A STUDY ON IMPLEMENTATION OF ELECTRONIC PROCUREMENT SYSTEM BY AN AEROSPACE COMPANY

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Abstract
Today's competitive pressures compel companies to continually seek new ways of doing business. Improving supply chain efficiency is one such area which can provide the companies competitive advantage. Building competitive advantage is no longer resides with the company's own capabilities, but with the relationships that the firm can forge with their external partners – the customers, the suppliers and other service providers. The formation of this network called as supply chain. If the supply chain is not managed properly then the delivery gets affected resulting in customer dissatisfaction and hence loss of business. Improving supply chain efficiency can be done through Implementation of various initiatives such as Enterprise Resource Planning (ERP) / IFS company wide, implementation of E- Procurement System(EPS), Integration of Materials Management (IMM) functions, Early Involvement of Suppliers (EIS), Widening scope of Outsourcing, Cost-reduction through Value Analysis / Engineering programmes, Lean Manufacturing, Entering into Long Term Business Agreements (LTBA) with key suppliers, Inventory Analysis etc. This research paper focuses mainly on implementation of e-Procurement System by a premier aerospace company in India. This premier aerospace company is owned by the government of India in the strategic defense area. Case Study approach has been adopted to address the mode of selection of solution provider, finalization of IT infrastructure, implementation methodology adopted, implementation issues and concerns, key benefits and value addition to the stakeholders etc.

Key words: Supply Chain, Electronic Procurement System, Outsourcing, Solution Provider, Value Addition.

1 Introduction

Electronic Governance (E-Governance) is seen as a 'decisional process'. It is about the use of Information and Communication Technologies (ICT) in systems of governance so as to ensure a wider participation and deeper involvement of citizens, institutions, non-governmental organizations, and companies in the decision making process of governance wider and deeper than is possible in the conventional forms and forums of consultation in democracies today. E-Governance allows direct participation of constituents in government activities (Electronic Governance) will bring forth new concepts of citizenship both in terms of needs and responsibilities (Satyanarayana, 2006).

Accordingly, the Government of India has designed a comprehensive plan for implementation of Electronic Government (E-Government). The National e-Governance Plan (NeGP) adopts a multi layered approach, spreading across the priority domains of the central, state and local governments in India. At the heart of the plan are set of core policies that address the common requirements of the entire e-Government plan, standards for E-Government, security policy, and policy on Public-Private Partnership (PPP), capacity building, and infrastructure for Electronic Government.

As part of National e-Governance Plan, Government of India has issued directives through the administrative ministries / departments to implement Electronic Procurement (E-Procurement) system in the procurement process of the Central Public Sector Undertakings (CPSUs), State Public Sector Undertakings, Government departments, with effect from the Financial Year 2011-12. Accordingly, companies /departments have adopted e-Procurement system implementation programmes through Outsourcing mode either partnering with Application Service Provider (ASP) or Solution Provider including integration for implementation.

Outsourcing is a cost saving strategy being implemented by both Private and Public Sector to concentrate on their core activities rather than non-core activities such as transportation services, health services, canteen services, maintenance services, administrative activities & back office

operations. Outsourcing encompasses 4 stages, first Strategic Thinking, to develop the concept of outsourcing in its activities, second evaluation & selection of outsourcing projects & service provider to do it. Third is contract development, to work out the legal, pricing & service level agreement and fourth is the outsourcing governance or management to refine the professional relationship between the client and service provider. Evaluating an outsourcing firm against key parameters shall give a better understanding about the service provider's credibility, experience, quality standards, and areas of expertise and organizational structure, work culture & ethics followed by company.

Owing to its advantageous factors like world –best intellectual and internet resources, lowest cost structure, multilingual capabilities etc, has made India the best choice as outsourcing destinations as much can be seen from the rise of software &BPO industries since two decades. The outsourcing industry not only provides employment but also contributing immensely in GDP growth of the economy. India's export of IT products mainly in the form of outsourcing services to grew to Rs.4000 crore in 2011. Banking & Financial Services contribute nearly 40% of India's outsourcing industry (MMR, 2013).

