Using the "Lean Concept" to Improve Contract Procurement Processes of Service Utility Companies

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Abstract: Annually, a service utility company in the Kingdom of Saudi Arabia processes thousands of contracts for bidding. These contracts will in turn generate projects to maintain the quality and consistency of the generation, transmitting and distribution of electricity to the company's consumers. The service utility company's Contracting Department is responsible for the process of bidding for these contracts. Contracts subject to bidding must be signed in less than 175 days from the date of approval to allow adequate time for the implementation of the company's maintenance and operational goals. However, at present, this conditional time allowance is rarely met. Hence, to improve the current situation, the "Lean Concept" is now applied and has resulted in a vast improvement in the contracting process. Contract cycle time has improved, waste has been eliminated and defects have been minimized. Improved cycle time of the contracting process has marked an increase in client satisfaction as a result of the finalization of contract signings in a shorter period in addition to a subsequent increase in the achievement of customer (utility user) satisfaction. The standard period for contracts signed-out has been reduced from 58.87% to 10.34%, and the sigma level process has jumped from -0.23 to 1.26.

Keywords: Contract Procurement, DMAIC, Lean

I. INTRODUCTION

A Contracting Department is considered one of the most important departments in any company, it provides its clients with clear, competitive contracts with qualified business partners at the lowest risk, cost and highest degree of efficiency.

The process of contract procurement plays a vital role to any organization especially in-service utility companies. As an example, this paper uses one of the largest energy companies in the Middle East as a case study.

This service utility company's total generation capacity in the Kingdom reached about 74.3GW. Electricity was delivered to more than 502,000 new customers in 2016, bringing the total number of customers to 8.6 million. The number of towns, villages and settlements powered by electricity reached more than 13,000, and the electrical network coverage reached 99.8%.

The Contracting Department deals with the company's business lines, namely; Generation, Transmission, Distribution and General Services. Each of these business lines has its own contracts which are procured through biddings by the Contracting Department. The process of contract

procurement, which start from the contract request, preparation of the bid package, bidding, evaluation and awarding procedures, must meet the standard time set for each business line.

This study aims, with the use of the "Lean Concept", to identify the root causes of excessive delays in the contract procurement process, improve cycle time of said process, minimize contract defects and develop an effective solution to avoid future issues. In addition, this study focuses on the activities of the Distribution & Generation Business Line Contracts Division of the afore mentioned company's Contracting Department, starting from the creation of contract request, up to the awarding and signing of the contracts by both the company and the contractor (winning bidder). We will observe and analyze all processes and procedures throughout the contract procurement process of all departments (Contract Dept., Finance/Comptroller Dept., Proponent Dept. & Technical Dept.).

II. LITERATURE REVIEW

The Lean Concept is an operational thinking process with a focus on identifying and eliminating all waste within a business. The Lean Concept contains several tools, techniques and means that aim to improve organizational performance [1].

Research proposed from India, used the DMAIC method to reduce the process variations of bead splice which causes wastage of materials. By utilizing the DMAIC method, the standard deviation was reduced from 2.17 to 1.69, process capability index (Cp) value improved from 1.65 to 2.95 and the process performance capability index (Cpk) value also improved from 0.94 to 2.66. The method was proven and played a key role in reducing defects in tire manufacturing process in India [2].

E.V.Gijo & Johny Scaria suggested a study which discusses the implementation of DMAIC method with Beta correction technique in an automotive part manufacturing company. DMAIC implementation lead to the reduction of process capability-related issues and improved the first pass yield from 94.86 % to 99.48 %. A saving of approximately US$87,000 per annum was reported, in addition to the improved customer quality on returns and sales [3].

The Skaraborg Hospital Group (SHG) implemented multiple quality management initiatives in the past 20 years in accordance with its strategy for excelling at quality growth to satisfy the needs of its patients. Such an initiative is an example of the Lean Concept, which is a factor to more than 40 completed improvement projects [4].

