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Digital Enterprise Architecture to Support Effective and Efficient Statistical Production

Virantina, Yulia[1] (virantina@bps.go.id);
Saputra, Herman[1] (hsaputra@bps.go.id);
Rahman, Khalilur[1] (khalilur.rahman@bps.go.id);
Rachmawati, Eka Miftakhul[1] (ekamifta.r@bps.go.id)
[1]BPS-Statistics Indonesia, Jln. Dr. Sutomo 6-8, Jakarta

Abstract:
BPS-Statistics Indonesia has implemented a Digital Enterprise Architecture (DEA) to support Digital Transformation. The goals of digital transformation are to build effective and efficient statistical production with business and IT integration, and also service standardization. Silo business process between subject matter made some surveys have the same target sample with the same questions in their questionnaire survey, moreover there is no integrated application, and unstandardized data that made data management become difficult. In an effort to resolve these problems, BPS has developed DEA. The implementation of DEA has been started since 2016 continuously. The initial stage in building DEA was to build a DEA repository that stores architecture-related information from the business, data, applications, and also technology. From the stored information, DEA help in aligning business needs and IT capability. DEA also help to identify silo business process, opportunities for survey integration, and simplification and integration application. DEA successfully maps overlapping business processes, applications, and variables data collected. By information from DEA, silo business process can be eliminated, survey integration can be carried out with several viewpoint such as variables collected, respondent burden, and enumerator resources, integration application that align with business needs can be done with more effective and efficient. Furthermore, BPS's DEA made benefits to more efficient business operation with lower costs, more shared capabilities, lower management costs, more flexible workforce, and more organization, less duplication and redundancies and improved business productivity. DEA is like a journey of BPS-Statistics Indonesia towards Digital Transformation.

Keywords: Digital Enterprise Architecture; Digital Transformation; Silo; Integration

1. Introduction:

The rapid IT development in industrial era 4.0, BPS as national statistics office insist to adapt with the disruption technology. Disruption in the context of technology is defined as change that makes previous products, services and/or processes ineffective (Millar, Locket, & Lad, 2018). BPS also has ambitions to achieve its vision as "A Pioneer of Reliable Data for All". These becomes the reasons BPS to do institutional transformation which includes digital transformation. Digital transformation is the stage of changing business process towards digitalization. Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business, (Gartner, 1994). The goals of BPS digital transformation are to build effective and efficient statistical production with business and IT integration, and also service standardization.

Some obstacles that have faced by BPS so far are silo business process, unintegrated application, and unstandardized data. Statistics programs and activities carried out by BPS are currently implemented in an environment that can be described as a "silo" approach. Each statistical program or activity is usually carried out independently from each other by an organizational unit in BPS called the Subject Matter Area (SMA) (BPS, 2018). Silo approach carried out BPS to the condition where several SMAs have some surveys that have same target sample category/group with the same questions in their questionnaire survey. In the silo process of statistical production, each SMAs have developed and implemented their own data processing application. In the process of developing application, SMAs used variety framework and there is no consensus to achieve integration. These made fragmented application and not well integrated. Furthermore, in the variety of SMA's developed applications will be produced data with various quality, format, and meaning that made unstandardized data in the almost SMA.

Based on the problems that has mentioned, BPS has implemented Digital Enterprise Architecture (DEA) as a tool to align business and IT strategies and become a gateway for digital transformation. DEA will captures and maps the entire domain (business, data, application, and technology) and their impact to business process and function. Furthermore, this paper will explain the stages of development and the results from implemented of enterprise architecture in order to produce effective and efficient statistical production in BPS-Statistics Indonesia.

2. Methodology:

Definition of Enterprise Architecture (EA) is an organizational blueprint that aligns the organization's vision and mission, risk, key performance indicator (Business Architecture) with information technology in the perspective of data (Data Architecture), applications (Application Architecture) and technology (Technology Architecture). The purpose of EA is to optimize across the enterprise the often fragmented legacy of processes (both manual and automated) into an integrated environment that is responsive to change and supportive of the delivery of the business strategy (The Open Group, 2018). Digital EA (DEA) is an advanced stage of EA by digitizing enterprise architecture (business, data, application, and technology) into digital repository that reflect dynamics enterprise. DEA digitally connected enterprise model and provide DEA Map. Furthermore DEA made business-IT alignment more adaptive and agile. In implementing Digital EA, BPS adopt Digital EA Framework and Methodology, which is a customization of the TOGAF 9.2 Framework. TOGAF is a framework — a detailed method and a set of supporting tools — for developing an enterprise architecture. TOGAF plays an important role in standardizing and de-risks the architecture development process (The Open Group, 2018).

