

Impact of procurement professionalization on the efficiency of public procurement

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Abstract. Each year the central and regional governments spend up to 1,000 trillion rupiahs for procurement of goods and services. In the past, government procurement of goods and services was exposed to leakage and corruption. If the leak is 30 percent, it means that the lost cost of 250 trillion rupiahs. Procurement professionals are key to addressing this problem. By enhancing procurement skills to employees implementing Procurement Services Unit (PSU), Procurement professionals aim to improve the efficiency of procurement of government goods and services, ensure timely availability of goods and services, and provide public services as planned. Through budget efficiency and savings, more and more quality goods and services will be earned so that they have a positive impact on economic growth. The Six Sigma approach with DMAIC stage series (define, measure, analyze, improve, control) is used as a reference to measure and analyze the effect of acquiring skills improvements. Observation 43 Pilot PSUs earned a budget efficiency of 14% or equivalent to 58 trillion rupiahs accumulated during the 2012-2017 period.

Keywords: Procurement Skills, Efficiency, Six Sigma, DMAIC

1 Introduction

Public procurement is an important function of the government for several reasons. Among them is the amount of procurement expenditure that has a large impact on the economy so that it needs to be managed properly. In many countries, estimates of financial activity for public procurement are believed to be in the range of around 10% - 30% of GNP. The Organization for Economic Cooperation and Development also collects statistics on the share of public procurement in its 35 member countries, which averaged 12 percent of GDP in 2015 (World Bank, 2016). For the rest of the world, there is scarce data and analysis. Whereas Indonesia spent around 50 % of the total expenditure budget for public procurement.

However, the limited procurement professionals worked in committees on an ad hoc basis and returned to their former position upon completion of the project. It has many weaknesses and results in low performance of public procurement. The low performance of public procurement has a negative impact to the state losses which consist of fictitious Procurement of Goods and Services, partners do not complete work, goods and services do not meet specifications, lack of work volume, price markup and expenditure are not in accordance (LKPP, 2011).

It is necessary to improve the performance of the public procurement. The development of procurement professionals is one of the key factors in the public procurement that are more quality, timely, and effective. The objectives of procurement professional's development activities include increasing efficiency and saving the public procurement; guarantee the availability of goods and services timely and provide public services as planned; through efficiency and savings will be obtained more and more quality goods and services to give positive impact on economic growth (MCA-Indonesia, 2013).

The procurement of goods and services is not without obstacles. The procurement unit was initially in the form of ad hoc with an honorarium that was still attached to the existing activity package Iskandar, (2013). Lack of knowledge and skills of procurement personnel can affect service quality and procurement efficiency (World Bank, 2016). Procurement personnel must focus on maintaining professionalism (Thai, 2001). The procurement unit needs to be changed into a structured organization to facilitate coordination (Farida, 2013). The role of government in public procurement policies is needed to improve long-term procurement efficiency (Harper et al., 2016). Inaccurate procurement of goods and services can lead to a case of fictitious Procurement of Goods and Services, low quality of partnerships, unfinished prices and expenditures that are not in accordance with the provisions (LKPP, 2011; LKPP, 2013).

This research was conducted to know strategies in improving the competence of procurement professionals and measure its impact on the efficiency of the budget absorption and procurement completion on the PSU (Procurement Service Unit) pilot.

2 Literature Review

Efficiency is the precision of the way (effort, work) in carrying out something by not wasting time, effort and costs. Efficiency also means the ratio between input and output or costs and profits (Mulyadi, 2007). Efficiency measurement is done by using a comparison between the output generated to the input used (cost of output). The process of operational activities is said to be efficient if a product or certain work results can be achieved with the use of resources and funds as low as possible (spending well). Efficiency indicators describe the relationship between the input of resources by an organizational unit (for example: staff, wages, administrative costs) and the output produced (Mardiasmo, 2009).

