# SGSC Framework: Smart Government in Supply Chain Based on FODA

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**Article Info**

***Article history:***

Received Sep 04, 2017
Revised Aug 10, 2018
Accepted Aug 24, 2018

***Keywords:***

Government system
Smart
SPL
Supply chain

**ABSTRACT**

Smart System has implemented in government sector. There are varies Implementation that was utilized by research activities for numerous domains is very broad. Besides that, the Industry, transportation and health, also where such a system is incredibly beneficial. This study discuss supply chain and governmental link issue, coordination of all stakeholder in supply chain has to reflect the government role. It support with the condition in Indonesian government environment is unique. It is a challenge to construct smart system based on Feature Oriented Domain Analysis (FODA) approach. It can produce software product line (SPL). We proposed framework for develop software product line for smart supply chain in government sector. It is used to enhance and improve the development of software systems by multiple software system developers. It will be a guidance for construct smart government, and more specificity in supply chain for government system area environment. It is called SGSC Framework. It consists of four layers, such as optimization layer, integration layer, supply chain layer and data layer.



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## 1. INTRODUCTION

The convincing feature in noticeably configuring a supply chain based business process are multi players and multi entities. Particularly in supply chain management (SCM) activity, the multi payers and entities symbolize the complexity and adversity of business process. The alternate approach to improve is applying and realizing an integrated application as a bridge between SCM players and entities in conducting their business process [1]. The business process improving technically means that the supply chain integration allows the complexity escalation in SCM can be managed [2]. While various problems (e.g. difficulty of collaboration and integration) appear in SCM [3]. The issues strongly relate to technologies, logistics, and partnerships integration [4]; customer, supplier, and internal collaboration [5]; or path, distribution, and transportation assimilation [6] [7]. Also, the study of several aspects have been academically conducted, e.g. an implementation of mutual cost in supply chain [8], supply chain integration particularly in information aspect [9], and a risk shifting to answer the problem in supply chain integration [10].

A design attempt to produce an optimal supply chain system designing is a motivating concern which is being realistically and scientifically studied. Not only a challenge, it is also as an opportunity for the industry as it is critical for success. Three major technical challenges conversed in such an issue are multi-scale, multi-objective and sustainability, and multi-player [11]. Relating to on sustainability (in a multi-stakeholder chain), there are three pillars talked about: economic, environmental, and social [12]. Likewise, regarding supply chain responsiveness, it is another side should be optimized. For example, in fulfilling and satisfying the customer orders, the responsiveness is able to be identified with a promised lead-time [13]. Exclusively, in the area of supply chain transportation, the study of optimization is still open. Particularly in transportation and logistics for perishable product case, an instantaneous rerouting transportation was explored and implemented in could supply chain logistic [14]. The transportation and logistics operation (e.g. the transportation situation monitoring) of such a product in cloud supply chain is the most imperative challenge.

Furthermore, still in supply chain, the optimization conception was technically benefited for both searching the shortest path search and examining its optimal state. The optimal state of supply chain was defined thru six performance values of supply chain element, they are the supply chain operations reference (SCOR) performance, financial, machine of manufacture, human resource, product quality, and waste management [15]. Equally, by taking into acount mass and energy losses, an optimal network flow model for bio-energy (bio-mass and bio-gas) supply chain was magnificently developed [16].Purposely, regarding linked issue between supply chain and government, coordination and synchronization of all stakeholder involved in supply chain should practically reflect the government role. Where, such a role is principally established to improve the quality of such coordination and synchronization [17]. Furthermore, the government policy influences supply chain activity, competition, and also emission holistically. The government has a strong power and capacity to optimize the running supply chain via realizing an objective tariff [18]. Even, to implement a good supply chain, the government can be a core player; e.g. the government can become a public administration for supply chain [19].

