# POTENTIAL APPLICABILITY OF JUST-IN-TIME TO IMPROVE PROCUREMENT EFFICIENCY REFERENCE TO SRI LANKA NAVY

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**Abstract-** Sri Lanka Navy (SLN) required to be equipped with resources by new acquisitions whilst upgrading inventory in hand. Meantime acquisitions are challenging as many constraints in spending government funds in peace time operations. Therefore this paper aims to identify factors relevant to procurement efficiency in SLN. The research choice is mixed method as quantitative and qualitative aspects of the research variables are being investigated. The primary data collected through surveying randomly selected procurement files during year 2017 at foreign procurement division relevant to engineering spares and through structured questionnaire responded by SLN officers in technical and logistics branches sampling of 120. Quantitative analysis carried out by descriptive statistics through multiple regressions and factor analysis. Qualitative data analyzed by contents analysis. According to the findings the procurement efficiency is affected by Duration of approval, Post tender duration, Duration prior initiation purchase, Verification of specifications, and Evaluation Committee duration. The study concludes that 'Just in Time' purchasing shall be implemented to improve procurement efficiency.

**Keywords-** 'Just in Time', Decision Making, Purchasing Regulations, Stakeholders Performance, Specifications

## I. INTRODUCTION

"If the war is politics, the art of the possible, logistics is the corresponding science" (Kane, 2001). The defense logistics is to protect and defend the public interest and long-term security of a State. An error in a military logistics resulted in unnecessary death or injury to personnel. Due to the risk of stock-outs and which thwarts mission critical functions the Operational Commanders store inventory more than the needed. The current society categorized inventories as a needed evil. Because there are costs accompanying with purchasing, ordering, inventory carrying, stock-out, inferior quality, obsolescence, pilferage, losses in stock, expiry and shrinkage. Thus inefficiency in the processes account for wastes. The elimination of those waste is essential.

### 1.1. Problem Statement

Accumulation of inventories on the basis of 'Just in Case' is foregoing the opportunities and weakening the working capital. Reduction of inventory will eliminate waste, regularize purchases, and reduction of storing related cost. Implementation of JIT related principles will help militaries to purchase inventory as and when required. SLN being the government institution required to abide with Procurement Gide Lines (PGL) 2006. The government institutes are operating under authority granted through statutory provisions, local and departmental rules/ orders. The government procurement process guarantees high magnitude of competition and equal opportunities. The weakness identified is inability to favor a well performed supplier. The fundamental of JIT procurement is long term relationship with suppliers and long term contracts yet government competitive bidding secured lowest qualified bidder therefore other criterion are overruled.

The appropriation budget allocated fixed amounts for expenditure for government institution to achieve goals during the financial year. Therefore the mangers focused on efficiency than the effectiveness. At the year-end managers are concerned expenditure of appropriated amounts rather than qualitative results due to reduction of allocation in succeeding budget. As such purchases are bulk and infrequent violating the fundamentals of JIT. Also few researchers are in the opinion that JIT will endanger the operational readiness of militaries and failed concept though JIT success in commercial entities. Therefore applicability of JIT philosophy has to be investigated at SLN as procurement efficiency improving tool.

### 1.2. Research Questions

The following questions are formulated to the current research.

i.   What are the factors influence procurement efficiency in SLN?

ii.  What are the relationship of such factors in efficiency of procurement process in SLN?

iii. Is JIT purchasing strategy applicable at SLN and will it improve procurement efficiency?

### 1.3. Research Objectives

#### 1.4.1. Core Objective

The study focus mainly to explore the factors affecting procurement efficiency in SLN and find applicability of JIT procurement to improve efficiency in procurement.

#### 1.4.2. Secondary Objectives

In order to achieve main objective of the study following secondary objectives are made;

i.   To explore the factors influence procurement efficiency in SLN.

ii.  To examine relationship of factors influence procurement efficiency in SLN.

iii. To justify applicability of JIT purchasing strategy to improve procurement efficiency in SLN.

## II. LITERATURE REVIEW

Oxford English Dictionary defines logistics as "the organization of supplies, stores, quarters necessary for the support of troop movements and expeditions". Evolution of military logistics over the period offers many insights for the practice of business logistics (McGinnis, 1992). The military logistics is concerned as projection and sustainment of forces in executing of mission (Tuttle, 2005). During the peacetime, militaries pursue to reduce government expenditure by minimizing the costs in logistics processes (Kovacs & Tatham, 2009 ) as such inventory control is a necessity.