Public procurement is an activity to obtain goods and services by Ministries/Institutions/Work Units of other Regional/Institutional Devices (K/L/D/I) whose process starts from planning needs until the completion of all activities to obtain goods and services. The Government Goods and Services Procurement Policy Agency (LKPP) is a government agency tasked with developing and formulating procurement policies for goods and services. Procurement Service Unit (PSU) is a government organizational unit that functions to carry out the procurement of goods and services in K/L/D/I that are permanent, can stand alone or attached to an existing unit. Electronic procurement or *E-Procurement* is the procurement of government goods and services carried out using information technology and electronic transactions in accordance with the provisions of the legislation. *E-Tendering* is a procedure for selecting providers of goods and services carried out openly and can be followed by all providers of goods and services registered in the electronic procurement system by submitting 1 (one) bid in the allotted time. An electronic catalog or *E-Catalog* is an electronic information system that lists, types, technical specifications and prices of certain goods from various providers of government goods and services (PP, 2010).

The procurement of goods and services in Indonesia is not without obstacles. State losses due to these obstacles include fictitious Procurement of Goods and Services, partners do not complete work, goods and services do not meet specifications, lack of work volume, price games and non-compliant spending (LKPP, 2011). Although it has been regulated by clear and binding legal rules, there are a number of irregularities in the process of procuring goods and services including tender conspiracy, passing bidders who do not meet the requirements, non-open tender announcements, price games and others (Arfanti, 2014).

Procurement requires professionals with qualifications, standardized, and experts in the tasks they carry out, through training and experience, where they always adhere to the professional code of ethics (LKPP, 2013). Procurement experts are expected to have in-depth knowledge of the things that are their responsibility and knowledge and experience regarding best practices, executions, tools and techniques used in activities related to public procurement.

Six Sigma is a quality improvement program that involves discipline, data-based approaches and methodologies to eliminate defects up to 3.4 parts per million opportunities or 0.0003% in any process; from manufacturing to transactions and from product to service. There are a number of different meanings and interpretations in *Six Sigma*. In the field of statistics, *Six Sigma* is the amount of variation around the average process (Henderson & Evan 2000). Minitab describes *Six Sigma* as an information-driven methodology to reduce waste, increase customer satisfaction, and improve processes, focusing on financially measurable results (Goh, 2002). *Six Sigma* also provides management of a business perspective in controlling and improving business processes. *Six Sigma* contributes by offering a framework that combines basic quality tools into one system with the commitment and support of high-level management of an organization (Catherwood, 2002).

Six Sigma is defined as a flexible and comprehensive system that is carried out to achieve, support and maximize business processes, which focus on understanding customer needs by using facts, data, and statistical analysis and continuously paying attention to regulation, improvement and review of business processes (Gaspersz, 2008).

DMAIC is a problem-solving procedure that is widely used in matters of quality improvement and process improvement. The DMAIC method consists of *define, measure, analyze, improve* and *control* phases. DMAIC steps with consideration for the service industry as follows (Hensley & Dobie, 2005):

1. Defining the process and identifying problems (Define). The purpose of *define* step is to identify the stages to determine the subject matter, research objectives, and scope of the process. For this reason, it is necessary to have data about the purpose of the activity so that it can identify the main issues that must be examined, then the activities will be carried out along with a description of each process and determine various indicators of the success of the activity.
2. Measuring process performance (Measure). In the field of services many processes are uncontrolled. Employee or customer factors can cause variability in the implementation of the process. In many cases, services must exceed current customers and examine stakeholder expectations whose views have an impact on service.
3. Analyze data collected from the process (Analyze). Initial data analysis may include process flow analysis, Pareto chart, histogram, running graph or scatter plot. Subsequent analyzes include tests for statistical significance, correlation or regression (Pande & Holpp, 2002).
4. Implement changes (Improve). The recommended tools include project management methods, analysis of failure mode effects, stakeholder analysis, force field diagrams, process documentation and balanced scorecard (Pande & Holpp, 2002).
5. Control the new process (Control). Process changes must be measured and evaluated. Feedback is important for understanding how well the change works. One way to achieve this is by conducting additional customer surveys. Organizations can develop steps from the process and analyze regular data. One final part of the control process is to continue to be vigilant for further improvements.

