

MATERIAL PLANNING AND CONTROL: A CASE STUDY OF TGTDCL

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ABSTRACT

Titas Gas Transmission and Distribution Company Limited (TGTDCL) is a public Limited (75% share of government) Company responsible for distributing natural gas to customers at the household, commercial and industrial level. In order to deliver it services more efficiently, the company needs to address a number of Material Planning and cost control issues such as supplier problems, accurate technical information, bureaucratic and administrative barriers, audit and tax burden, as well as financial and customer services. Titas Gas personnel uses manual procedure to purchase material and to manage of inventory. TGTDCL needs to purchase material in case of unavoidable conditions. Therefore, some of the items go to pile up and some of them go shortages when materials need. The purpose of this paper is to investigate the role of material management in a downstream Natural Gas Company. This paper discusses the current procedure material planning and controls of traditional model of Titas Gas. It also outlines strategies for improving material management in the downstream Oil & Gas Company. Finally, this paper introduces a case study that shows how material management model of TGTDCL can be improved and thereby make the material planning and customer service of TGTDCL more efficient.

Keywords: material plan, cost control, innovation, public procurement rules (PPR), Inventory control, supply chain, customer service

INTRODUCTION

Material Requirements Planning is a time phased priority-planning technique that calculates material requirements and schedules supply to meet demand across all products and parts in a service company [1]. Material management is a scientific technique, concerned with Planning, Organizing & Controlling of flow of materials, from their initial purchase to destination. Usually, materials, information, capital, labor, technology, financial assets, and

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other resources flow through the material planning and inventory control processes. The main theme of Material Planning is “getting the right materials to the right place, right price at the right time” [5, 6]. Information Technology, Enterprise Resource Planning (ERP) plays a major role in designing and implementing Material requirements. Planning systems and processes as it provides information about service needs (linked with customer demand) as well as information about inventory levels. It clearly known that inventories have a direct impact upon the firms’ profit and proper inventory management is a major contributing factor to fluctuations in business activity. Thus both from operational and profitability point of view, maintaining an optimum level of inventory is very important for any business enterprise. Inventory control is not only the control of physical goods owned by an enterprise but also the control of the amount of funds invested in inventories of each type. The good understanding of sensitivity analysis, sound capital rationing and use of correct investment appraisal technique are all-imperative for a material manager [13]. As a Material Planner, the manager needs to maintain good personal relation with proper supplier and good information systems, be informed about government policy and community plan, environmental impact and nature conservation, compatibility with existing uses, economics benefit, interdepartmental harmony and consistency with quality service. Besides, terms of personal circumstances, private interests, moral or religious considerations, political or ideological interest, cost of development, ownership are irrelevant. There are three main steps [2] of material planning: a) identification of material requirements, b) creating suggestion (Critical, expedite, delay items), c) firming suggestion (Purchasing order, various reports). Planners need to think about the dimension of Inventory, priorities and capacity before doing material planning. Recognition of business and technical opportunity, solving the inventory problems consideration of motivational factors of MRP is also important [7].

The problem of lot sizing is one of satisfying the requirements while trying to minimize holding and setup costs. A variety of lot sizing rules has been proposed. The vital aspect of inventory planning is to find out and maintain the optimum level of inventory in an enterprise. The ideal inventory level is a material's Economic Order Quantity (EOQ) [6]. EOQ is a mathematical formula designed to minimize the combination of annual holding costs and ordering costs. EOQ is amount when an order has placed to consider. It can be determined by, $EOQ = \text{average monthly consumption} \times \text{Lead Time (in months)} + \text{safety Stock} - \text{Stock in Hand}$. Here, Lead-time is the time between placing order and receipt of material. Ideally, lead-time should be between 2-6 weeks. Next, Planners need to determine Safety Stock (SS). This is the amount that one should have remaining when the EOQ arrives. Safety stock is the average bare minimum that will have at any given time and $EOQ+SS$ are the average maximum amount that will have at any given point in time. This should be intuitive because safety is what we have when our shipment arrives and when the order arrives (EOQ) it gets added to the safety stock. A sound, mathematical approach to safety stock will not only justify the required inventory levels to business leaders, but also balance the conflicting goals of maximizing customer services and minimizing inventory cost.