According to it, we can said that Supply chain is not only in logistic environment, it can be applied in government environment as well and required to be managed. Meanwhile, software development in e-government application is intended to support government business processes, such as supply chain processes. Its purpose is to achieve a good governance in the environment. It will construct software product line using FODA approach. According to [20], FODA approach can be implemented while construct software commonality and variability in software product line.

## 2. RELATED WORK

Intelligent system (Intel Sys) implementation was largely exploited in research activities for various research domains. The domains of industry, transportation, health, and also government are a number of area examples where the Intel Sys is extraordinarily valuable. For instance in industry, Intel Sys (specifically based on cyber-physical system) was operated as a theoretical framework to recognize an intelligent industry of chemist. It was realistically benefitted to increase the level value of optimal control of the system. The study clearly showed the process parts of the system which should be improved urgently [21]. On the subject of service adapted manufacturing system, the Intel Sys also was methodically studied and functioned as a framework for engineering. Here, it was executed for becoming an intelligent automation control and execution [22]. Similarly, in the context-aware service system), it was benefited for optimization in supplying the data and information for miners in real time condition.

The study was conducted intensely correlating to coal mine industry [23]. Furthermore, in transportation research field, intelligent transportation system was employed every so often. It was explicitly executed for solving many kinds of problem relating to road traffic and transportation; e.g. reducing road traffic congestion, searching the optimal path, protecting transportation infrastructure, etc. In protecting the transportation infrastructure, it was used in the point for increasing the safety level of transportation [24]. Likewise, the Intel Sys concept was adopted as well to create the cooperative intelligent transportation system. Here, it was operated based on two central roles; support in reducing CO2 emission and find the best track to avoid the road traffic congestion [25].In addition, the Intel Sys was implemented also in avoiding road traffic accident [26], in reducing negative influences of road transport on the city environment [27], solving parking problems [28], or even in responding the problem of product distributing particularly in supply chain case [29]. In health sector, the Intel Sys is awfully beneficial. One of them is for detecting a child mental illness. It was realistically utilized in China for solving approximately 60 million mental health care issues [30]. The system was used also to record personal health data. It was functioned in reason to postulate the health requirement analysis [31]. Or else the concept of Intel Sys was accepted to create the service system of health care [32]. Absolutely in research field regarding to governmental issues, quite a lot of scientists operated Intel Sys as a central approach in their studies. Let's say, it was used in emergency response services [33], advisory service improvement [34], removing the gap of information between government organizations and public association, and in planning a national security and protection financial plan [35] In comparing between FODA to traditional reuse is maintenance, minimize cost and time to develop software systems, to improve the reusability of commonality features [11].

According to [36], there is a methodology in enterprise system development which is relate to intelligent system. Besides that, the mechanism to reduce software complexity in e-government applications has done by [37]. As stated by [20], SPLE can manage the software systems that have commonality and variability features. SPLE is an approach to create a software system with diversity software system. It can be used for customization and modifying [20].

## 3. RESULTS AND DISCUSSION

We were undertaking and executing the case study in Indonesian E-Government Applications. As the Indonesian government policy which is always transforming and changing, in this study it is called as a dynamic environment. It is able to affect to the software use and authority for information system. Re-design, re-code, and re-implementation functionality of system are several impacts. It affects an inefficiency both of physical and logical. In general, software for information system consists of a number of features. One technique that can be theoretically operated for managing commonalities and variability within a product line is feature modeling.

Feature modeling is construct using FODA approach. Regarding to it, We proposed one framework which is called SGSC Framework. It functioned to embed an intelligence and smart system concept into supply chain. Then, the framework consists of FODA approach while creating SPL. Numerous things related in supply chain elements (and also in their activities) could feasibly be taken into account via performance value measurement. Here, the value is used to define the best act in supply chain behaviors. Based on [38], the performance essentially can be generated via numerous ways (e.g. by using the SCOR notation) [38]. Schematically, the performances considered regarding performance of plan, source, make, deliver, return, and enable. The construction of performance for supply chain is able to be depicted substantially in Figure 1 through high level class diagram, where ideally the performance of each element in supply chain is generalized from the SCOR based performance.