3 Method

This study uses a descriptive evaluative approach. The descriptive approach aims to explain the characteristics of variables and indicators examined in certain situations (Sekaran, 2006). This descriptive approach is used to explain a series of activities to increase the skills of procurement professionals. Evaluative research is done to design, refine, and test the implementation of a program. To know in detail, the conditions and objects being evaluated, it is necessary to identify the components that are located as a determining factor for the success of the program. The results of the study compile detailed and accurate recommendations so that appropriate follow-up can be determined. The results of the study are used as input or recommendations for a predetermined program policy or plan (Arikunto, 2013).

The research variables in this study consist of human resource development in the procurement professionalization program and increasing the productivity of PSU. Human resource development consists of procurement skills training and institutional development training.

Data collection is carried out to support the research objectives. The data collected comes from primary data and secondary data. Primary data was obtained from the survey results of 43 Pilot PSUs, while secondary data was obtained from *Smart Report* of LKPP.

The data have been collected from 43 pilot PSUs was analyzed and compared with a national scale of PSUs. The variables analyzed are then calculated the proportion of *waste* or *defect* and looks for the control limit to see the distribution of the calculated data. After that, the proportion of waste occurrence is calculated to get the *DPO*, *DPMO* and *Six Sigma* values.

Define Phase

Define phase will discuss the identification of problems that generally occur in achieving efficiency in the public procurement. Data collection is carried out both in primary data and secondary data. The SIPOC diagram is used to explain the process flow of increasing the skills of procurement professionals.

Measure Phase

On measure phase is done by measuring the performance of the public procurement in terms of achieving efficiency. The procurement efficiency indicator of 43 Pilot PSUs is calculated from the value of the

procurement results that are completed compared to the ceiling value of the procurement. Then the efficiency value of 43 Pilot PSUs was compared with the efficiency value of all PSUs registered in LKPP which currently have 620 units.

Measurements on procurement efficiency are carried out using Statistical Quality Control Types P-Chart. P-Chart is applied to the difference between the total procurement value that was successfully completed with the total value of the procurement ceiling carried out from 43 pilot PSUs. The proportion of efficiency is obtained by comparing the average value of efficiency with the average ceiling value per year. After the proportion of procurement efficiency obtained, the Upper Control Limit (UCL) and Lower Control Limit (LCL) values are also calculated. Thus, it will be illustrated whether the proportion of the efficiency of the procurement is in the normal range. From the calculation, the Defect Per Opportunities (DPO), Defect Per Million Opportunities (DPMO) and Sigma values are calculated.

Analyze Phase

At analyze phase an analysis of the data collected and a process map to determine the root of the problem is carried out. Analyze stage is also an opportunity to make improvements to obstacles that might occur. Procurement efficiency is also influenced by the number of failed procurement. Analysis is done using a cause and effect diagram or fishbone diagram to determine what factors caused a procurement to be declared a failure.

Improve phase

After analyzing, all the root causes and the causal factors can be identified. Further, improving the target of the process by designing the right solution to overcome and prevent these problems.

Control phase

In terms of procurement efficiency, it is expected that the results achieved can be maintained by encouraging sustainability from improving the skills of procurement professionals and making pilot PSUs as a measure of the success parameter for improvement activities. A series of activities need to be carried out to maintain the sustainability of the activities as outlined in the form of Strengthening Human Resource Development Sustainability (SHRDS).

4 Result and Discussion

DMAIC is a method in Six Sigma that is used to measure the efficiency of procurement activities. The improvement of the procurement professionalization towards procurement skills training and institutional development training will be achieved. The activity is expected to make the PSU as a more effective public procurement; and improve planning and budgeting towards more strategic public procurement and budget use.