"Echeveste, Márcia Elisa, Henrique Rozenfeld, and Monique Sonego," Journal of the Brazilian Society of Mechanical Sciences and Engineering " 38.8 (2016): 2499-2511, discussed the implementation of the Six Sigma approach in corporations to identify difficulties and ideal practices that can contribute to the efficiency of the Six Sigma tool in the integrated product development process. Results show that the main contribution of Design Six Sigma is to establish a structured method that conducts the translation of market demands into specifications for a new product development. The companies who have been interviewed understand the Six Sigma tool as an isolated application of tools, which are not integrated in the New Product Development Process information flow [5].

According to Atmaca & Girenes, for the last 15 years, many companies' managers have put lean concept into practice to help companies increase their profit and grow by making their process more effective. Lean Management bypasses the weakness of the Six Sigma approach by speeding up the process. The goal of this application is to make the process lean and to increase the sigma level [6].

A study was conducted by Jamil Sarhan, Bo Xia and Sabrina Fawzia, Azharul Karim, Ayokunle Olanipekun (2017) which pertains to barriers to implementing lean construction practices in the Kingdom of Saudi Arabia (KSA) construction industry. The results were analyzed using mean item score (MIS), Mann–Whitney U test and principal component analysis (PCA). Results revealed twenty

(22) barriers to lean construction implementation in KSA construction industry. Principal factors that constitute these barriers were found to be traditional practices, client related, technology, performance and knowledge and cost-related barriers in descending order of occurrence [7].

S. Pimsakul conducted a study which improved a manufacturing process of a laser computer mouse by using the DMAIC approach. The study centers on the functional test procedure. By working on the proposed conditions, income of the functional test procedure increases from 96.2 to 98.6% [8].

A study conducted by Jeffrey Fletcher of Iowa State University, Ames, Iowa, USA on March of 2018, explains that Lean six sigma is a quality improvement methodology which is widely implemented in the for-profit sectors. The study uncovered that overall, there exists a keen interest in the use of Lean Six Sigma and how it can be applied to streamline and improve organizational processes, produce cost-savings, improve organizational culture and improve the quality of goods and services. The Study discovered plenty of opportunities for Lean Six Sigma in the public sector and municipalities that can, in fact, incorporate its philosophy and methodology to streamline and improve organizational processes, produce cost-savings, improve organizational culture and improve the quality of goods and services [9].

Zakaria Dakhli, Zoubeir Lafhaj and Marc Bernard used "Action Research" and the results were based on an assessment conducted after 6 months of the kaizen event. The Lean implementation had positive side-effects on the company's organization and strategy. The findings of this action-research project can be used to help researchers and practitioners assess the potential application of Lean in the bidding phase. It also provides insights into the importance of the cultural and existing practices for a successful Lean implementation [10].

III. METHODOLOGY

The Lean Concept is an operational thinking with a focus on identifying and eliminating all waste in a business. Lean concept contains several tools, techniques and means that are aimed to improve organizational performance.