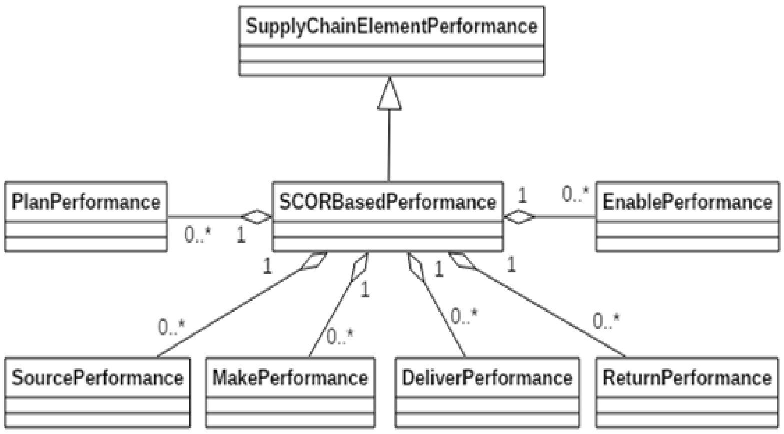


Figure 1. Schematic construction of supply chain elements' performance

According to Figure 1, the mechanism of Smart SPL System using SOA approach which is described in Figure 2 is offered. The figure describes the mechanism of Smart SPL System, where business process model (BPM) of Indonesian Government is derived from. Furthermore, Indonesian e-government applications composed of a function block, sub- functions block and application modules and can be grouped into a common application modules and specific applications based on regulations [39]. In enterprise government, it can be observed that a common business processes exists in many variations across different parts of the government entities.

The standard of supply chain business processes are enable to more efficient and effective connections across structural boundaries supply chain entities. It will make a result in a range of benefits for supply chain entities, players, citizen, and government. We proposed Smart SPL System for supply chain which is consists of six SPL, such as SPL budgeting, SPL tax& retribution, SPL human capital, SPL legislation, SPL administration, and SPL planning development. The classification and clustering of SPL are inspired from blue print of Indonesian government system. However, we need SOA approach to construct the

Smart SPL System. This stage using SOADL methodology to identify and analysis list of business services and services before implementation stage.

According to Figure 2, the supply chain element performance is a baseline for constructing the Smart SPL System. It means, we should calculate supply chain elements' performance before doing the analysis and development of Smart SPL System. Mathematically, the supply chain elements' performance can be measured by using equation (1); where P_el represents a supply chain element's performance, ω_i symbolises a coefficient of performance for i SCOR item, P_i is a performance of i SCOR item, and n=5 characterises SCOR items (plan, source, make, deliver, return, and enable respectively). Or, the whole performance of supply chain (P_all) can be calculated by using equation (2), with m symbolises a number of supply chain element.