The economics cites three theoretical reasons for Just-in Case inventory: production smoothing, avoid stock out, and reduce transaction costs.   Blinder & Louis (1991) explained holding inventories secure material cost against price escalation. Keeping inventory is not free because there are opportunity costs of "carrying" or "holding" inventory in the organization. Thus, the paradox is though we need inventory, it is not desirable to have inventory. Naddor (1966) suggested that we need to decide about when to initiate a purchase and what quantity to buy. In solving these twin problems of decision making, we need to develop a scientific approach in decision making by developing an inventory model. Thus Just-in-time (JIT) is one of the most talked topic in inventory planning primarily due to success in the Japanese companies.

JIT was firstly applied within Henry Ford's manufacturing plants (Cheng & Podolsky, 2005). Taiichi Ohno implemented JIT in Toyota manufacturing in order to achieve competitive edge over the oil embargo in 1970's. Ohno applied JIT to avoid wastes, reduce inventories and increase production efficiency. JIT defined as zero inventories, zero transaction and zero disruptions (Womack, Jones, & Roos, 1991) in order to produce with the shortest possible lead-time, the lowest possible level of inventory and the fewest possible waste (Asad, 2014) (Moreira & Alves, 2006). JIT facilitate getting right quantity of raw material and processing the right quantity of products in the right place at the right time (Dange, Shende, & Sethia, 2016).

Decision making is a process of selecting a choice between numbers of options. Willis & Huston, (1990) emphasized that decision making in JIT were categorized as financial,

service, and technical. Barnett (1988) researched on financial aspects and emphasized that reduction in inventory leads to reduction in total logistics costs and allows better utilization of working capital. Phogat (2013) stated that JIT is being advocated by many defense policy planners in both the US and the UK as tool of eliminating waste and releasing capital from unnecessary stockholding in military environment.

Das & Handfield (1997) found that JIT global sourcing alliance developed through overseas supplier-selection resulted reductions in total costs of acquisition, storage, repair and warranty, and inventory audit time. Svensson (2001) asserted that global sourcing and sole sourcing becomes necessary, due to geographic location, exclusive rights, customer preference, and lack of alternatives or monopoly. Moreira & Alves (2006) asserted that JIT procurement concern suppliers' performance and quality thus reduces inventory, scrap and defectives. The improved relationship with OEM is an option for especially Made-To-Order (MTO) initiatives. Kros, Falasca & Nadler (2006) researched JIT production systems through different OEM's and asserted the differences on Made-To-Stock and MTO. In result Gahlan & Arya (2015) researched the concept of Zero inventories based on JIT purchase through Supply Hub and how inventory holding costs can be diminished. The supply-hub is promoting rapid response to customer demand reducing the total cost of supply chain (Rong & Wang, 2015). Nawanir, Teong, & Othman, (2013) asserted that specification of good is important in procurement to assured quality. Study of Aljunaidi and Ankrah (2014) found cost reduction through JIT can be achieved through quality.

# III. RESEARCH METHODOLOGY

## 3.1. Conceptual Framework (CF)

Conceptual framework Figure 3.1. is developed in accordance with the research objectives and literature reviewed. Procurement efficiency is dependent variables which gets affected by the independent variables of decision making, purchasing regulations, stakeholder's performance, and specifications.

The justification to the CF as per the Figure 3.1, the CF is discussed as follows. The independent variables are affected by many factors. The decision makers' decisions are influenced by factors such as timely availability of spares, cost efficiency, availability of funds, transparency



*Figure 3.1. Conceptual Framework*
*Source: Developed by the Author (2018)*

and accountability (Asad, 2014). The purchasing regulations are affected by the factors such as orders, time line of purchase, stock levels and replenishment plans (Willis & Huston, 1990), (Phogat, 2013). The factors of stakeholders' performance are lead time, storage and direct vendor delivery (Kros, Falasca & Nadler, 2006). The specifications of product also affect the dependent variable and quality compliance (Nawanir, Teong, & Othman, 2013). Verification of specifications (Gahlan and Arya, 2015), post tender durations (Svensson (2001), number of quotations, duration of approval (Kros, Falasca, & Nadler, 2006), duration prior initiation of tenders, evaluation committee duration (Das & Handfield, 1997), PGL clause and quality control duration (Nawanir, Teong, & Othman, 2013) are other intermediate variables which affect dependent variables as depicted at Figure: 3.1.