Safety Stock = $\{Z \times \text{SQRT} (\text{Avg. Lead Time} \times \text{Standard Deviation of Demand}^2 + \text{Avg. Demand}^2 \times \text{Standard Deviation of Lead Time}^2)\}$, $Z = Z$ score [3]

The best way to deal with variable supply is to have high level of communication with the vendor and not to count on safety stock. At the end of each day, the MRP (Material

requirement planning) system will run to identify items as critical, expedite, or delay. The MRP system will suggest if we need to order more of a certain material by classifying into the three categories. There are different methods to do plan material [1] such as ABC (Always Better Control) based on cost criteria, VET (Vital, Essential, Desirable) based on critical and shortage cost of an item, SDE (Scarce, Difficult, Essentially available) based on availability, FSN (Fast, Slow, Non-moving) based on utilization, HML (Highest, Medium, Low) based on cost. Material Planner should think about latest technology, opportunity cost, repair facility within shortage downtime, post warranty and repair, proper installation and procedures, reputation of manufacturer and available spare parts and outside agency, environmental effects. Inventory management is important to keep material at optimum level and reduce the losses against deterioration, obsolescence and wastage, minimize inventory-ordering costs. Efficient inventory management process involves controlling the level of units in stock in order to prevent the inventory from becoming too high and a good inventory management controls the costs associated with the inventory, both from the perspective of the total value of the goods included and the tax burden generated by the cumulative value of the inventory [7, 8]. One need normally set a time framework of 12 months for implementing MRP. In case of Material Planning, Cost is specified in terms of % of total effort and represents labor (i.e., in person – months). Nevertheless, Cost associated with capital acquisition (hardware or software) is not included.

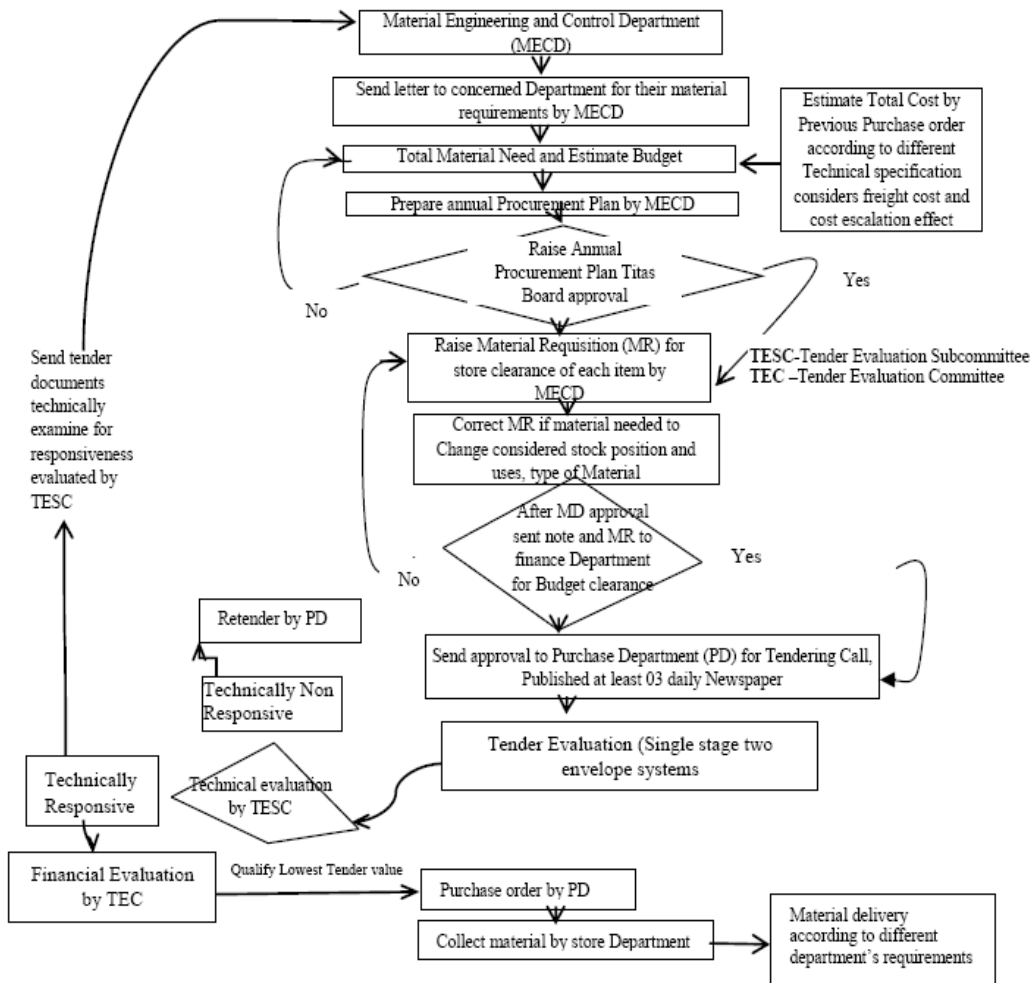
As a material planner, one should consider shareholders expectation such as sustainable growth, sustainable dividend growth, accurate forecasts, good governance & reputations, clear strategic directions, regulatory and legal compliances. She/he needs to consider Confidence in Board and Management, Government and regulatory body's expectation such as public safety, innovation and economic growth, industry leadership, workplace safety, infrastructure investment, reduce emission, good regulatory outcomes. Material plan is vital for safety and reliability, reasonable price, timely response, to complaints and queries, innovative solution. Shareholder's expectation is normally sustainable growth, sustainable dividend growth, accurate forecasts, good governance & reputations, clear strategic directions, regulatory and legal compliances [10]. Confidence in Board and Management and Government and regulatory body's expectation is public safety, innovation and economic growth, industry leadership, workplace safety, infrastructure investment; reduce emission, good regulatory outcomes. Material Planner should consider that Material would not unduly stress under normal operating conditions such that full-required demand can met.

