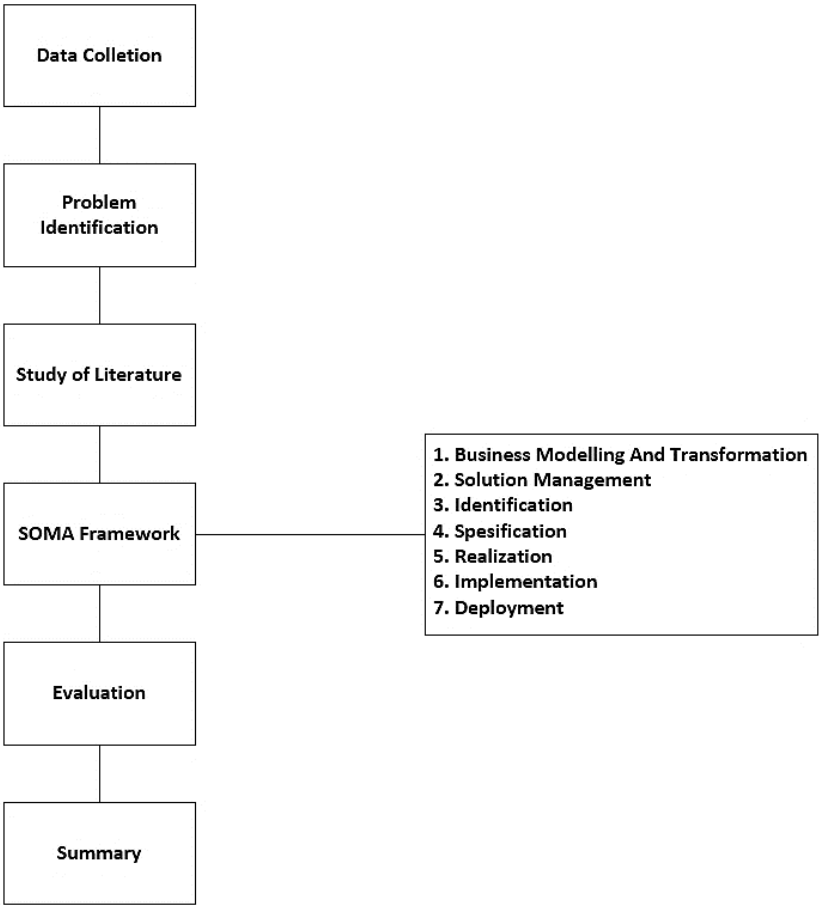



**Figure 3.** **Research flow**

## 4- Result and Discussion

The process of implementing the SOMA framework in designing in-house applications with a SOA approach based on the application of problems that have been collected at the problem identification stage, formulated and solutions taken using the concept of SOMA. In Figure 4 it is explained that upstream is the main business process owned by company. Upstream industry is the initial stage of oil and gas processing including exploration and production activities. The company needs supporting business processes in carrying out its main activities. The supporting process on the company's business map above is in the global corporate function.