Define phase

Define phase identifies matters related to improving the procurement professional's skills. Identification of these processes is carried out using a Supplier-Input-Process-Output-Customer diagram or abbreviated as SIPOC.

Explanations of the SIPOC diagram are as follows:

1. Supplier in the form of training curriculum.
2. Input in the form of training material provided to participants. Procurement skills training consists of training on functional positions, financial planning, procurement and contract management.
3. Process includes the implementation of procurement skills training.
4. Output in the form of professional staff certified procurement skills.
5. Customers in the form of achieving better skills in terms of procurement procedures.

Table 1 SIPOC diagram

Supplier	Input	Process	Output	Customer
		Procurement Principle		
	Training materials on functional positions of professional procurement personnel	Auction Evaluation		
		Procurement Documentation	Professional procurement staff certified for procurement skills training	Achieving better skills for procurement procedures
Training curriculum		PMIS device		
		Estimated costs		
	Training materials on financial planning, procurement and contract management	Procurement Strategy		
		Risk Management		
		<i>Fraud</i> indicator		

Measure phase

In the measure phase, measurement of efficiency in the procurement process is carried out. The steps taken in the measure phase are:

1. Calculate the difference between the procurement value that can be settled compared to the total amount of the procurement ceiling carried out using the P-Chart. P-Chart is performed to determine whether the efficiencies gained are still within reasonable limits.
2. Measuring the efficiency of the public procurement. This measurement is done using DPMO (Defect per Million Opportunities).

The P-Chart analysis is carried out by analyzing the ceiling and procurement values that have been completed from the *e-Tendering* efficiency data derived from LKPP *Smart Report*. Procurement efficiency values taken from the difference between the ceiling of the value of the completed procurement results finalized then the proportion is calculated to produce a proportion of efficiency. Table 2 shows data on the calculation of procurement efficiency from 43 pilot PSUs in the period 2012-2017.

Table 2 Efficiency Data for Pilot PSUs Procurement Period 2012-2017

Year	PSU	Ceiling (Million IDR)	Value of Procurement Results (Million IDR)	Difference (Million IDR)	Proportion of Efficiency
2012	43	44,680,677	37,605,420	7,075,256	0.158
2013	43	61,979,890	53,443,145	8,536,745	0.138
2014	43	63,757,826	57,304,710	6,453,116	0.101
2015	43	127,683,871	102,868,538	24,815,333	0.194
2016	43	47,395,858	41,436,504	5,958,478	0.126
2017	43	42,104,017	36,896,834	5,207,183	0.124
Total	43	387,602,139	329,555,151	58,046,111	0.140

Table 2 shows that the total number of procurement efficiencies completed was 58,046,111 (accumulated in million rupiahs) and the total number of procurement ceiling which was 387,602,139 (accumulated in million rupiahs). From the data is calculated the mean (CL) or the average number of procurement efficiency completed as follows:

$$CL = \bar{P} = \frac{\sum np}{\sum n}$$

$$CL = \frac{58,046,111}{387,602,139}$$

$$CL = 0.140$$

To determine the upper control limit (UCL) and lower control limit (LCL), the following calculations are carried out:

$$UCL = \bar{P} + \sqrt{\frac{\bar{P}(1-\bar{P})}{n}}$$

$$UCL = 0.140 + \sqrt{\frac{0.140(1-0.140)}{43}} = 0.281$$

$$LCL = \bar{P} - \sqrt{\frac{\bar{P}(1-\bar{P})}{n}}$$

$$LCL = 0.140 - \sqrt{\frac{0.140(1-0.140)}{43}} = -0.001 = 0$$

UCL : Upper Control Limit

LCL : Lower Control Limit

\bar{P} : Mean of Efficiency

n : Number of PSU

To display the upper control limit (UCL), the lower control limit (LCL) and then make the efficiency data as in Table 3 and displayed graphically as in Figure 1 for ease of understanding.