CASE STUDY – TITAS GAS TRANSMISSION AND DISTRIBUTION COMPANY LIMITED (TGTDCCL)

Material Procurement Planning and Procedure at TGTDCCL

TGTDCCL is a Government Company, so strategic national plan needs to consider for developing a material plan. Government circular and PPR, orders, statutory instruments, guidance and advice needs to follow when one considers material plan. The flow diagram-1 shows the material planning of TGTDCCL performed by Material Engineering and Control Department (MECD). This is a traditional, classic and well-defined system, however, it is not a dynamic system that can apply to the modern world. MECD does not enjoy the

independency according to the current system. Titas Board and approval authority (Managing Director) can get troubles according to this system. MECD conducts MR (material requisition) and note sheet to the Finance Department to get budget clearance after completing every procedure and taking expertise advice and approval from Managing Director. Sometimes, Finance Department raises voice about technical matters; such that type and number of materials etcetera instead of financial matters that can delay the material purchase. As a result, sometimes MECD needs to change preplan material that affects the customer services and user departments' requirements and company's goodwill. In addition, MECD needs to take information user department. Some of the concerned official does not know the material specification and installation date of equipment upon his/her tenure/jurisdiction due to installation of material and equipment did long time ago and previous persons didn't keep all reports proper way. Moreover, some officials do not know how to write requisition of material specification due to lack of training. In that case, MECD can get wrong idea or information. MECD personnel needs to be intuitive with proper training, planning, maintenance, procurement, operational, cost administrative experience.



Flow diagram-1.

Two envelopes single systems of international tendering method is used to purchase material and equipment according to CPTU and Public Procurement Rule (PPR)-2008. One envelop of tender documents examine technical matters of tender, if Technical evaluation subcommittee takes responsive action then open the tender for economic matters. Purchaser pursuant the Public Procurement Rules, 2008 shall make Tender Documents available immediately to the potential Bidders, requesting and willing to purchase at the corresponding price if the advertisement has published in the newspaper pursuant of the Public Procurement Rules, 2008. Nevertheless, MECD emerges some traditional and cultural factors instead of PPR.