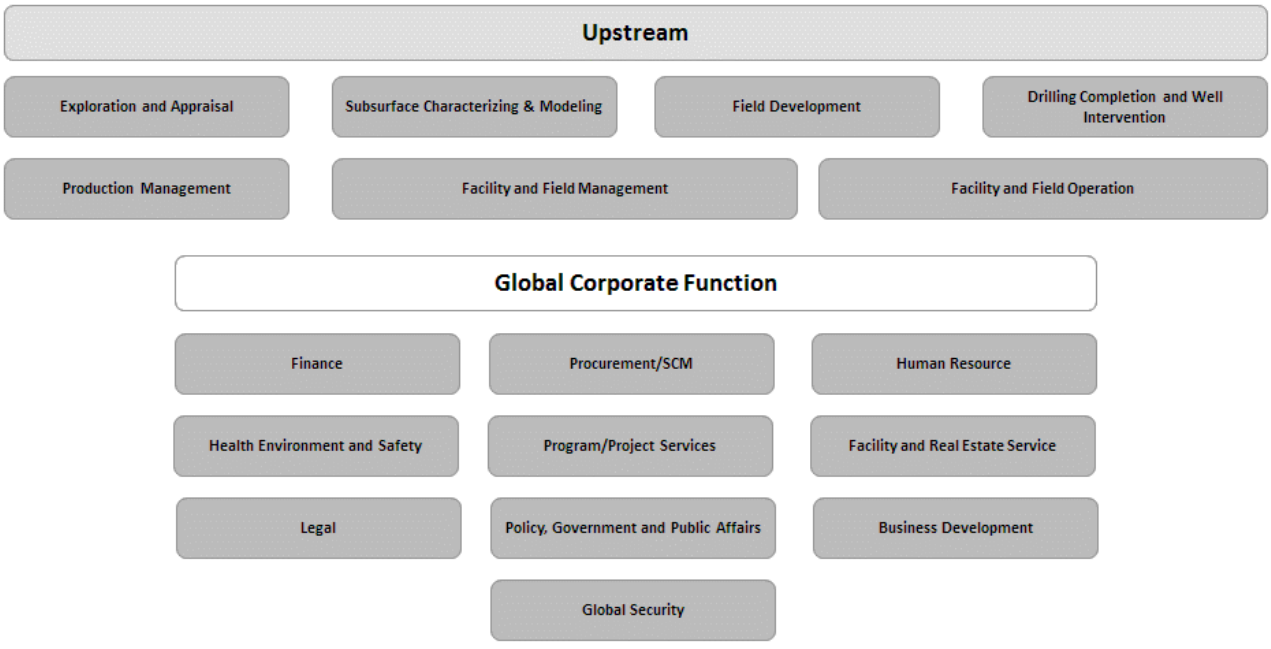



**Figure 4.** **Company Business Map**

This research focused on business components in the global corporate function. The development of several internal applications in the global corporate. To simplify operational activities and meet the needs of users of each function, the ERP and business apps team will support the creation of business solutions using information technology. To support the global corporate function, the company has 10 in house applications. In this research take 4 application ETRAVEL, CLARA, STAR, and HR Dashboard which are represent human resource and finance function to be focused.

### *4-1- Business Modelling and Transformation*

Applications that are referred to are translated into business models and components using CBM. From the diagram in Figure 5 shown below, it can be explained that the employment data is very important to be useful in all applications that have been running the company's daily operational activities.

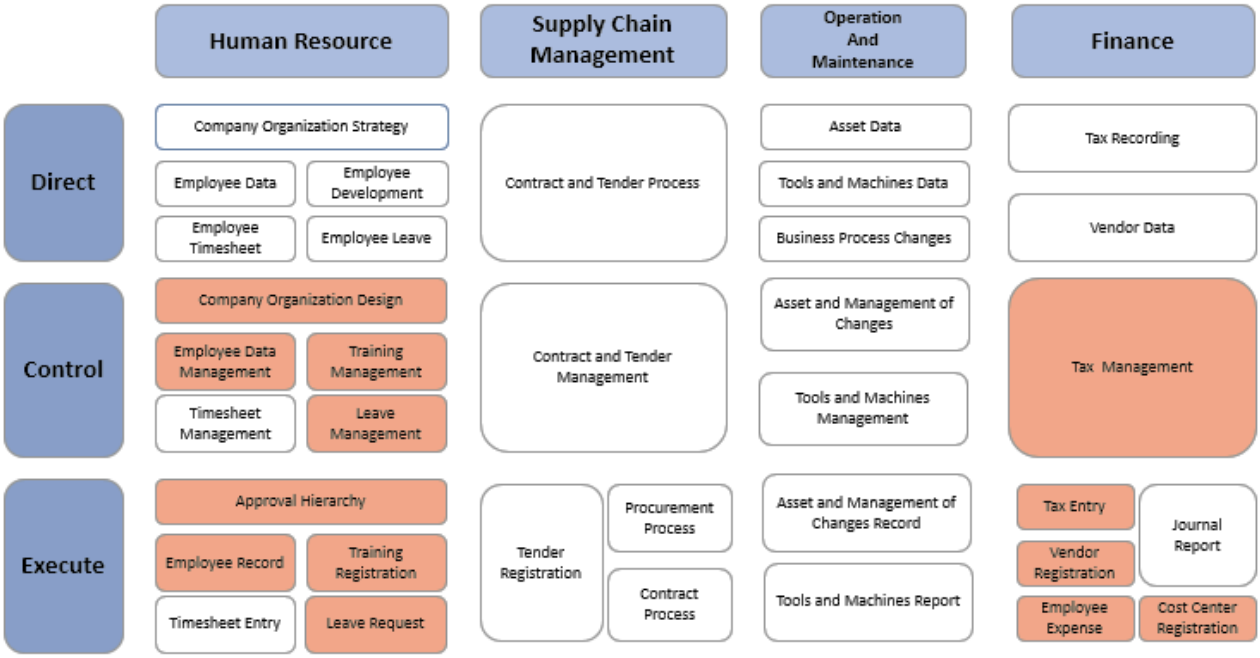



**Figure 5. CBM Diagram**

In the CBM diagram, business components were obtained from existing applications. In this research, the main focus of the study is on the components marked in red. Having obtained applications that are the focus of research, at this stage, business process modeling is carried out using BPMN. The business process description is carried out in detail by describing the business logic of each existing process for each application.