Table 3 Data on the Proportion of Efficiency of Pilot PSUs Period 2012-2017

Year	PSU	Proportion of Efficiency	UCL (%)	CL (%)	LCL (%)
2012	43	0.158	0.281	0.140	0
2013	43	0.138	0.281	0.140	0
2014	43	0.101	0.281	0.140	0
2015	43	0.194	0.281	0.140	0
2016	43	0.126	0.281	0.140	0
2017	43	0.124	0.281	0.140	0

Explanation of Table 3 is as follows:

- If $P < LCL$, meaning the sample jumped down past the receiving area (*LCL*) then check the cause.
- If $LCL < P < UCL$, means all samples are in the received area (just behaving normally) .

- If $P > UCL$, it means the sample jumps up past the receiving area (LCL) or it can be said that the number of auctions that are not finished is above the normal limit, so check the cause and take performance improvement actions.

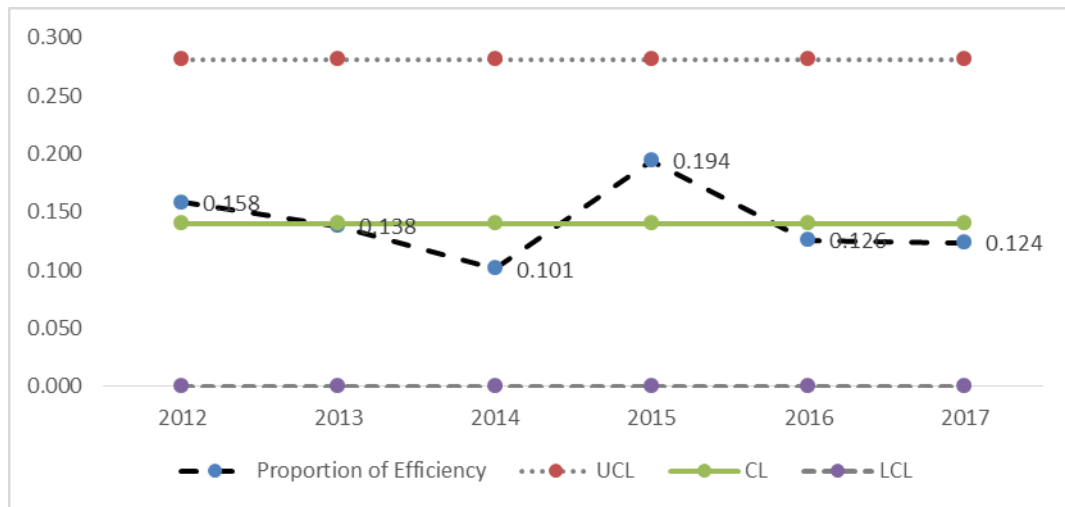


Figure 1 Proportion of Efficiency of Pilot PSU Procurement in 2012-2017

Potential Critical to Quality can be interpreted as factors that can directly affect the achievement of efficiencies that occur. If the procurement is conducted by PSUs, there are 9 (nine) factors that can cause the procurement to not be resolved or declared to have failed (Potential CTQ). The factors include:

1. The number of participants who passed the qualification in the prequalification process is less than 3 (three) participants.
2. The number of participants entering the bid documents less than 3 (three) participants.
3. The objection from the participant to the results of the prequalification turned out to be correct.
4. There are no bids that pass the bid evaluation.
5. In the evaluation of the offer found evidence/indication of unfair competition.
6. The lowest bid price is corrected for Unit Price Contracts and the combined Lump Sum Contract and Unit Price are higher than Own Estimated Price.
7. All bid prices for the Lump Sum Contract above Own Estimated Price.
8. Disclaimer of results the bid of the participants turned out to be correct.
9. Prospective winners and prospective 1 and 2 reserve winners, after deliberately evaluating are not present in the clarification and/or verification of qualifications.