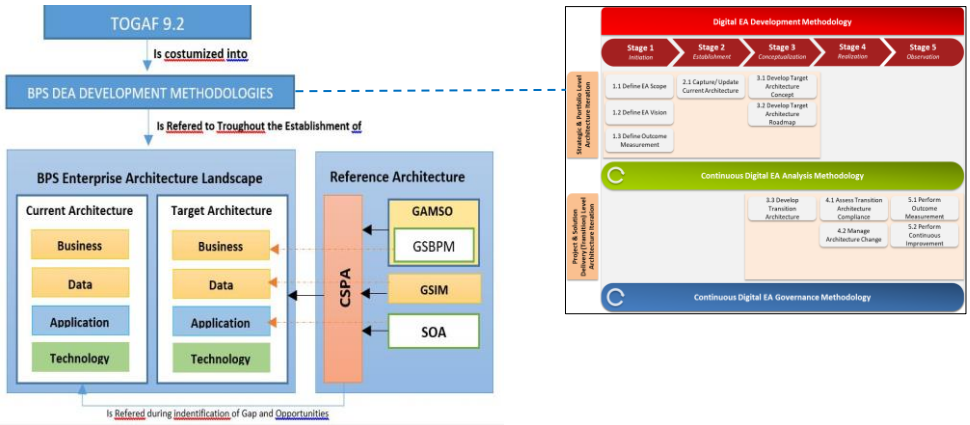

Figure 1. BPS DEA Methodology

A. BPS DEA Development Methodology

BPS adopts the TOGAF ADM as the EA framework Methodology. As seen as Figure 1. some changes were made to be more agile, structured, and modular that can be replicated at BPS. The phases in the TOGAF ADM are simplified from nine (9) into five (5) different stages, namely:

1. Phase 1 - Initiation, focuses on identifying the focus and objectives of the organization, as well as the vision of stakeholders
2. Phase 2 - Establishment, focusing on the formation of the current EA landscape (Business Architecture, Data Architecture, Application Architecture and Technology Architecture).
3. Phase 3 - Conceptualization, focusing on conceptualizing architectural targets that meet stakeholder vision or achieve the goals set, by overcoming limitations, gaps and opportunities in the current Architectural Landscape of the organization, and the establishment of portfolio roadmaps, programs and projects that can be implemented.
4. Stage 4 - Realization, focusing on the detailed realization of the portfolio or program or project identified, and the governance of the solution delivery.
5. Stage 5 - Observation, focusing on the assessment and measurement of the results of the realized

BPS DEA Analysis Methodology as shown in the Figure 1.above adopted in BPS focusing on stakeholder analysis and also consolidated gaps and impact analysis. While, the DEA Governance methodology in organizations focuses on three parts, namely Artifacts, Standards and Implementation Governance to ensure that architecture compliance is implemented during implementation.

B. DEA Development Reference Architecture

In developing the DEA target architecture, BPS adopts GAMSO (Generic Activity Model for Statistical Organizations) and CSPA (Common Statistical Production Architecture) as Statistical Reference Architecture. GAMSO describes and defines the activities that take place within a typical organization that produces official statistics. It extends and complements the Generic GSBPM by adding additional activities needed to support statistical production (UNECE, 2019). CSPA covers statistical production across the processes defined by the GSBPM, provides a practical link between our conceptual standards – the Generic Statistical Information Model (GSIM) and the Generic Statistical Business Production Model (GSBPM), and statistical production, includes application architecture and associated principles for the delivery of statistical services, includes technology architecture and principles - limited to the delivery of statistical services and does not prescribe technology environments of statistical organizations (UNECE, 2019)

3. Result

Depictions of current and target architectures are presented in the following viewpoints:

1. Landscape Map Viewpoint, figure business processes, data, applications and positions involved in an activity at a high level.
2. Business Process Viewpoint, figure the business process of an activity that consists of actor, role, processes and data. The business process consists of statistical production and also institution support
3. Application Usage Viewpoint, figure the relationship between business processes and applications used.
4. Information Structure Viewpoint, figure inter-relations between businesses objects (survey variables).
5. Application Cooperation Viewpoint, figure inter-relations between application
6. EA Data Model, figure in detail the attributes (main variables) of existing survey variables.
7. Technology Usage Viewpoint, figure the relation between application and technology.