## 3.2. Formulation of Empirical Model

Based on the conceptual framework (figure 3.1), the following empirical models have developed.

EP=$f$(Y) ----------------------------------------- (1)

Y=$f$ (X$_1$, X$_2$, X$_3$, X$_4$) err ----------------------- (2)

Where: EP stands efficiency of procurement. Y stands for Duration of Supply and vectors X$_1$, X$_2$, X$_3$, and X$_4$ stand respectively decision making (X1), purchasing regulations (X$_2$), performance of stake holders (X$_3$), and specifications (X$_4$). Further Table 3.1 shows the data and variables. The variables were regressed using a model and all coefficients interpreted as follows;

Y= $\beta_0$, $\beta_5$ X$_5$, $\beta_6$ X$_6$, $\beta_7$X$_7$, $\beta_8$ X$_8$, $\beta_9$ X$_9$, $\beta_{10}$ X$_{10}$, $\beta_{11}$ X$_{11}$, err- (3)

Where: Y= Dependent Variable (Efficiency of procurement) = Time duration to supply

$X_{1-n}$ = Independent Variable ($X_5$ is vectors of Prior initiation purchase, $X_6$ is vectors of Verification of specifications, $X_7$ is vectors Evaluation Committee Duration, $X_8$ is vectors of Quality Control Duration, $X_9$ is vectors of No of Quotations, $X_{10}$ is vectors of Post Tender Duration, $X_{11}$ is vectors of Duration of Approval)

$\beta_0$ =  the constant

$B_{1-n}$ – the regression coefficient or change included in Y by each X

$\mathcal{E}$ =  error term

### 3.3 Operationalization

As per the empirical model developed dimension of purchasing efficiency and indicators of each dimension are as follows:

**Table 3.1. Variables, Factors, Indicators and Measurement for data collection**

| Variable | Factors | Indicators | Measurement |
|---|---|---|---|
| X1- Decision making | Efficiency | Time consume | No of days consume |
|  | Control budget environment | Financial situation | 5 points Likert Scale |
|  | Readiness of the force | Knowledge of resources | 5 points Likert Scale |
|  | Timely availability of spares | Risk minimization | 5 points Likert Scale |
|  | Cost-effective decision-making | Improving working capital | 5 points Likert Scale |
| X2-Purchasing Regulations | Efficiency | Response from suppliers | No of quotations |
|  | PGL sanctions on JIT | PGL clause selection | 5 points Likert Scale |
|  | Timeline of purchase | Availability of funds | 5 points Likert Scale |
|  | Minimum stock levels for 'Vital' and 'Essential' items | Economy of order quantity | 5 points Likert Scale |
|  | Annual procurement plan | Implementation | 5 points Likert Scale |
| X3 -Performance of Stake Holders | Efficiency | Time consume | No od days |
|  | Lead time | Availability of stores | 5 points Likert Scale |
|  | Storage and vendor delivery | Delivery terms | 5 points Likert Scale |
| X4 - Specifications | Efficiency | Verifying of specifications | No of days |
|  | Quality compliance | Quality checks | 5 points Likert Scale |
| X5 –Prior initiation purchase | Efficiency of initiating authority | Time consumption | No of days |
| X6 - Evaluation tenders | Accuracy of tenders | Time consumption | No of days |
| X7 - Procurement Guide Line clause | Accuracy of PGL Clause | PGL Clause | No of occurrence |
| X8 - Quality control | Supply accuracy | Time consumption | No of days |
| X9 – No of quotations | Sources of supply | Response by suppliers | No of quotations |
| X10- Post tender duration | Timely execution | Time consumption | No of days |
| X11- Duration of approval | Manager efficiency | Time consumption | No of days |

*Source; Researcher (2018)*

### 3.4. Sample Profile

The research population was 1164 Lieutenant Commander rank naval officers serving in SLN according to the Navy List published in 2017 (sample list). The research sample is 120 officers randomly selected according to their job description as Staff Officers in approving authority, workshop engineers, initiating certifying and paying authority, logistic officers. Kiage (2013) has also used random sampling method. This sample profile will be used address research questions 1 as per the empirical model 2. As per the procurement file register 2017 in foreign procurement division SLN there were 458 completed engineering spares files. The researcher randomly selected 50 completed purchase files as sample profile 3 to address research question 2 as per the empirical model 3.