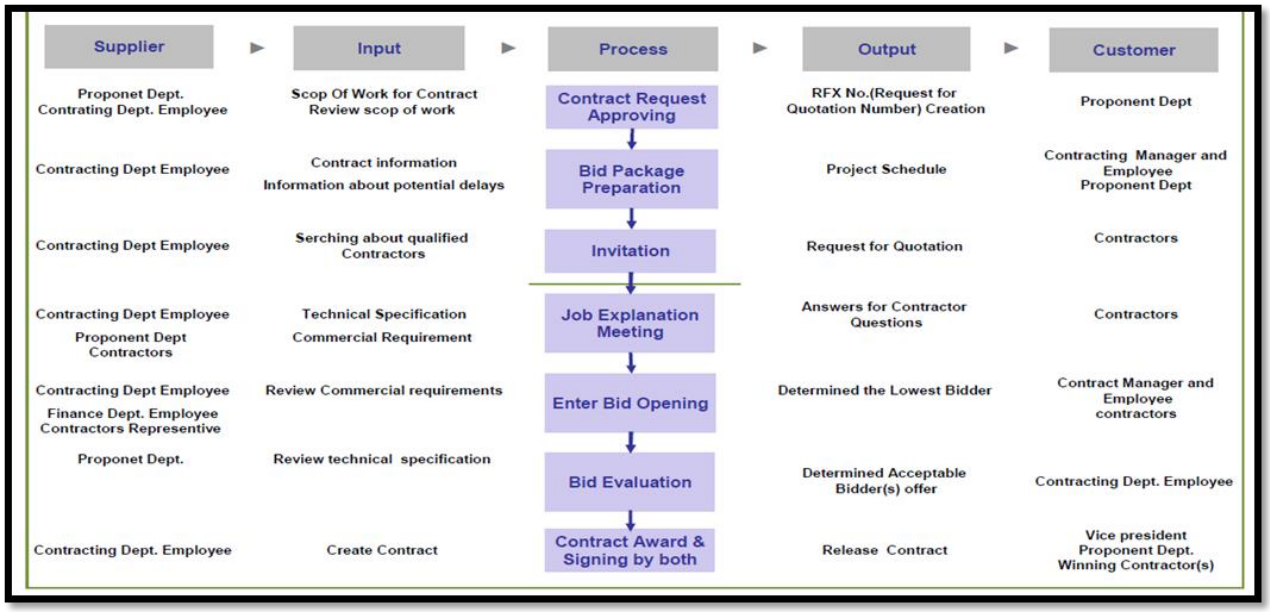


Figure 1. SIPOC Diagram which describes and simplifies the Contract Procurement Process at a Company.

SIPOC, (Supplier, Input, process, output, customer) process maps and process flow charts were used to show and identify all relevant elements of a process and distinguish interfaces. To improve a Contracting Department, it must view its business with a process perspective in order to monitor the

influence of each process and procedure on another. Process mapping is the graphic representation of these processes, procedures, events, operation and value. Figure 1 describe the SIPOC Diagram.

Another method is the Failure Mode and Effects Analysis, which analyzes the function, design and potential failure of each product. The FMEA process analyzes the key outputs and potential failures of each step of a process and considers the effect of process failure on the contract procurement process.

Figure 2 shows the stages/steps under investigation. In this study three stages critical to the procurement process are presented. These stages/steps are based on data collected from 2015 to 2017 when major delays in delays in the procurement process were most prevalent. As you can see in this figure the procurement process cycle requires additional revision of policy (ies) / procedures to improve the contract cycle. In addition to this, employees of the Contracting and Proponent Departments, which play a pivotal role in the procurement process, should always be on point to improve the cycle.

Process/Product
Failure Modes and Effects Analysis
(FMEA)

Process or Product Name:	Contract Process Time	Prepared by: Turki	Page _1_ of _1_
Responsible:	Turki Aljedaani	FMEA Date (Orig)	1

Process Step/Part Number	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes	OCC	Current Controls	DET	RPN	Actions Recommended	Resp.	Actions Taken	SEV	OCC	DET	RPN
What is the process step under investigation?	What do you see in the factory that tells you the cause has occurred?	What is the impact on the Key Output Variables (Customer Requirements)?	How Severe is the effect to the customer?	what are the potential ways the Key Inputs can vary from desired (Out-of-spec)? Start with Key Inputs from C&E Matrix.	How often does cause or FM occur?	What are the existing controls and procedures (inspection and test) that prevent eith the cause or the Failure Mode?	How well can you detect cause or FM?		What are the actions for reducing the occurrance of the Cause, or improving detection?		What are the completed actions taken with the recalculated RPN?				
Contract Documents Reviewing	Incomplete Contract documents	Return docs to prop. Department to complete and dealy in contract process	5	* Use old scope of work ,* not checking new update before sending docs.	7	SAP quick review by managers	4	140	* Consulte Contracting Dept. by Email before sending docs via SAP.	Contracting Dept. Staff					0
Contractors Clarfications	a lot of contractors clarfications	dealy in bid opening to answer and resolve questions	6	* Unclear scope of work , * Contractors missing job explanation meeeting	8	Clarifications resoving	3	144	*Write a clear scope of ork to avoid contractors questions , * All Contractors should attend job meeting .	Prop. Dept. Contracting Dept.					0
Final Contract Signing	Dealy in signing contractor by either SEC Management or Contractor Management	Dealy in project start .	7	Availibilty of sinatory for signing	6	Follow up and reminders	6	252	Give authortiy to other managers in the same area to sign .	Procdures department .					0
								0							0