In this study, choosing to focus on several applications, application names are CLARA, ETRAVEL, CAROL, and STAR applications. There is one other focus on the HR Dashboard, which is a sharing point that is useful for sharing information related to employee data. The selection of this application focus is based on interviews with IT business analysts regarding the level of data requirements, differences in the application technology platforms used, the use of a database server built separately that makes duplication of the same information, and the logic of application functions considered to be duplicated. Table 1 explains the function, main focus of the business component, and applications.

**Table 1. Applications**

| Function | Business Component | Application Name |
|---|---|---|
| Human Resource | Approval Hierarchy | CLARA, ETRAVEL |
| | Employee Data Management | HR Dashboard |
| | Training Management | CLARA |
| | Leave Management | ETRAVEL |
| Finance | Tax Management | STAR |
| | Vendor Registration | STAR |
| | Employee Expense | STAR |
| | Cost Center Registration | STAR |

This stage also defines the business process modeling notation for the focused applications. The business process description is carried out in detail by describing the business logic of each existing process for each application.

### *4-2- Solution Management*

Based on the description of business processes in the previous section of business modelling and transformation, the problems experienced by the development of enterprise applications are the lack of integration between enterprise applications. All applications will then be connected to an integration layer for sending or requesting one or a set of information. An integration layer is built, in which there is a set of web services that are grouped according to the function of the business process. This web service performs business logic that is different and unique according to its designation. To realize the architecture as the solution chosen, the technology plan that will be used is shown in Table 2.

**Table 2. Solution**

| Application/Web Service | Technology | Database |
|---|---|---|
| Central | .Net MVC 4 C# | SQL Server |
| Michelle | ASP .Net Web Service (asmx) C# | SQL Server |

### *4-3- Identification*

Based on the problems found in the field, the goal service to be determined is that this SOA-based system can integrate different platforms and database applications that are able to make it more adaptive to business changes, provide convenience, and speed up its development. At this phase also done process domain decomposition based on application process using use case. Figure 6 is a sample of domain decomposition.

### *4-4- Specification*

This phase describes the relationship between data and services that are part of the entire business process and that occur between the applications studied in more detail. The data linkages show how services that have been collected in the previous stage are processed and exchange data between applications. Interrelated data will be mapped in the domain modeling stage. The component specification process maps the services that are obtained to the business processes that use them. Figure 7 shows the service layer and component layer as the result of this phase.