Procedure and Costing of Material at TGTDCL

As a Service and Government public Limited company TGTDCL, customer service must focus on considering benefits verses costs of each decision. Like all other oil gas company in the world, TGTDCL almost all significant and important operations are planned. Thus, the whole procedure needs to fine-tune in to a high performance moneymaking machine. In that case, if the company acts best interest to optimize its profit can jeopardize customer service and satisfaction. There are two sections of MECD such as MEES (Material Engineering and Evaluation Section) and MPCS (Material Planning and Control Section). MEES of MECD prepares Technical specification of different material and equipment's. This is a vital task for material Planning and Costing. Technical specification (TS) determines material quality and availability, supplier availability and costing, transparent and fair neutral competition among suppliers. Concerned Committee approves TS. MEES arranges meeting for evaluation of international tender technical matters by TESC (Tender Evaluation Sub-Committee) for technically responsive. Those submitted tenders qualify technically responsive are evaluated financially by TEC (Tender Evaluation Committee) only. TEC should advise to give purchase order to the lowest bidder (+-5% of estimated price according to PPR-2006) and this procedure is done by Purchase Department. Relations of different departments at TGTDCL regarding material requirements plan and purchase are following Figure 1:

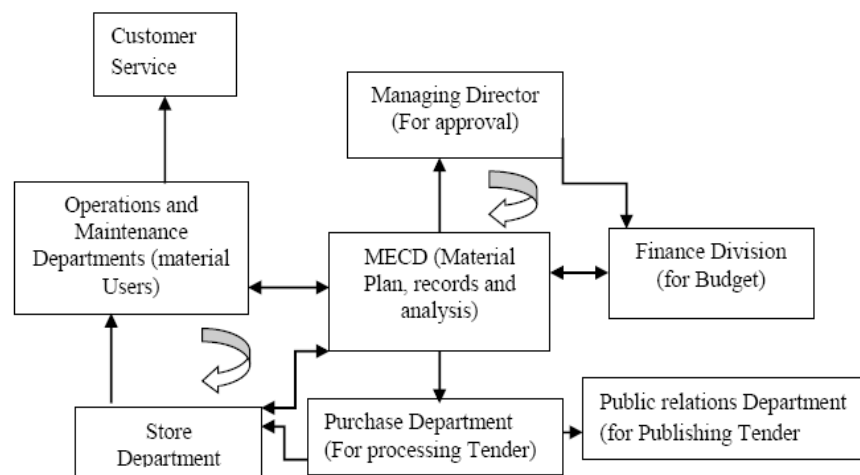


Figure 1. Departmental relations regarding material plan and purchase, TGTDCL.

On the other hand, MPCS takes action material and cost estimation according to concerned Technical specification. They normally estimate unit cost considering the previous purchase order. Here, intuitive decision, information and practical experience of MPCS personnel plays vital role. EOQ (economic order quantity), previous use, present stock and user department advice normally considers before to prepare material requirements plan. MEES makes technical specification by taking advice from concerned committee according to different required British, American and Canadian standard. MPCS needs to prepare annual procurement plan after collecting data from relevant department. They also prepare material requisition (MR), material transport Order/voucher (MTO/MTV) and they take action budget clearance from finance department. They need to estimate unit price and budget considering previous purchase order. MPCS considers reconciliation cost, freight and delay of materials also. They normally use excel sheet to estimate instead of commercial software. They face challenges to estimate price of materials especially if they do not have previous purchase order of that materials. MPCS should follow strict rules and regulations (Public procurements rules, PPR-2008, act 2006) because of TGTDCCL as a Government Company. Coordination with store department and store accounts section is vital to take decision how many items need to buy. Here, MPCS faces bureaucratic barrier. They have restriction to communicate any suppliers in tradition. Although, there are no problems to communicate perspective's supplier according to PPR keeping transparency and impartiality. As a third world country, TGTDCCL face human, political and cultural restrictions. Sometimes, Material planners lose their motivational factors. In addition, they face questions difficulty under or over price estimation. The rest of the procedure regarding procurement such as Tendering and publish tender to daily newspaper, purchase contract, procurement method, monitor order status, reception of material, reconciliation are done by Purchase Department (PD).