A. **Meta-model**

This meta-model will serve as a guideline on how each element of the Architecture Building Block in BPS EA is related to each other. Meta-model is divided into five layers including Motivation and Strategy Layer, Strategic Level Architecture Layer, Segment Level Architecture Layer, Capability Level Architecture Layer and also Implementation and Migration Layer. Each Layer describes the relationships between objects that represent conditions in the faithful layer on the same level. Figure 2.below is meta-model for Strategic Level Architecture layer. It describes relation between business, data, application and technology in a high level. While Segment Level Architecture Layer is detailed of strategic level. Motivation and Strategy Layer contains the objects of motivation and leadership strategies that are interrelated. The capability object and business service object in the Figure 2, will connect to Motivation and Strategy Layer.

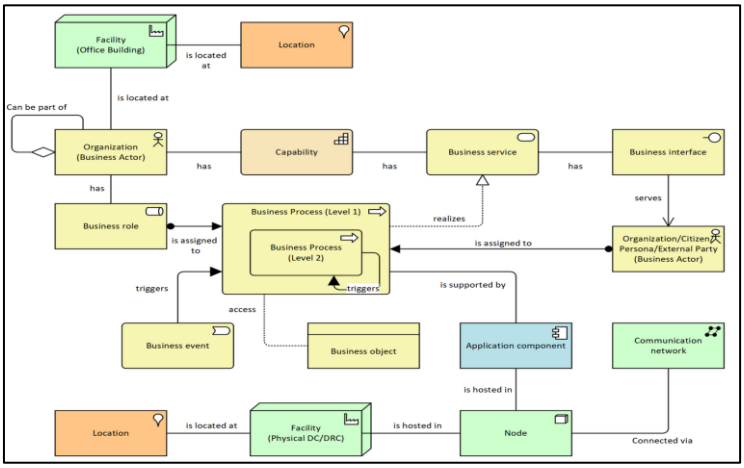

Figure 2. Strategic Level Architecture Layer

B. **BPS Current Architecture**

The results of describing the current architecture are we get the number of objects that have been defined as the number of business processes, the number of applications, the number of business actors and also number of viewpoint based on category. The more detailed the level of drawing, then we can get information on who does what, what applications are used, what information comes in and goes out, what infrastructure supports it, as well as many other information. The deeper and broader the level of drawing, the more information can be obtained. Figure 3. below is Business Process Viewpoint that figure the business process of an activity that consists of involved roles, processes and data, in one of segment level layer.

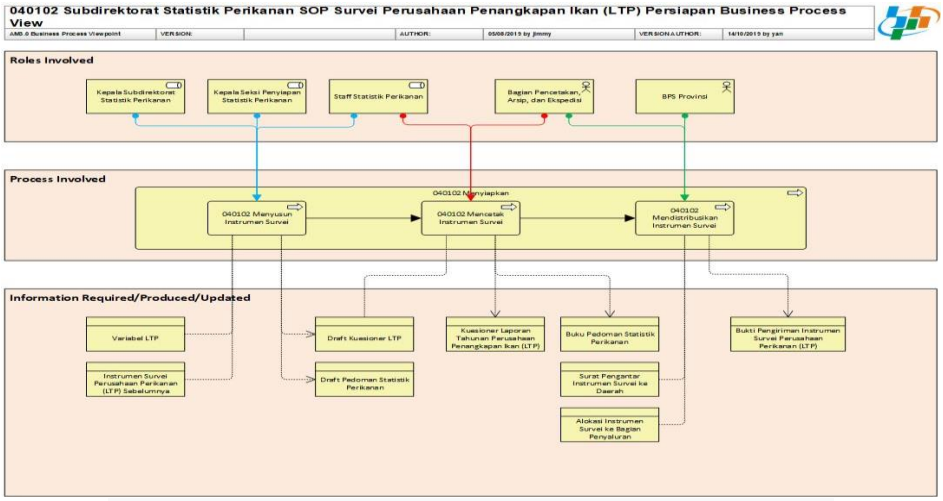

Figure 3. Survey Preparation Business Process Viewpoint

C. **BPS Target Architecture**

In developing target architecture BPS follows some statistical reference architecture. The business process used as a reference is GSBPM, with some adjustments called the Statistical Business Framework Architecture (SBFA). In SBFA, the business process will be supported by Corporate Statistical Infrastructure (CSI) that consist of several applications that integrated to serve each main business process as shown as Figure 4.below