### 3.5 Data Collection Methods

The researcher has selected structured questionnaires to collect the data in sample profile 1. This is consistent with Kiage (2013) and Nawanir, Teong, & Othman, (2013). They have also used structured questionnaires method as per the primary data collection technique. Out of 120 questionnaires distributed in sample profile 1, 99 responded positively. The researcher recorded details of time consumption in major events at randomly selected 100 completed purchase files in 2017. The qualitative data for contents analysis to address research question 3 collected through publish journal articles.

### 3.6 Data Analysis Methods

All collected data statistically analyzed using the support of the Statistical Package for Social Science (SPSS) version 20. The validity and reliability of the data and sample assured by the use of SPSS software. As the statistical model, the regression analysis, factor analysis and model fit are utilized. Same method have been used by Kiage (2013) and Nawanir, Teong, & Othman, (2013) in their researches. Qualitative data analyzed by contents analysis to establish facts for research question 3.

## IV. DATA ANALYSIS

### 4.1 Summary of Reliability Test

According to Pallant (2005) if Cronbach Alpha coefficient reported of .7 or above the satisfaction of scales has good

internal consistency. In the current study the Cronbach Alpha coefficient was .723. Therefore the scale was considered reliable with the sample.

### 4.2 Factor Analysis (FA) to Address Research Question 1

According to the research objective 1 the study focus to identify the factors influence procurement efficiency in SLN. Therefore study carried out Principal Components Analysis (PCA) through the SPSS as both Factor Analysis (FA) and PCA produce similar result (Pallant, 2005). The 11 items of the Positive and Negative Affect Scale (PANS) were subject to PCA using SPSS version 20. Prior to performing PCA the suitability of data for FA were assessed. Inspection of the correlation matrix revealed the presence of many factors coefficients of .3 and above. The Kaiser-Meyer-Okin value was .841, exceeding the recommended value of .6 and the Bartlett's Test of Sphericity reached statistical significance, supporting the factorability of the correlation matrix. PCA revealed the presence of three components with eigenvalues exceeding 1, explaining 48.11 percent, 15.12 per cent, 9.4 percent of the variance respectively. An inspection of the scree plot revealed a clear break after the second component. Therefore it was decided to retain two components for further investigation. Parallel Analysis result summary is at Table 4.1 and Monte Carlo PCA for Parallel Analysis survey data is submitted as Appendix I as Table 4.3.

**Table 4.1. Result Summary - Parallel Analysis**

| Component number | Actual eigenvalue | Criterion value from parallel analysis | Decision |
|---|---|---|---|
| 1 | 5.292 | 1.5787 | Accept |
| 2 | 1.664 | 1.3984 | Accept |
| 3 | 1.042 | 1.2713 | Reject |
| 4 | .859 | 1.1652 | Reject |
| 5 | .827 | 1.0611 | Reject |

*Source: Survey Data (2018)*

According to the Table 4.1 and parallel analysis Table 4.3 of Appendix I only two initial eigenvalues are larger than

the criterion value. To interpret of those two components, Varimx rotation was performed. The rotated solution revealed the presence of simple structure, with both components showing a number of strong loadings and all variables loading substantially on only one component. The two components solution explained a total 63.23 percent of the variance, with component 1 contributing 46.39 per cent and component 2, 16.84 contributing 63.23 per cent. The interpretation of the two components was consistent with previous research on the PANAS scale, with positive affect items loading strongly on component 1 and negative affect items loading strongly on component 2. Survey details of Rotated Component Matrix according to Varimax with Kaiser Normalization is submitted as Appendix I, Table 4.4.

### 4.3 Hierarchical Multiple Regression Analysis to Address Research Questions 2

A model regression analysis was conducted to evaluate the variables influencing effectivness of procurement

system in SLN. The following regression model applied.

$$Y= \beta_0, \beta_5 X_5, \beta_6 X_6, \beta_7 X_7, \beta_8 X_8, \beta_9 X_9, \beta_{10} X_{10}, \beta_{11} X_{11}, err\text{-}(3)$$

The β's are the regression coefficients, representing the amount of dependent variable changes when independent variable changes by 1 unit. The Є representing the amount the dependent Y will be when independent variables are 'Zero' (0). $R^2$ multiple correlation, which is the percent of variance in the dependent variable explained collectively by all of the independent variables. The Model Summary is submitted as Appendix II, Table 4.5.