Problems Background of Material Planning at TGTDCCL

Titans gas deals with complex gas distribution services, it has active valve and metering station involves meeting stringent safety regulations and follow other government requirements related to existing and new gas distribution networks. TGTDCCL also needs integration with decision supports systems, business functions such as design, engineering, gas line construction and networks analysis etc. This paper discusses about the foreign purchase of TGTDCCL material to support the whole systems operations. The drawback of TGTDCCL material planning is repressive interdependency and time consuming of financing systems. In addition, there is restriction to communicate tenderers and manufacturer from MECD keeping secrecy. MECD sometimes does not get budget timely, as per demanding of regulator-meter, materials continue to increase. Most of the cases, finance arises question about number of proposed items to be purchased and audit matters. As a consequence, this affects general customer services. Finance division should consider that Innovation and competition resulted in greater efficiency of the performance of financial function. Sometimes, user department cannot be able to supply specific material/instruments. Therefore, Operation and Engineering services department do not be able to install accurate sizes of meter, regulator and other materials due to lack of available proper sizes of materials. In that case, they install alternative instruments in to the existing operating systems that affect the measuring systems and eventually TGTDCCL loses money. Titans Engineering services

departments need to install higher capacity meter and regulator which increase installation and investment cost due to lack of proper material. It also affects planning of these items. Means, some of the material can lose out within short time and some may increase to block or pile up the store and inventory. Total setup material and spare parts also can hinge customer services and measurement systems. In addition, some of the material needs special technical specification and updated technology. In that case, Store personnel needs training to adapt themselves in the technical matters those who do not have relevant experience. According to Store accounts/Accounts department, about TK 19.33 crore, number of 10849 items did not use from the last five years from 2005 to 2013 (Dead Stock Committee interim report, TGTDCCL) equivalent materials or these are slow/dead items. However, Committee decided that about Tk. 5.56 crore (about 685 number items) equivalent items has had definitely usable conditions and Tk. 3.32 crore (376 number items) have had usable conditions, but they need to justify whether it can be used present operating conditions. Rest of the TK 10.18 crore 9788 number items are obsolete, cannot be used under present operating conditions due to technological change, quality, future requirements. The most of the 9788 items (Automobile items) purchased long time ago (during 1970-1990 years). Here, as a downstream gas company, material manager often purchase products months ahead through forward contracts. Material manager considers price risk supplying material by a short notice. Dead material can be the cause of technological change, ignorance of management or ignorance of user department. However, that does not mean TGTDCCL will not purchase regular items for proper operations of existing systems and serve customer services. After formation of MECD in 2009, they try to establish updated technique avoid unnecessary financial burden.

Table 1.

Procurement Plan	Approved Plan (Lac Taka)		Actual Execution (Lac Taka)		% of Execution		Note
	Local	Foreign	Local	Foreign	Local	Foreign	
FY 2011-12	990.02	3732.09	410.09	2526.62	41.42	67.69	
FY 2012-13	2313.28	3770.88	1195.17	1215.48	51.66	32.23	
FY 2013-14	5229.43	4328.80	4317.73	1097.96	82.56	25.36	
FY 2014-15	6698.22	3849.40	5968.81	2359.87	89.11	61.30	
FY 2015-16	14165.29	13281.32					

Sources: MECD, TGTDCCL.

Table 2.

Procurement Plan	Approved Plan (Lac Taka)		Actual Execution (Lac Taka)		% of Execution		Note
	Local	Foreign	Local	Foreign	Local	Foreign	
FY 2011-12	990.02	3732.09	410.09	3284.05			For carry over
FY 2012-13	2313.28	3770.88	1195.17	5496.60			For carry over
FY 2013-14	5229.43	4056.60	4317.73	975.67			
FY 2014-15	6698.22	3849.40	5968.81	919.67			
FY 2015-16	14165.29	13281.32		1409.35			

Source store accounts, Department of Accounts, TGTDCCL.