Figure 2. FMEA

IV. DATA COLLECTION & ANALYSIS

The data used in this study is a collection of different contracts from Distribution & Generation Business Line Contracts Division within the three fiscal years of operation 2015-2017. Contracts within these periods are procured through online bidding using Suppliers Relationship Management (SRM) which is part of the SAP program. Data collected showed that total contracts procured in 2015 totaled 136 and the contract defects (contracts not signed within the standard time) totaled 68. In 2016, the total procured contracts stood at 164 and the defects 126. Finally, in 2017, total procured contracts were 123 and the defects were 55. From the data collected it was observed and identified that there are numerous delays in the contract procurement process. Most of the contracts exceeded the standard

time on all business lines. Approximately 58% of the contracts were found to be signed after the standard time limit as seen in the table 1.

Table 1. 2015 to 2017 Contracts Data

Year	***No. of Contracts Procured***	***No. of Defects***	***% of Defects***
2015	136	68	50%
2016	164	126	76.83%
2017	123	55	44.72%

Table 2. Root Cause for Contract Signing Delays

Proponent Department	***Top Level Management***	***Bidders***	***Others***
Tendering Planning	Delay in Signing	Bid Opening Extension Request	Lack Proper Training & Motivation of employees
Weak & Unclear Scope of work	Unavailability	Lack of commercial and technical documents	Delay in Finance review
No Budget Allocation	Delay in approval for Contract Awarding	Delay in submission of bid bond and bank guarantee	SAP issues for some users
Wrong Contractors Selection		Delay in responding for post bid clarifications	Banks Delaying in issuing guarantees
Delay in Bid Evaluation and Response for Clarifications			System Approvals

Table 3. Ideas to Resolve Root Causes of Delay

Proponent Department	***Top Level Management***	***Bidders***	***Others***
Weekly Follow up by Contracting Dept.	Awareness of quick SAP Approvals & Consequences	Complete All Documents Before Awarding	Improve Yearly Increment for Contracting, Finance and Proponent Staff
Online courses to improve staff skills	Decentralized Approvals	SAP Workshops	Online Guide for Procedures
Endorse SOW by Experts	Change Authorities Limitations	Penalty for Signing Delay	Managers Support
Provide Yearly Projects Plan for Contracting Department		Review Qualification Procedures	Follow Up System

This study aims to identify the root causes for this excessive delay in the contract procurement processes and to deal with them in order to reduce the percentage of contracts that exceeding the standard limit from 58% to 10% by the end of the year 2018.

Table 2, shows the root causes for delays as well as Table 3, which shows ideas generated to resolve said delays.

V. RESULTS AND DISCUSSION

In addition to the collected data, a questionnaire was developed that contained a list of defective contracts within the period of 2015-2017. The document was sent to all concerned contract representatives of the company via email. Each representative was asked to fill out the questionnaire and list all circumstances and reason(s) occurring during the contract process which contributed to the delays. After gathering and analyzing the responses, the major contributing factors to said delays were found to be as follows; Proponent Department, Signatory (management level), Finance and Investment sectors and bidders. Figure 3 illustrates the size or the magnitude of delay of each contributor in the procurement process.