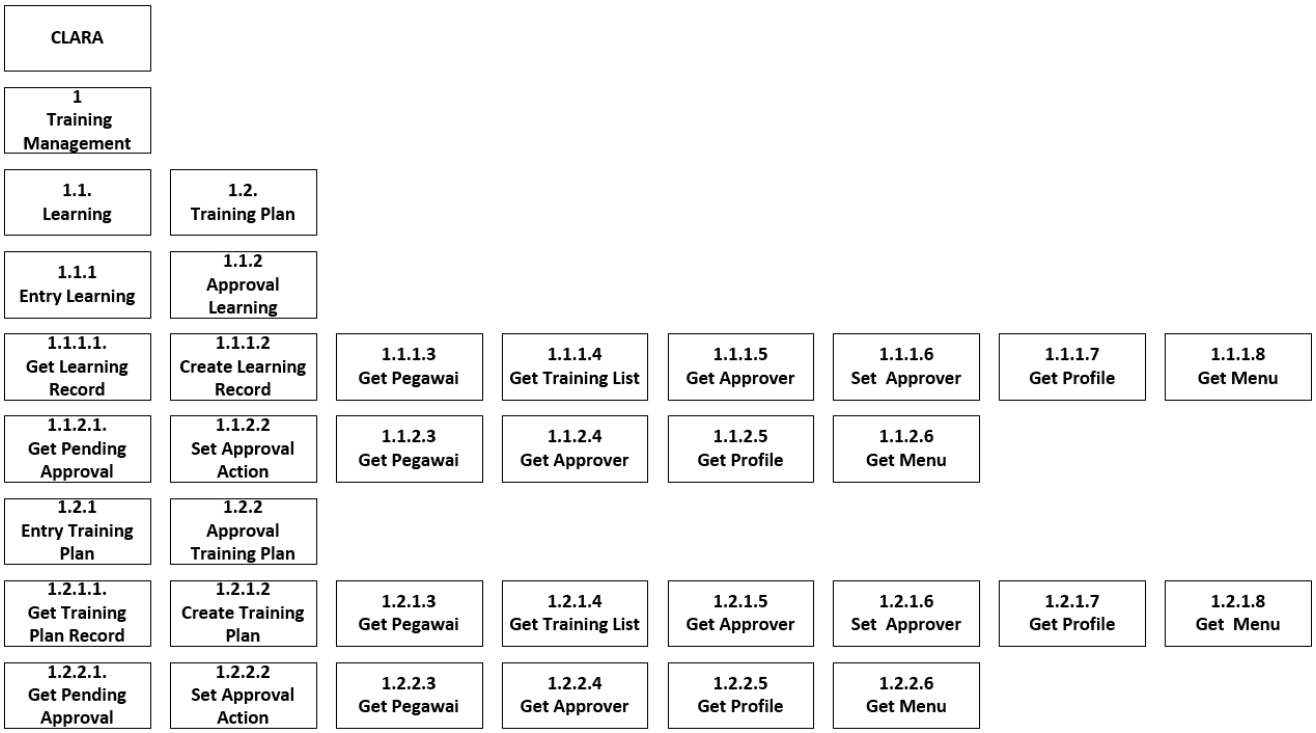



**Figure 6. Domain Decomposition**

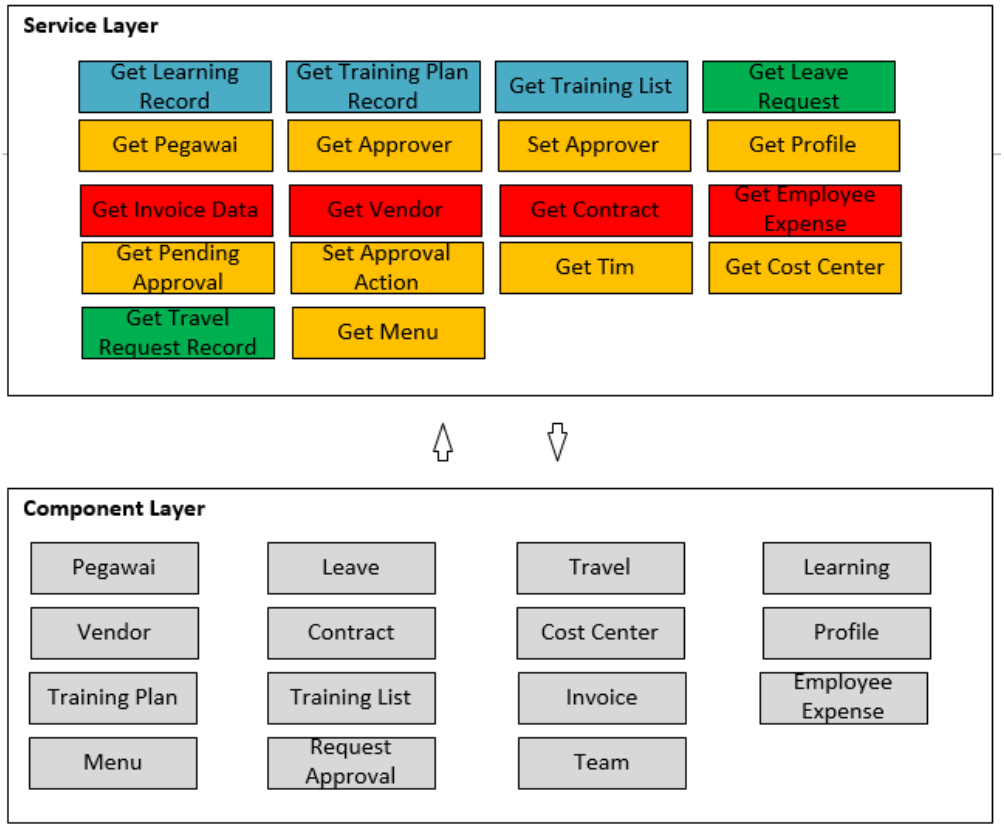
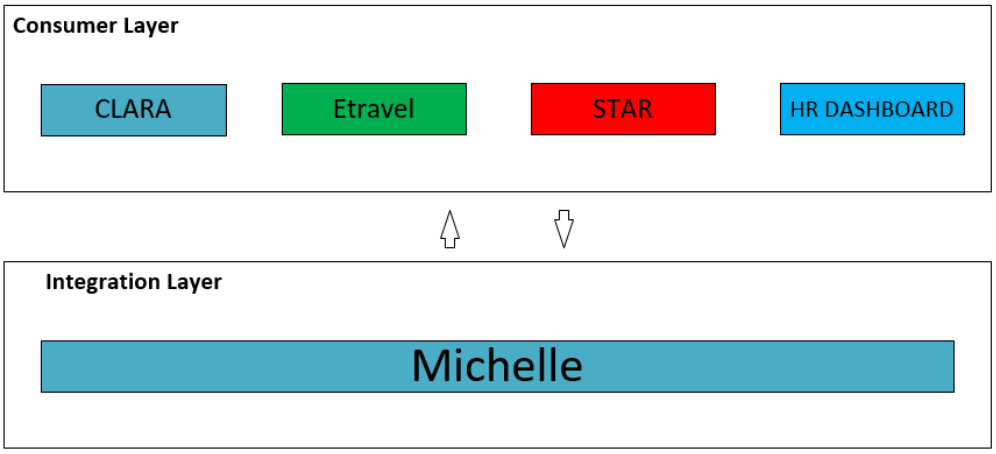