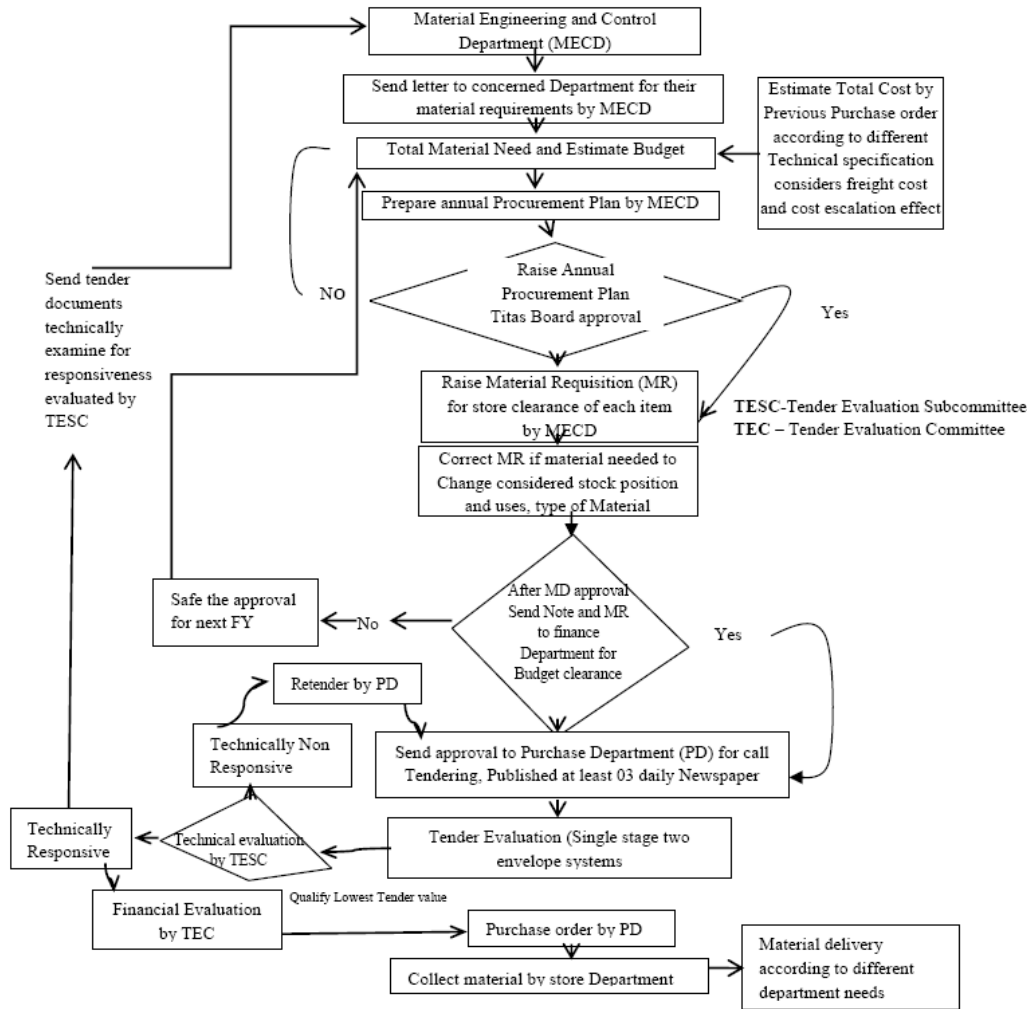
The Tables 1 and 2 show that the actual percentage of execution of plan does not consider as satisfactory level. Sources of the two section's data also show the coordination level is poor. After completing the material procurement procedure from MECD, tables shows clearly that, material does not reach proper time into the store department (within FY). Therefore, Management procedure is not effective to purchase foreign plan-material just in time. This troubles may relate to tendering, suppliers, evaluation, political or management. TGTDCCL needs to address this matter. According to Manager (MPCS), MECD information, the approval of financial budget sometimes takes time and they cannot execute plan within financial year July to June. In addition, Material planner does not keep independency; financial persons sometimes arise questions irrespective of material plan and out of their professional jurisdiction. Here, user department sometimes send incomplete information regarding material requirements and description. MECD draws procurement plan manually based on the user information and based on their judgment. On the other hand, purchase department faces problems of tendering time and execution, supplier scarcity. Some of the tender can be non-responsive due to technically and financially nonresponsive according to PPR-2008 [9] and Tender committee decisions. Some of the Supplier cannot deliver product within time after getting purchase order. For instance, after 03 years gas connection binding open in 2013, the demand of residential gas customer was pile up. As a result, Supplier (BMTF, BSCIC) of residential gas instruments and materials such as regulator, lock wing cock, elbow and nipple was their beyond capacity. Finally, general stakeholder and shareholders did not get benefit due to material shortage affects ultimately customer services.