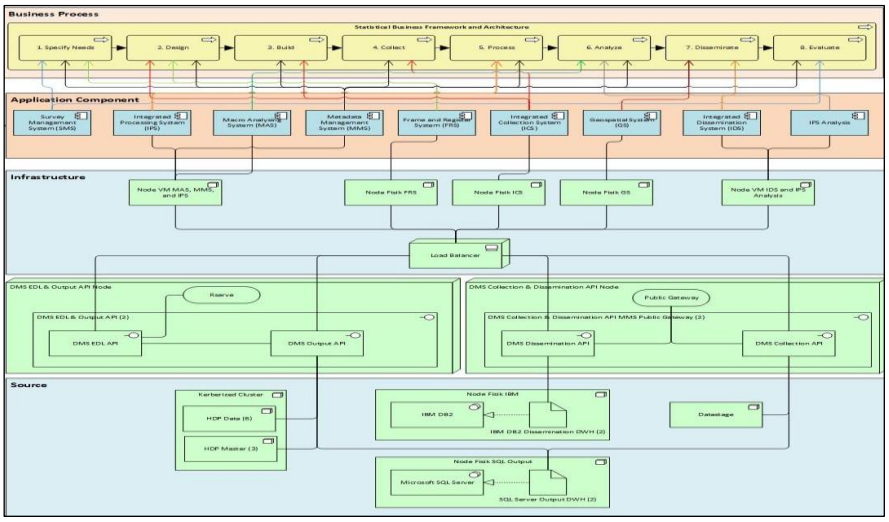

Figure 4. Target Architecture

The design of target architecture that shows application support for business and the relationship between applications and infrastructure is the basis for integrated application development.

D. Gap Analysis

From the results of target and current architecture it can be seen the things that need to be done to achieve target architecture. Interrelated objects and information stored in the EA repository in all layers help BPS identify gaps such as:

a. There are standard differences in the statistical production business process.
Through the business process and business actor matrix produced from DEA, it is seen that the same business process is carried out by many units. After the assessment, it shows that the units have different Standard Operation Procedure (SOP).

b. Unstandardized and redundant variable.
DEA shows the use of non-standard main variables in statistical production activities at BPS. Main variable refers to the purpose of statistical activities. Based on the EA data model viewpoint, there are some surveys that have the same purpose, but using different naming main variables.

c. There is no standard application development platform.
Based on the current application usage viewpoint and application portfolio, BPS has many applications that have same function especially for data collecting and monitoring in each SMA. Applications that have developed didn't have standard specification, platform and consensus to integration. These made many applications difficulty to manage and reusable. The effect will increasing the workload in the developing applications, and adding substantial technological costs.

d. Survey data collection based survey activities approach
Based on information structure viewpoint, at present BPS was still conducting survey activities where each survey requires a questionnaire made by SMA that will be asked to respondent. During survey data collection, respondent also get different questionnaire from other survey activities many times. It impact the increasing of respondent burden and enumerators' workload.

Based on TOGAF ADM, the results of the gap analysis of the architectural model that has been built will be evaluated. In this phase there will be identifying and prioritizing process of solution projects that will reduce the gaps to the desired architectural target. Project candidates that are included in the BPS Roadmap as a solution to the problems that occur. As a form of the solution provided is related.

E. DEA Benefit

Information stored in DEA repository will provide following benefits:

1. Align the statistical business processes with the organization's vision and mission with the guidance from EA Meta-model. DEA will map business proposals with the BPS strategic plan. Thus the DEA will ensure that existing business processes are related to the organization's strategic plan. The business capability and business service have to exactly mapped to organization strategic plan
2. Through existing artefacts, DEA helps identify objects that exist in the current and capture the gaps
3. Aligning IT with Business Based on the depiction of the application layer that is connected to the business layer. DEA will show applications or secure systems that are not related to the business process. This is the basis for evaluating IT support for business processes while helping technology adoption opportunities based on business needs
4. Linkages between objects between layers can help make an impact analysis. If a disturbance occurs in technology object, it will affect to the supported application. This means that there will be several business processes that are disrupted. This impact analysis will be very useful in helping the leader to make some decisions.

4. Discussion, Conclusion and Recommendations

In adapting to technological disruptions in the industrial era 4.0, BPS-Statistics Indonesia has been working digital transformation to effective and efficient statistical production. As quick win, BPS-Statistics Indonesia has been implementing DEA as gate to make it. The implementation of the DEA BPS is assisted by the BPS DEA Framework that was customized of TOGAF 9.2 framework with number of international statistical reference architecture. The information that has been obtained will be drawn with guidance by DEA meta-model to see the relationship between architectural domains. The results drawing architectures were stored in the DEA repository as a single reference source of EA artefact. In the digital repositories also can see the mapping of each architectural domain and do the gap analysis. The results of the gap analysis are then used as the basis for making effectively and efficiently the statistical production. However, to be able to support accurate decision making, the information in the DEA must be updated frequently. Requires human resources with supporting skills and competencies, as well as regular socialization so that all parties at BPS have the same understanding and perception related to DEA

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