**Figure 7. Service and Component Layer**

### *4-5- Realization*

At this stage, determine the integration of services that will be implemented in a SOA environment that is built by exploring the feasibility of service testing. The author analyzes and tests each service based on the nature of the service to be designed from the beginning so that it can be developed in the future following the prevailing business changes. In this stage, the author describes the details of the flow of the relationship between users, services, and components. At this stage, all the services that have been determined are approved to be applied to this SOA based on existing business needs. This stage also defines and merge parts between the service layers, layer components to find the operational layer in detail.

This definition describes the applications that perform data processing based on each business function. The relationship between layer components and operational layers is a component of the data model used in a business process. At this stage, we are also detailing the entire set of layers based on the SOA Reference Architecture in detail. This breakdown illustrates the SOA architecture model in building the integration of enterprise in-house applications, as shown in Figure 8.



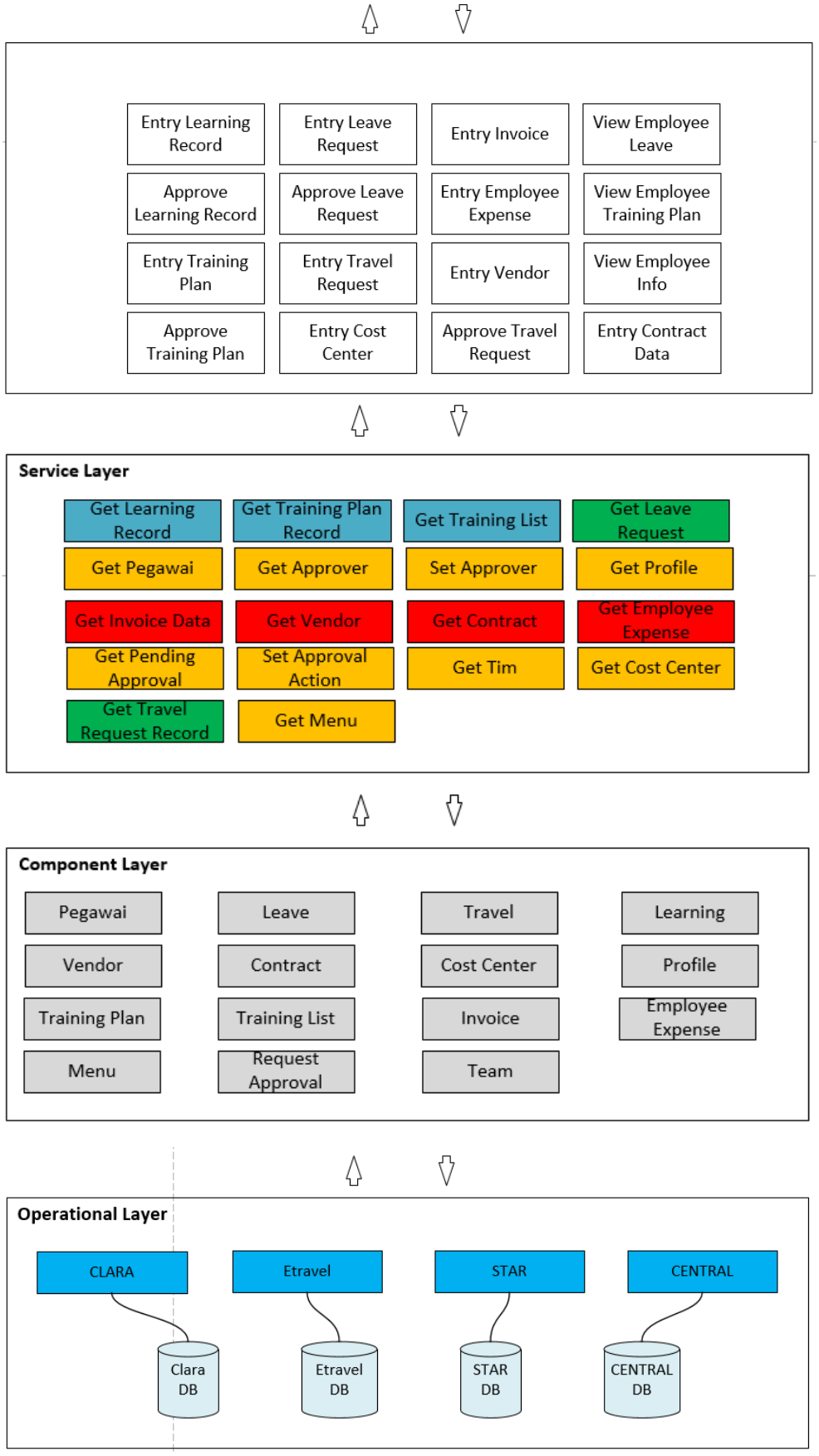



**Figure 8. SOA Reference Architecture**

The operational layer consists of in-house applications that already exist and are the focus of integrating the data in this study. Applications in the operational layer perform data processing based on each business function to produce a data model that will be used by the web service that will be functioned by its users. The Component Layer section