Total authorized capital of TGTDCCL 2000.00 crore, Paid up capital 989.22 crore (as 30 June, 2014), annual gas sales revenue 7695.50 crore, fixed asset 1057.18 crore, administrative cost 370.38 crore, cost payment to national exchequer 615.41 crore [sources 2013-14 annual report of TGTDCCL]. TGTDCCL performed execution of material procurement only 0.704% of gas sales revenue, 2.7% of authorized capital, 5.47% of Paid-up capital and 8.8% of government payment to national exchequer (2013-2014 FY annual report and sources MECD, TGTDCCL) annually. Material Procurement planning can consider moderate, but execution level is poor. Management should consider the execution of material plan and no more delay of irrespective question arise from concerned department fulfilling proper customer services and respective shareholder wishes. As a material manager, one should consider initial capital cost of construction, safety and reliability, efficiency of operation, operating and maintenance cost, availability of spare parts, frequency extent and type of servicing, and environmental condition before purchase a material [8]. Here, some of the foreign materials spare parts conformity can secure significant money of TGTDCCL.

Proposed Model for Material Plan of TGTDCCL

Proper planning of material and its execution can save Titas Gas money as well as fulfill customer satisfaction. According to MECD material planning and Control Section (MPCS) of current situation, it is very difficult to execute Procurement Plan. TGTDCCL needs to execute material plan professional way. Considering material in hand, prior given purchase order and uses, MPCS normally prepare material procurement plan according to the different department requirements. MPCS considers the practical situation and engineering point of view as well as financial matters what material needed to operate Titas Gas smoothly.

Practical situation regarding material purchasing is crucial in Bangladeshi Government Company like TGTDCCL. Here, Material planner should be initiative, intuitive and professional and handle different departments with care. The irrespective quarry from concerned department ultimately kills time and MECD cannot purchase proper material within the financial year. Therefore, it can be improved by the following proposed systems:



DISCUSSION OF PROBLEMS FINDING DIFFERENT SOLUTIONS AT TGTDCCL

The questions normally arise about purchase and inventory management systems about what proportion are in house production, local purchase and foreign purchase, financial/budget systems, handling communications between suppliers and company, type of technology adapted, ensuring supplier effectiveness in cost, timeliness and quality. TGTDCCL runs a monopoly business at gas distribution sector due to government in nature. However, they should not forget regarding efficiency equivalent to international gas company and

general public services. Most of the cases about the foreign purchasing at TGTDCCL takes long time due to bureaucratic and financial decision. Management should consider cost effective, trouble free, easy handling and high return on investment matters. Here, excellence, high quality network, effective maintenance plan, safe & reliable service, fit for purpose of network design, clear role and responsibilities, Technical training and development and last understanding market and customer service level are essential for a material planner. The material plan can do the best way based on previous consumption. Random decision about material purchasing of TGTDCCL cannot satisfy customer, shareholder, employee and vision of a large company like TGTDCCL. TGTDCCL needs central repository interdepartmental and intercompany decision support system led by MECD. This central system can perform long range planning and forecasting by complying with the repair and maintenance staff, regulatory and safety requirements.

The inventory status records contain the status of all items in inventory, including on hand Inventory and schedule receipts. These records must keep up to date, with each receipt, disbursement, or withdrawal documents to maintain record integrity. Here, Problem of TGTDCCL material planning are information gap and coordination, Store department contains records of inventory, and sometimes it differs with the material engineering & control department and purchase department after using user departments. It is a management control issues. Titas authority should address it with proper job staffing, guidelines, and training. It is a government & management policy to overlap role with three departments like purchase, store and MECD. Therefore, Communication and coordination are vital. Titas needs to enable the international standard, streamlined inventory and seamless dataflow conditions across the enterprise. The basic facts of finance are the time value of money, opportunity cost, cost of capital, expected return and risk, valuing the financial securities should consider before rejecting any budget of proposed material requisition from the finance section.

MECD of TGTDCCL is responsible to monitor material demand and supply condition, communicate market and performance of materials. There are some unavoidable problems of management communication and hierarchy systems according to Bangladeshi culture. It is very difficult to break the systems. TGTDCCL needs to accustom abide by Bangladeshi culture. To honor the culture, they need to develop systems for general public services. TGTDCCL uses traditional method for purchasing instead of improving performance of entire supply chain of materials. However, the choice focuses on economic decision hinging provide maximum benefit at minimum cost. Hence, TGTDCCL is a public limited government company; Management should consider public service as well as public safety. Enterprise Resource Planning (ERP) systems are extensions of material resources planning (MRP) systems that run on a single database in a client server environment. SAP (Systems, Applications and Products) in Data processing is currently the leading provider of ERP systems. Management can consider purchasing of modern supply chain management software like Enterprise resource planning, ERP (example, SAP) software. TGTDCCL has significant meritorious Manpower. TGTDCCL needs to develop labor by giving them robust training before purchasing this type of expensive software.