The multiple linear regression model with variables in block 1 (verification of specifications, Post tender duration, number of quotations and duration of approval) have been entered the overall model explains 59.4 percent of the variance. After block 2 variables (duration prior initiation of purchase, evaluation committee duration,

## Table 4.2. Output from Hierarchical Multiple Regression-Coefficients

| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| 1  (Constant) | 120.914 | 36.966 | | 3.271 | .002 |
| Duration approval | .954 | .118 | .677 | 8.119 | .000 |
| No of quotations | -12.140 | 11.789 | -.086 | -1.030 | .309 |
| Post tender duration | 1.169 | .182 | .535 | 6.416 | .000 |
| Verification specifications | 1.037 | .655 | .133 | 1.584 | .120 |
| 2  (Constant) | 64.819 | 34.279 | | 1.891 | .066 |
| Duration approval | .997 | .096 | .708 | 10.383 | .000 |
| No of quotations | -9.315 | 9.665 | -.066 | -.964 | .341 |
| Post tender duration | 1.126 | .151 | .515 | 7.455 | .000 |
| Verification specifications | 1.099 | .533 | .141 | 2.061 | .046 |
| Duration prior initiation | 1.022 | .215 | .322 | 4.747 | .000 |
| EC duration | .957 | .463 | .141 | 2.068 | .045 |
| QC duration | .832 | .841 | .069 | .990 | .328 |

*a. Dependent Variable: Duration of Supply*
*Source: Survey Data (2018)*

PGL clause and quality control duration) have also been included the model as a whole explains 79.4 percent. In the model 2 R Square Change explains variance after removing the effects of variables at model 1 which is 20.1 percent. This is statistically significant contribution, as indicated by the Sig. F change value is (.000). The ANOVA Table 4.6, Appendix II indicates that the model as a whole (including both blocks of variables) is significant {F (7, 42) = 25.53, p<.0005}.

In order to establish contribution of variables to the equation defining the Coefficients tables is important. Table 4.2 below summarizes survey data.

According to the survey data at Table 4.2, the model 2 summarizes the results with all the variables entered in to the equation. Scanning the Sig. Column, there are 5 variables that make a statistically significant contribution (less than .05). In order of significance they are: Duration of approval ($\beta$ = .71), Post tender duration ($\beta$ = .52), Duration prior initiation purchase ($\beta$ = .32), Verification of specifications ($\beta$ = .14), and Evaluation Committee duration ($\beta$ =.14). Number of quotations, and quality control duration are not made unique contribution. The theoretical model here is:

$$Y= \beta_0, \beta_5 X_5, \beta_6 X_6, \beta_7 X_7, \beta_8 X_8, \beta_9 X_9, \beta_{10} X_{10}, \beta_{11} X_{11}, err$$

The estimated model after removing X9 (no of quotation) and Quality Control Duration X8 here is:

$$Y= 64.82 + .32 X_5 + .14 X_6. +.14 X_7+ .52 X_{10} + .71 X_{11} + 34. 27$$

### 4.4 Content Analysis

The qualitative data analysis conducted through contents analysis to address research question 3. According to the PGL (2006) the elements of public procurements are

maximizing economy, timeliness, quality, least cost, standards, specifications, rules, regulations and good governance by fair, equal and maximum opportunity for eligible parties, transparency, consistency and confidentiality. However the 'Pull' based JIT and promote strong buyer-supplier relationship and team work (Phogata & Guptab, 2017). The military processes high technical complexity, thus the inventory ordering to be

shifted to Make to order (MTO) strategies with standard specifications. MTO environment forces companies to deal with demand uncertainty by implementing JIT purchases (Hale, 2005). Further uncertainty shall be reduce with continuous order and periodic ordering (Qureshi, Iftikhar, Bhatti, Shams, & Zaman, 2013). The clause 3.5 of PGL and its amendments sanctions single source supply through an agreements with OEM. The clause 3.2 and 3.3 of PGL facilitate for contractor logistics support and blanket purchase agreements.