describes the relationship of the component layer to the operational layer. This link shows the interrelationship of the data model used in a business process for each in-house application.

The service layer section describes the service provider processes that can be accessed by in-house applications. These services have input parameters to be processed according to predetermined business logic and provide output in the form of a data model that represents a component. The business process layer describes a collection of business activities that were born from the applications that are the focus of this research. Each business process illustrates its relation to the application in carrying out business logic that will be performed by a web service. Changes in business process logic are also carried out in implementing web services that will be built in this SOA environment. Integration layer serves to connect applications in conducting business processes and realize data integrity in the SOA environment.

In the process of linking, it will use web service technology that will be built using ASP .Net Web Service with the concept of RESTFUL, which will issue a JSON model format in each of the business logic results therein. This JSON format can be used by various types of corporate in-house application platforms so that data exchange can be done between in-house applications. The consumer layer describes the collection of enterprise in-house applications that interact with SOA-based business services, so that this picture shows the integration of all applications involved in the SOA environment. Integration between applications occurs in communication and data exchange.

### *4-6- Implementation and Deployment, Monitoring and Management Phases*

At this stage it is necessary to determine the technology to be used from the software in accordance with the rules of the company that shown on Table 3.

**Table 3. Technologies**

| Name | Fungsi |
|---|---|
| Visual Studio 2012 | Tools for developing Central and Web Service |
| Window Server IIS | Application and Web Service Server |
| ASP .Net Web Service | Web Service Technology |
| .Net MVC 4.5 | Application Technology |
| SQL Server | Database Server |

The Central Application was built to manage the integration of existing in-house applications. This application manages data components such as application user management, application menus, application access rights, and workflow approval of transactions carried out in in-house enterprise applications. As a form of managing in-house application integration, Central Application is a tool to monitor data integration through web services, both in terms of service contracts and data services. A service contract is a permit to use existing services. A service contract enables a consumer to register to use a web service that is available. The service contract mechanism is that the consumer will be registered and given a token code named APIKEY, which will be used in calling the service.

At this stage the creation of all web services that are approved to be realized and used by in-house company applications through construct and generate web service process, assemble web service process, unit test, and execute integration and system test. The construct and generate web service process stage is where we already have a list of services that will be built. Web service applications will use ASP .Net Web Service technology and are created using Visual Studio 2012 as the programming editor. This stage also tests the web service that has been created in the legacy application. This stage aims to ensure the web service can run well in accordance with the expected output of the parameters thrown.

At the deployment stage, web services that have been developed are published to the server and implemented in in-house applications that will use them. Before the web service was used completely, the implementation of SOA in in-house applications was tested by its users. In user testing, this is done in every application process according to the use case that has been designed by testing the input parameter to get the expected output. After conducting a user assessment test on the development environment, the results obtained indicate that the implementation of SOA is successfully functioning in the development environment. That web service that has been tested can be published to the production environment to be ready for use by users online.

Furthermore, at the monitoring and performance phase, the implementation of SOA in the integration of enterprise in-house applications, the results of this application provide a difference with the old concept in the development of existing in-house applications both in terms of business processes and technical development.

At the evaluation stage, we collect information from respondents in an effort to analyze the impact of SOA implementation on corporate in-house applications. This information collection uses a rating scale questionnaire given to respondents by giving several questions related to SOA implementation. Questionnaire in the form of an online

questionnaire distributed to IT managers, team leaders / assistant managers, business analysts, and programmers. The questionnaire focused on the results of the SOA design and implementation. The 18 respondents were people who were involved in either using the application directly or developing it. The respondents are considered to have known that the implementation of SOA has been carried out within companies. Table 4 shows the questionnaire results.