From the data on Table 2 can be calculated the value of *Defect per Opportunities (DPO)*, *Defect Per Million Opportunities (DPMO)* and *Sigma* values as shown in Table 4.

$$DPO = \frac{\sum \text{Unfinished Procurements}}{\sum \text{Total Procurements} \times \text{CTQ Potencial}}$$

$$DPMO = \frac{\sum \text{Unfinished Procurements}}{\sum \text{Total Procurements} \times \text{CTQ Potencial}} \times 1.000.000$$

Table 4 Calculation of DPO, DPMO and Procurement Efficiency Sigma values

Year	Ceiling (Million IDR)	Difference (Million IDR)	CTQ	DPO	DPMO	Sigma
2012	44,680,677	7,075,256	9	0.0176	17,594,621	3,6
2013	61,979,890	8,536,745	9	0.0153	15,303,790	3.7
2014	63,757,826	6,453,116	9	0.0112	11,245,880	3.8
2015	127,683,871	24,815,333	9	0.0216	21,594,421	3.5
2016	47,395,858	5,958,478	9	0,0140	13,968,586	3.7
2017	42,104,017	5,207,183	9	0.0137	13,741,584	3.7
Total	387,602,139	58,046,111	9	0.0156	15,574,814	3.7

Analyze phase

The results of calculations that have been made in the measure phase are then analyzed to find the cause of the failure in the public procurement. This analysis is done using a cause and effect diagram or *fishbone* diagram. Figure 2 is a cause and effect diagram to find out what factors caused a procurement to fail.

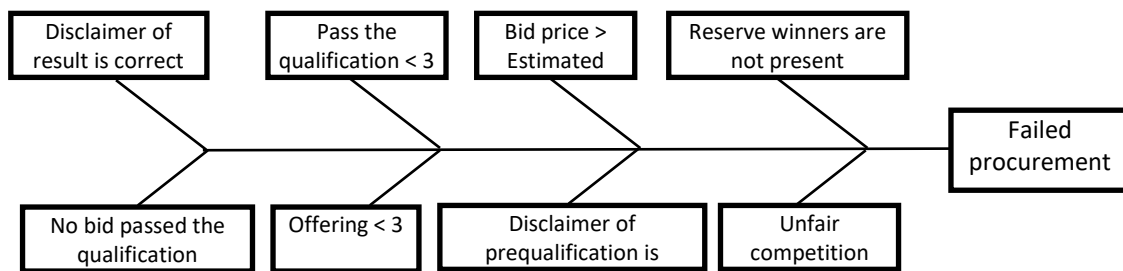


Figure 2 Fishbone Diagram Due to Bid Failure

Improving the procurement skills can increase compliance in the process of public procurement. Public procurement that are not completed or failed can occur at the tender stage, direct appointment or in the selection stage. The failure of the procurement of goods and services can reduce state losses. If the procurement is not feasible to be resolved and is still forced to be completed, it can cause problems such as the existence of fictitious procurement, partners do not complete the work, goods and services do not meet specifications, lack of work volume, price markup and expenditure are not in accordance.

The analysis was also carried out to determine the absorption of the procurement budget compared to the efficiency that occurred on a national scale. The efficiency of public procurement is calculated from the data of 620 national PSUs registered at LKPP in year 2018.

$$\begin{aligned}
 CL &= \frac{152.938.991}{1.475.923.825} = 0,106 \\
 UCL &= 0,106 + \sqrt{\frac{0,106(1-0,106)}{620}} = 0,159 \\
 LCL &= 0,106 - \sqrt{\frac{0,106(1-0,106)}{620}} = 0,052
 \end{aligned}$$

Table 5 National Scale Procurement Efficiency Data

Year	PSU	Difference (Million IDR)	Proportion	UCL	CL	LCL
2012	620	16,758,400	0.115	0.157	0.104	0.051
2013	620	21,696,809	0.101	0.157	0.104	0.051
2014	620	21,378,848	0.100	0.157	0.104	0.051
2015	620	24,606,058	0.101	0.157	0.104	0.051
2016	620	28,312,260	0.093	0.157	0.104	0.051
2017	620	35,712,008	0.113	0.157	0.104	0.051
Total	620	148,464,383	0.104	0.157	0.104	0.051

From the data in Table 5 procurement efficiency data on a national scale then calculated the DPO, DPMO and Sigma values as shown in Table 6.