## V. DISCUSSION

The research question 1 raised to find the factors influence procurement efficiency at SLN. As such $Y=f$ ($X_1$, $X_2$, $X_3$, $X_4$) err empirical model developed to find functions and vectors of decision making ($X_1$), purchasing regulations ($X_2$), performance of stake holders ($X_3$), and specifications ($X_4$). The decision makers' decisions are influenced by factors such as timely availability of spares, cost efficiency and availability of funds. The descriptive statistics attested that decision making is significantly contributed to efficiency in procurement process in SLN. The factors such as budgetary constraints, readiness of the force, JIT spares availability, cost-effective decision-making plan are significantly contributed in decision making in purchasing procedures. The research tested the vectors of purchasing regulations such as PGL sanctions on JIT, prescribed timeline for purchase, inventory minimum levels for 'Vital' and 'Essential' items and annual replenishment plan. The factor analysis confirmed that stocks levels, annual replenishment plan and time line for purchase were positively affect to the efficiency whilst sanction on JIT was negatively affected. This research inquired factors of storage and direct vendor delivery and lead time affect to test stakeholders' contribution in purchase efficiency. The descriptive statistics attested that stakeholders are significantly contributed to efficiency in procurement process. However factor analysis proved storage and direct vendor delivery and lead time are negatively affect to procurement efficiency. The descriptive statistics attested that quality compliance, vector of specifications negatively affect to the procurement process.

The research tested descriptive statistics to find relationship of factors in efficiency of procurement process in SLN through empirical model 3, $Y= \beta_0, \beta_5 X_5, \beta_6 X_6, \beta_7 X_7, \beta_8 X_8, \beta_9 X_9, \beta_{10} X_{10}, \beta_{11} X_{11}$, err. Multiple regression of vectors of Prior initiation purchase $X_5$, Verification of

specifications $X_6$, Evaluation Committee Duration $X_7$, Quality Control Duration $X_8$, No of Quotations $X_9$, Post Tender Duration $X_{10}$, and Duration of Approval $X_{11}$ were surveyed to find coefficients of each variable. It was found that Duration of approval, Post tender duration, Duration prior initiation purchase, Verification of specifications and Evaluation Committee duration significantly contributed for procurement efficiency whilst Number of quotations, and quality control duration are not made unique contribution.

Poor selection of sources and long lead time in purchases are barriers for efficiency. The implementation of JIT purchasing systems is a solution to resolve this problem. Good relationships and skilled/ loyal supplier selection leads to On-time deliveries (Herzog & Tonchia, 2014). JIT global sourcing alliance through overseas supplier-selection, evaluation and buyer-logistic carrier (Das & Handfield, 1997), supply-hub which promote rapid response to customer demand (Rong & Wang, 2015) are other options. The friendly militaries shall have collaboration to support other in meeting urgent needs of crucial inventories. Also collaboration with other organization with in the country can form an alliance with improved buying power.

## VI. CONCLUSION

SLN procurement procedure is a lengthy process influenced positively with the factors such as stock levels, cost-effective decision-making plan, control budgetary environment, urgency of the requirement, readiness of the force, annual replenishment plan, and timely availability of spare parts. Also storage and vendor direct delivery, lead time, PGL sanctions on JIT and quality compliance negatively affected factors. Therefore managers concern on the assert visibility, avoid expenditure on unneeded inventory, specifications, retention of contingency stock and minimum stock levels for 'Vital and "Essential items, annual replenishment plan are essential. Lack of standardization, absence of inventory categorizations caused incomplete technical evaluations, demand compliance, excess inventory. The estimated model (3) after removing insignificant variables, No of quotation $X_9$ and Quality Control Duration $X_8$ and applying the values of survey is Y= 64.82 + .32 X5 + .14 $X_6$. +.14 $X_7$+ .52 $X_{10}$ + .71 $X_{11}$ + 34. 27. Therefore it is evident that any purchase will consume more than six months. According to descriptive analysis the number of quotation become insignificant as only one quotations received in majority of occasions even with restricted international and national competitive bidding (PGL clause 3.3). Therefore efficiency of present system in question.

PGL is sanctioning single source suppliers which support implementation of 'JIT' procurement strategy. JIT facilitate on time purchases through OEM and sole agents. Long term relationship. Alliance and agreement abide both suppliers and buyers, amalgamation with other government organization for common requirement will help manufacturer for JIT supply having larger market share. Supply hub is another JIT option available to have continuous supply at stable price. These strategies facilitate JIT application for military reducing the risk of stock out. Therefore it is proved that 'JIT' procurement is a possible solution for SLN to apply in procurement of spares parts. As such inventory cost shall be minimized and working capital could be improved. The future research shall be focused to investigate item categorization in naval environment to facilitate application of JIT as inventory reduction instrument.

## VII. ACKNOWLEDGEMENTS

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