The developments of material planning should include the focus of demanding better and faster customer service; know globalization of the oil and gas business; inner company competition; and the availability of information technology to facilitate information exchange with Parents Company. Company's integration and cohesiveness will reduce costs if it leads to a more efficient system. Here, strong political and regulatory body's commitment and

management people selection is a vital role to execute dynamic material management systems. Vertical integration of Parents Company can reduce cost and better customer service. TGTDCL communicate to Parents Company normally when problem arises. However, it is not effective. TGTDCL should develop communication systems with sister concern Company like PGCL, BGDCL, KGDCL, JGDCL, SGCL and BAPEX.

CONCLUSION

Smooth cooperation's is vital for the Purchase, Store and Material Engineering and Control Department for proper asset data management and compliance. Change of management procedure regarding material planning at TGTDCL needs to emphasize improved material unit-coding system. This study shows that TGTDCL should reduce the bureaucratic barrier and improve professional conduct within the departmental jurisdiction. This paper demonstrates that Service innovation is not given due importance at the TGTDCL. The reasons for not emphasizing services innovation needs further study. Transparency and accountability can play a vital role in improving management and expenditure of TGTDCL's gas distribution network. This study shows that TGTDCL has lack of relevant trained people and deficiency regarding proper staff selection of work force on material planning control systems. Finally, TGTDCL can purchase Material Resource Management Software, ERP (SAP) with user module environment by giving robust and proper training and selecting of TGTDCL Personnel.

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REFERENCES

- [1] Selvaraj, I. *Material Management*, I. R. M. S Sr. D. M. O (Selection Grade officer) (on study leave), Indian Railways Medical Service.
- [2] Solayman Hoque¹, K. M., Biswas S. K. and Wazed, M. A. (2015) Relationship between inventory management and industries becoming sick, especially in third world countries, *Journal of Mechanical Engineering, Mechanical Engineering Division*, The Institution of Engineers, Bangladesh Vol. ME 45, No. 1, June 2015, Page 7-13.
- [3] Titas Gas Transmission and Distribution Company Limited, Dhaka, *Annual Report 2013-14*, www.titasgas.org.bd.

- [4] Chima, Christopher M. (2007), Supply- Chain Management Issues in the Oil and Gas Industry. *Journal of Business & Economics Research* – June 2007, Volume 5, Number 6, California State University, Dominguez Hills.
- [5] Professor Gallego, Guillermo. *Material Requirements Planning (MRP)*, IEOR 4000: Production Management.
- [6] Volman, T. E., Berry, W. L., and Whybark, D. C. (1992), *Manufacturing Planning and Control Systems*, Third Edition, IRWIN, Burr Ridge, IL.
- [7] Dr Moustakis, Vassilis (2000), *Material Requirements Planning, Dissemination of Innovation and Knowledge Management Technique*, Associate Professor, Department of Production and Management Engineering, Technical University of Crete, January, 2000.
- [8] Government of Alberta. *Technical Standards and Specification Manual for Gas Distribution Systems- Safety, Design, Construction, Operation and Maintenance of Natural Gas Distribution Systems*, Sixth edition, Alberta, November, 2010.
- [9] Public Procurements Rules. *Public Procurement Act-2006*, Bangladesh.
- [10] Vector, *Gas Distribution Asset Management Plan, 2015-2025*, New Zealand.
- [11] Department for Communities and Local Government. *Planning Practice Guidance of Onshore Oil and Gas*, July-2013, UK.
- [12] Brown, Ken, Moles, Peter, Vagneur, Kathryn, Robinson, Craig. (2011) *Finance for the Oil and Gas Industry*, Heriot-Watt University, FO-A1-engb 1/2011 (1046).
- [13] Kearney, A. T. (2002), *Materials Management, A Gold Mine for Upstream Oil & Gas*, LLC Korea.

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