**Table 4. Questionnaire Result**

| No | Question | Score (Total) | Percentage | Criteria |
|---|---|---|---|---|
| 1 | SOA design can be a reference in developing in-house applications of the company in meeting the company's business needs. | 85 | 94% | Very Good |
| 2 | SOA implementation supports the ability to exchange data in real time between in-house applications on different platforms. | 82 | 91% | Very Good |
| 3 | SOA implementation synchronizes staffing data used by in-house enterprise applications with data accuracy in accordance with HR data. | 83 | 92% | Very Good |
| 4 | SOA implementation reduces duplication of business process functions and application governance. | 79 | 87% | Very Good |
| 5 | SOA implementation helps simplify and accelerate the creation of new or in-house applications for changes or new needs of the company's business processes. | 79 | 87% | Very Good |
| 6 | SOA helps make it easier to manage enterprise in-house applications related to managing user, profile, access rights, and workflow approval | 83 | 92% | Very Good |

To get the value of the criteria from the questionnaire, we must get an average percentage of all the average percentage criteria. Based on the responses to the questionnaire and the results of SOA design and implementation, an average criteria value of 91% is obtained, which is a very good criteria.

Testing was also done to see the difference between before and after the implementation of SOA. Table 5 shows the result of the loading time of the application process. The result is a faster data collection speed.

**Table 5. Application Testing Result**

| Apps | Web Service | Process | Loading Time Without SOA (in ms) | | | Loading Time Using SOA (in ms) | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 1 | 2 | 3 |
| Clara | Get_Learning_Record | Entry Learning Record | 58.73 | 59.03 | 55.76 | 51.22 | 50.65 | 51.33 |
| | Get_Training_Plan | Entry Training Plan | 54.39 | 56.20 | 55.95 | 52.31 | 50.08 | 50.66 |
| | Get_Training_List | Pemilihan Traiing List | 60.12 | 56.69 | 58.42 | 50.11 | 51.38 | 52.07 |
| Etravel | Get_Leave_Request | Entry Leave Request | 59.13 | 60.83 | 60.75 | 50.15 | 52.65 | 50.41 |
| | Get_Travel_Request | Entry Travel Request | 57.43 | 54.88 | 59.01 | 50.04 | 50.99 | 50.37 |
| | Get_Profle | Login | 76.03 | 64.01 | 64.36 | 52.86 | 53.71 | 52.04 |

## 5- Conclusion

The results obtained from this study is the implementation of SOA in the oil and gas company, that this application provide a difference with the old concept in the development of existing internal applications both in terms of business processes and technical development. The employee data is centralized in the central database. This makes it easy to adjust if there is a change in organizational data and also there is no outdated between one application and another because it is accessed through a web service that has the same source data. New applications only need to create functions that call certain web services. This makes it easier to handle changes in business processes because they only need to be made on the web service side without changing the function modules of each application. As a result, data collection speed is increased.

SOA implementation using the SOMA framework can help analyze a company's business model by generating information needs and service candidates that refer to the SOA concept. SOA implementation is able to integrate internal applications with different platforms and data sources from different databases. SOA implementation can support real-time data exchange between internal applications on different platforms as well as synchronizing staffing data used by internal applications that is considered appropriate and in accordance with company data. SOA implementation can help reduce duplication of business process functions and in house application governance. SOA implementation simplifies and accelerates the creation of new or internal applications updates to changes or new needs in the company's business processes. SOMA framework can be used as a reference for companies in developing future company in house applications with SOA basics.

## 6- Declarations

### *6-1- Author Contributions*

Conceptualization, N.L. and A.S.; methodology, N.L. and A.S.; formal analysis, N.L. and A.S.; data curation, N.L.; writing—original draft preparation, N.L. and A.S.; writing—review and editing, N.L. and A.S.; supervision, N.L. All authors have read and agreed to the published version of the manuscript.

### *6-2- Data Availability Statement*

The data presented in this study are available on request from the corresponding author. The data for this research is provided by Enterprise, which has an oil and gas business which is managed by a foreign company and taken over by the Government. Data is prohibited to be duplicated and shared with other parties without prior approval from the Company. The data and information generated in this study were provided by the authors based on the results of a field survey, and were only used for the purposes of this research so that they are not allowed to be shared and reused for other purposes.

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### *6-5- Institutional Review Board Statement*

Not applicable.

### *6-6- Informed Consent Statement*

Not applicable.

### *6-7- Conflicts of Interest*

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

## 7- References

[1] Sun, Z., Strang, K. D., & Yearwood, J. (2014). Analytics Service Oriented Architecture for Enterprise Information Systems. Proceedings of the 16th International Conference on Information Integration and Web-Based Applications & Services. doi:10.1145/2684200.2684358.

[2] Oliveira, S. B. de, Balloni, A. J., Oliveira, F. N. B. de, & Toda, F. A. (2012). Information and Service-Oriented Architecture & Web Services: Enabling Integration and Organizational Agility. Procedia Technology, 5, 141–151. doi:10.1016/j.protcy.2012.09.016.

[3] Hasić, F., De Smedt, J., & Vanthienen, J. (2017). A Service-Oriented Architecture Design of Decision-Aware Information Systems: Decision as a Service. Lecture Notes in Computer Science, 353–361. doi:10.1007/978-3-319-69462-7_23.