Table 6 Calculation of DPO, DPMO and National Efficiency Sigma values

Year	Ceiling (Million IDR)	Difference (Million IDR)	CTQ	DPO	DPMO	Sigma
2012	145,724,645	16,758,400	9	0.0128	12,777,828	3.7
2013	214,286,561	21,696,809	9	0.0113	11,250,153	3.8
2014	213,869,090	21,378,848	9	0.0111	11,106,923	3.8
2015	242,722,527	24,606,058	9	0.0113	11,263,917	3.8
2016	305,799,106	28,312,260	9	0.0103	10,287,168	3.8
2017	315,358,497	35,712,008	9	0.0126	12,582,508	3.7
Total	1,437,760,426	148,464,383	9	0.0115	11,544,750	3.8

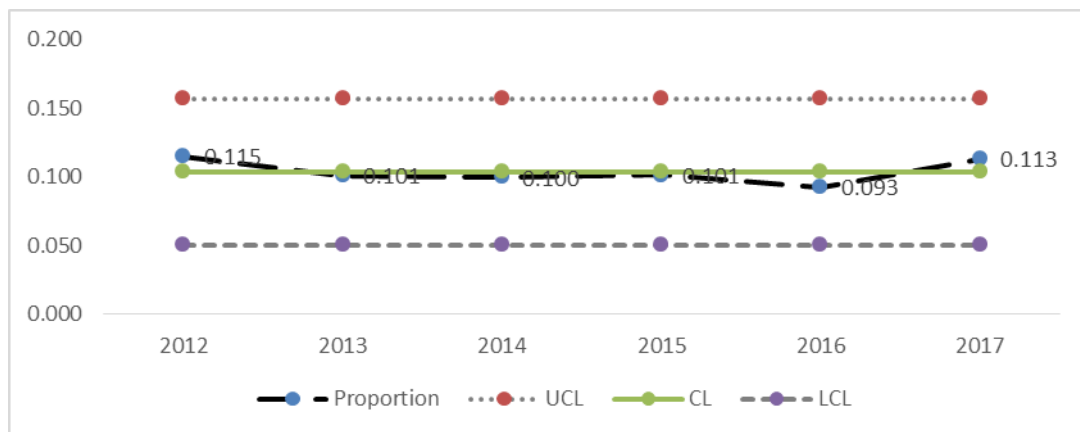


Figure 3 Proportion of National Scale PSU Efficiency

The results of the proportion of efficiency of national scale PSU can be seen in Figure 3. From the figure it appears that the efficiency of national-scale bid is relatively stable despite fluctuations in the period of 2012-2017. To provide an overview of the efficiency of the auction results, it is necessary to conduct an efficiency comparison for both Pilot PSUs and national scale PSUs. Table 7 shows comparative data between auction efficiencies conducted by 43 pilot PSUs and 620 PSUs nationally active. Figure 4 shows the comparison graph for easy understanding.

Table 7 Comparison of Efficiency of Pilot and National PSU Bids

Year	Pilot PSU	National PSU	UCL	CL	LCL
2012	0.158	0.115	0.281	0.140	0
2013	0.138	0.101	0.281	0.140	0
2014	0.101	0.100	0.281	0.140	0
2015	0.194	0.101	0.281	0.140	0
2016	0.126	0.093	0.281	0.140	0
2017	0.124	0.113	0.281	0.140	0