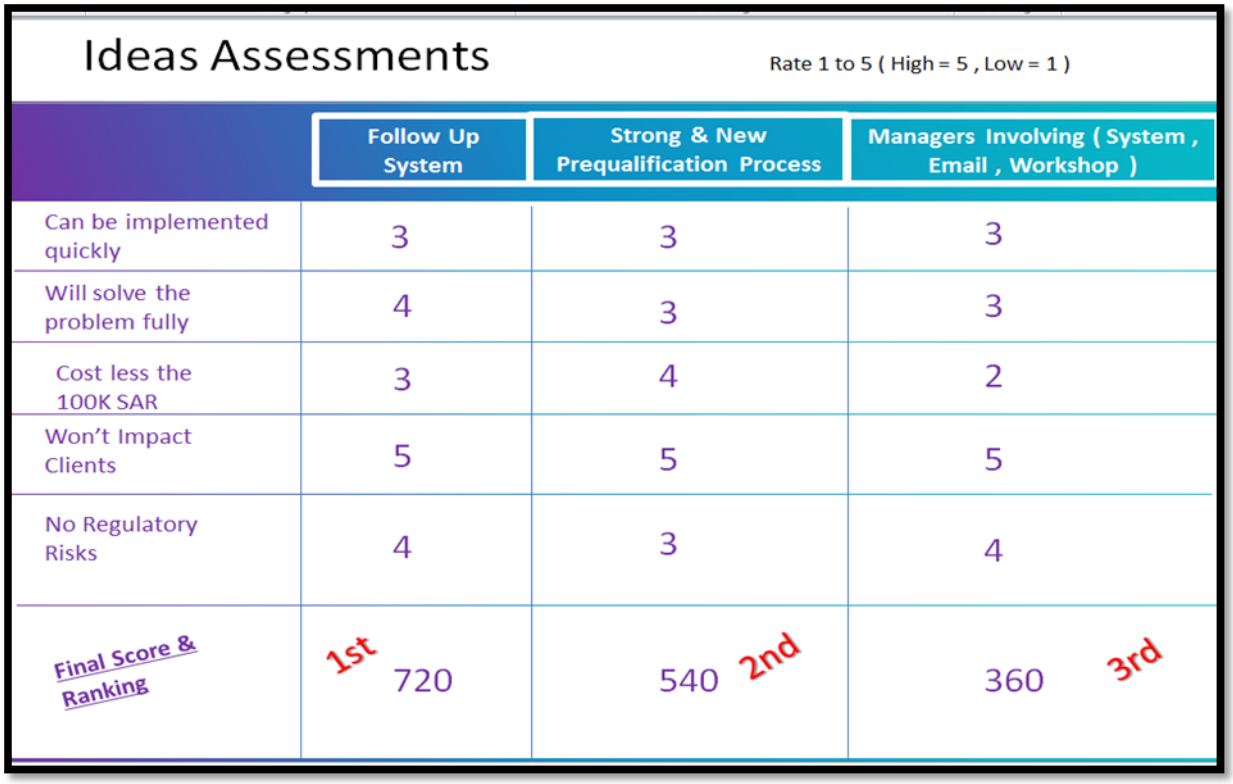
After identifying the root causes, ideas for improvement were generated through brain storming sessions. The ideas were then assessed as shown in table 4. The idea with highest points was found to be the "Follow Up" system, however, application of said system would require revision of system approvals which would result in increased cost, in addition to new system approval being a time consuming and complicated procedure.

Instead, a new form was composed which consisted of most of the generated ideas. The form serves as a guide for Contracting and Proponent Department representatives and can be used in monitoring the steps of the procurement cycle.

The result was noticeable after applying the improvement techniques as the number of defective contracts were reduced by 48%.

To maintain this improvement, the company should conduct monthly evaluations of the contract process cycle, scrutinize any changes in the procurement process and closely monitor the performance of supervisors, division heads and department managers. Additionally, the company should train its employees in the use of the SAP system & Commercial Contracting to further improve the contract cycle and to develop employee awareness of the company's power plants and assets.

Figure 3. Delay Reasons



Ideas Assessments

Rate 1 to 5 (High = 5 , Low = 1)

	Follow Up System	Strong & New Prequalification Process	Managers Involving (System , Email , Workshop)
Can be implemented quickly	3	3	3
Will solve the problem fully	4	3	3
Cost less the 100K SAR	3	4	2
Won't Impact Clients	5	5	5
No Regulatory Risks	4	3	4
Final Score & Ranking	1st 720	540 2nd	360 3rd

Figure 4. Idea Assessment

VI. CONCLUSION

Contract Procurement is a challenging field, where in activities require quick actions, careful decisions and effective follow up on a management level. After applying the "Lean Concept" to the current procurement process it was found to be highly effective and, therefore, vast improvement in said process is indeed possible and sustainable.

Conflict of interest: The authors declare that they have no conflict of interest.

Ethical statement: The authors declare that they have followed ethical responsibilities

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This volume is dedicated to Late Sh. Ram Singh Phanden, father of Dr. Rakesh Kumar Phanden.