$$P_{el} = \sum_{i=1}^{n} \omega_i P_i \qquad (1)$$

$$P_{all} = \sum_{j=1}^{m} \sum_{i=1}^{n} \omega_i P_i \qquad (2)$$

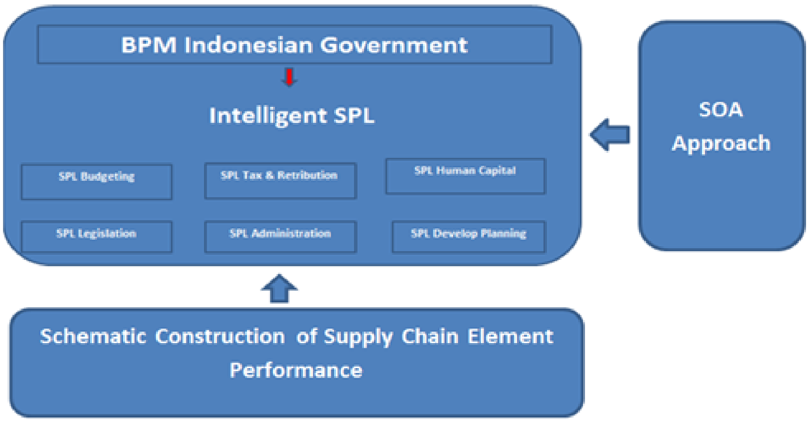


Figure 2. Smart SPL system using SOA approach

Figure 2 explain about SOA mechanism in Smart SPL System, the mechanism described the business process in several supply chain processes would be implemented to create data repository. We proposed composite applications in software product line using use SOA approach. Its purpose to achieve the mechanism of reusable business services, composite application and composite business processes will be described in Figure 3.

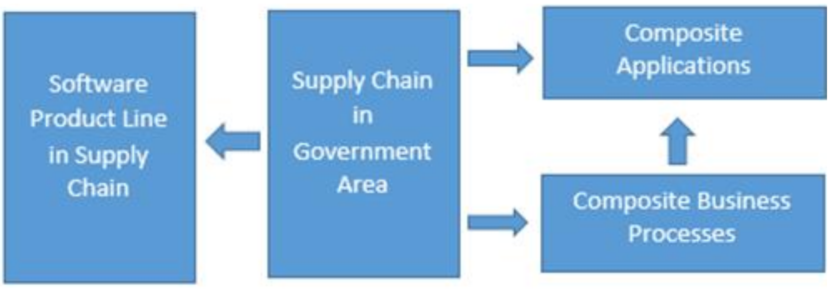


Figure 3. Composite applications in software product line

We construct the SGSC framework that consists of four layers, such as: (1) optimization layer, (2) integration layer, (3) supply chain layer and (4) data layer. The SPLSCGS framework is described in Figure 4.

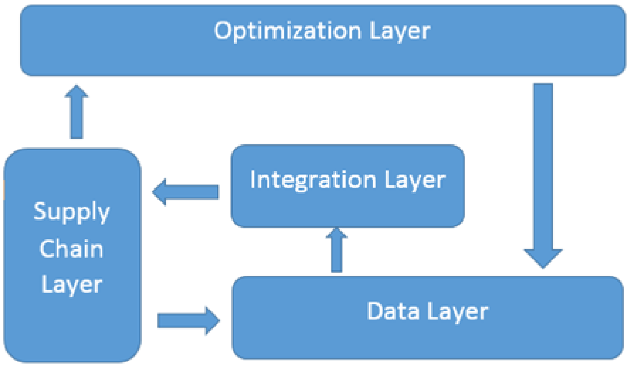


Figure 4. The SGSC framework

The SGSC framework in Figure 4 above shows the presentation layer, integration layer, supply chain layer and data layer. The data layer is a layer which is responsible for monitoring and optimizing data and information. The presentation layer is a layer which responsible for viewing of the system and represent the logic of the system, and also relate to human computer interaction. The integration layer is responsible for data, business process and information integration. It consists of orchestration and choreography mechanisms in SOA development based on Service Oriented Analysis and Design. The supply chain layer responsible for supply chain in government domain environment which is implement the software product line. The optimization layer is a layer that focus on optimization resources for support intelligent mechanism. It focus to provide and implementation the optimization study in business processes in government systems.

## 4. CONCLUSION

We construct SGSC Framework that consists of four layers to support the Smart Government System in Supply Chain Based on FODA Approach. This framework using Intelligence concept in supply chain to develop Schematic Construction of Supply Chain Element Performance. It will be a guidance for construct Software Product Line (SPL) in FODA. The framework has smart system characteristics in intelligence and optimization. This framework facilitate SOA Approach to support the created reusable business services, composite application and composite business processes. Besides that, Supply chain element performance is a baseline for constructing the Smart SPL System. It means, the framework guidance the step that should calculate supply chain elements' performance before doing the analysis and development of Smart SPL System.

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