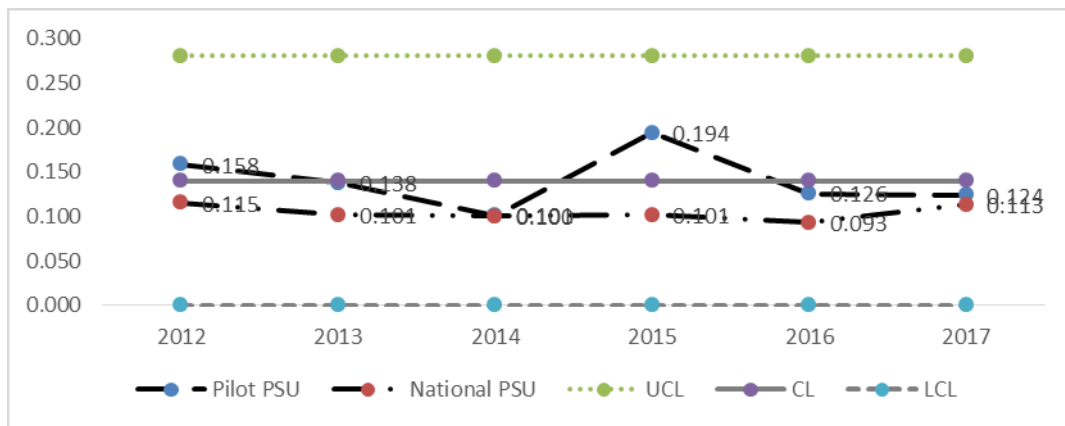


Figure 4 Comparison of Efficiency of Pilot and National PSU Bids

The efficiency of 43 pilot PSU shows a stable trend at the beginning and end of the observation period but has a higher level of efficiency than efficiency on a national scale.

Improve phase

In the *improve* phase, *improvements* are made to the provision of skills training in the framework of developing human resources and other activities that support the achievement of better procurement efficiency.

Table 8 Proposed Improvement

Corrective action	Description of corrective actions
Development of curriculum and training materials	Curriculum and training material development is carried out to produce skills modules which consist of procurement training, functional positions, budget planning and contract management
Auditor training	Auditor training is carried out to support the achievement of professional procurement personnel
Mentoring	Mentoring procurement skills are carried out to create equitable understanding and skills among procurement staff

On the other hand, training for procurement professionals also contains understanding and skills in PSU organizational development. Institutional mentoring done by way of assistance to the PSU to manifest the permanent staff PSU. Thus, a more effective procurement organization can be achieved. With the achievement of professional procurement personnel and supported by an effective procurement organization, it is expected that a more quality and productive procurement process will be created.

Control phase

In the control phase several activities are carried out to continue to strengthen and maintain sustainability towards the implementation of procurement professionalization activities. Thus, it is expected that efforts to improve the quality and productivity of procurement from PSUs can be maintained.

Strengthening Human Resource Development Sustainability (SHRDS) is a series of activities carried out to strengthen and maintain the sustainability of human resource development. Table 9 shows the following SHRDS activities:

Table 9 SHRDS activity

Activity	Information
1. Knowledge Center	Virtual Library of PST Training
2. Good News Stories	Documenting and disseminating good practices
3. Procurement Clinics	Reformatting of training materials for the COEs
4. Procurement Champions	Additional training of selected champion mentors
5. PST Database	Architect, reconcile and manage participant databases
6. Procurement Modernization Forum	Communication across this professional network and promotes the value of procurement

Improved procurement skills and organizational skills cannot be sustained in the long term only through training. It is necessary to mentor the management of the organization and staff regularly to continue to maintain the quality and effectivity of public procurement.

5 Conclusion

From the results of research on the impact of increased procurement skills on the efficiency of public procurement shows positive results in the observation period of 2012 - 2017. The proportion of efficiency in the absorption of government goods and services procurement budget by 43 Pilot PSUs at the beginning and end of the observation period shows stable trend despite fluctuations during the observation period. However, the efficiency carried out by 43 Pilot PSUs is still better than the efficiency carried out in general by national scale PSU.

Increasing competencies in procurement skills can be effective if the PSU is permanent and independent. Thus, the PSU can provide opportunities for procurement professionals to have a career and focus in carrying out their duties and responsibilities.

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