[4] Abedalla, R. W. (2014). The Silo Effect of Information Technology on the Organizational Productivity: A Qualitative Research Study. International Journal of Computer (IJC), 15(1), 42–50.

[5] Villamizar, M., Garces, O., Castro, H., Verano, M., Salamanca, L., Casallas, R., & Gil, S. (2015). Evaluating the monolithic and the microservice architecture pattern to deploy web applications in the cloud. 10th Computing Colombian Conference (10CCC). doi:10.1109/columbiancc.2015.7333476.

[6] Hiremath, R. (2012). Business Silos Integration Using Service Oriented Architecture. International Journal of Computer Science, Engineering and Applications, 2(2), 71–81. doi:10.5121/ijcsea.2012.2206.

[7] Kasparick, M., Schmitz, M., Andersen, B., Rockstroh, M., Franke, S., Schlichting, S., Golatowski, F., & Timmermann, D. (2018). OR.NET: A service-oriented architecture for safe and dynamic medical device interoperability. Biomedizinische Technik, 63(1), 11–30. doi:10.1515/bmt-2017-0020.

[8] Erl, T. (2016). Service-oriented architecture: concepts, technology, and design. Pearson Education, New York, United States.

[9] Rumez, M., Grimm, D., Kriesten, R., & Sax, E. (2020). An Overview of Automotive Service-Oriented Architectures and Implications for Security Countermeasures. IEEE Access, 8, 221852–221870. doi.:10.1109/access.2020.3043070.

[10] Vernadat, F. B. (2006). Interoperable Enterprise Systems: Architectures and Methods. IFAC Proceedings Volumes, 39(3), 13–20. doi:10.3182/20060517-3-fr-2903.00010.

[11] Maamar, Z., Mostefaoui, S. K., & Mahmoud, Q. H. (2005). On Personalizing Web Services Using Context. International Journal of E-Business Research, 1(3), 41–62. doi:10.4018/jebr.2005070103.

[12] Touzi, J., Benaben, F., Pingaud, H., & Lorré, J. P. (2009). A model-driven approach for collaborative service-oriented architecture design. International Journal of Production Economics, 121(1), 5–20. doi:10.1016/j.ijpe.2008.09.019.

[13] Haki, M. K., & Forte, M. W. (2010). Service oriented enterprise architecture framework. Proceedings, 6th World Congress on Services, 391–398. doi:10.1109/SERVICES.2010.39.

[14] Weiss, P. (2010). Modeling of Service-Oriented Architecture: Integration of Business Process and Service Modeling. Information Sciences and Technologies Bulletin, 79-92.

[15] Hurwitz, J., Bloor, R., Baroudi, C., & Kaufman, M. (2006). Service-Oriented Architecture for Dummies. Wiley, Hoboken, United States.

[16] Arsanjani, A., Ghosh, S., Allam, A., Abdollah, T., Ganapathy, S., & Holley, K. (2008). SOMA: A method for developing service-oriented solutions. IBM Systems Journal, 47(3), 377–396. doi:10.1147/sj.473.0377.

[17] Arsanjani, A. (2004). Service-oriented modeling and architecture. IBM developerWorks. Available online: https://immagic.com/eLibrary/ARCHIVES/GENERAL/IBM/I041109A.pdf (accessed on January 2023).

[18] Carter, S. (2007). The new language of business: SOA & Web 2.0. Pearson Education, New York, United States.

[19] Turban, E., Volonino, L., Sipior, J. C., & Wood, G. R. (2011). Information technology for management: Improving strategic and operational performance. John Wiley, Hoboken, United States.

[20] Turban, E. Al. (2012). Information Technology for Management Improving Strategic and Operational Performance (8th Ed.). Wiley, Hoboken, United States.

[21] Laudon, K. C., & Laudon, J. P. (2004). Management information systems: Managing the digital firm. Pearson Education, New York, United States.

[22] Baltzan, P., Phillips, A., Lynch, K. & Blakey, P. (2013). Business Driven Information Systems. McGraw Hill, Sydney, Australia.

[23] Tabein, R., Moghadasi, M. N., & Khoshkbarforoushha, A. (2008). Broker-based Web service selection using learning automata. 2008 International Conference on Service Systems and Service Management. doi:10.1109/icsssm.2008.4598440.

[24] Kroenke, D., Bunker, D. & Wilson, D. (2014). Experiencing Management Information Systems (3rd Ed.). Pearson Education, New York, United States.

[25] Walker, L. (2007). IBM business transformation enabled by service-oriented architecture. IBM Systems Journal, 46(4), 651–667. doi:10.1147/sj.464.0651.