1.1 Scope of the Study
This study outlines the various initiatives adopted by a premier aerospace company in Asia to improve the supply chain efficiency. This study also focuses mainly on implementation of Enterprise Resource Planning (ERP), Electronic Procurement (E-Procurement), implementation methodology, issues and challenges, key benefits. The Case Study approach has been adopted to address various facets of implementation of ERP, E-Procurement and its key learning.

1.2 Key objectives of the Study
The key objectives are:
1. To outline the various initiatives adopted to improve the supply chain efficiency
2. To study the methodology adopted to implement ERP, e-Procurement initiatives
3. To study the implementation issues and challenges
4. To study the key benefits envisaged from these initiatives
5. To study the value addition to the stakeholders- Citizens, Business firms, and Information and Communication Technology (ICT) Industry

2. Overview of the Company
The beginning of Hindustan Aeronautics Limited (HAL) can be traced to the year 1940 when a far-sighted industrialist, the late Seth Walchand Hirchand set up a Company Hindustan Aircraft Limited at Bangalore with the object of establishing an Aviation Industry that can manufacture assemble and overhaul Aircraft under license. Initially, Aircraft like Curtiss Hawk Vultee Bomber and Harlow Trainer were taken up for manufacture and overhaul in collaboration with Inter Continental Aircraft Company of the USA. With the escalation of the Second World War, the Government of India took over the management of the Company in 1942 and handed it over to US Air Force for repair & overhaul of various aircraft. Between 1942 & 1945, a total of 1000 Aircraft & 3400 Engines were overhauled. The main activity for the next few years after the War was reconditioning & conversion of war surplus Aircraft for the use of IAF and Civil operators.

In the seven decades this company has spread its wings to cover various activities in the areas of Design, Development Manufacture and Maintenance. Today HAL has 19 Divisions, 10 at Bangalore, 2 each at Nasik & Koraput and one each at Kanpur, Lucknow, Korwa, Hyderabad and Barrack pore. These Divisions are fully backed by 10 Design Centres, which are co-located with the production Divisions. These Centres are engaged in the Design & Development of combat Aircraft, Helicopters, Aero engines, Engine Test Beds, Aircraft Communication & Navigation Systems and Accessories of Mechanical & Fuel Systems and Instruments.

The company has successfully developed Advanced Light Helicopter (ALH)-Dhuruv, Light Combat Aircraft (LCA), Advanced Jet Trainer (AJT), etc. Other major projects on hand are production of SU-30 MKI, IJT, design & development of Multirole Transport Aircraft (100 Seater) etc.

HAL has climbed 11 notches up to reach the 34th position in the list of top 100 defense companies in the world. The ratings are based on the company's sales and turnover and HAL's leap forward to the 34th position is being attributed to a series of up gradation programmes and ongoing new projects.

This company became a 'Navratna' company in 2007, achieved a sales turnover of Rs.7784 Crore in 2006-07, a year- on-year growth of 45%. The company's profits before tax soared to Rs.1744 Crore, a jump of 55% over previous year. The value of production has also gone up by 56% at Rs.9202 Crore and exports registered a growth of 45% at Rs.271 Crore.

The company has been achieving all rounds in terms of Technology Absorption, Production, Sales and Profit. The company achieved the highest turnover of Rs14, 324 Crore during 2012-13 with Profit before Tax of Rs.3329 Crore. HAL paid the second interim dividend cheque for Rs.699 Crore to the Government. The high lights are given in table-1.

Table-1 Financial Performance of the Company during 2012-13 and 2013-14. *(Rupees in Cr)*

Particulars	2012-13	2013-14	Growth over previous year
Sales (Rs.in Crore)	14,324	15,180	6.0%
Operating Profit(Rs.in Crore)	1,194	1,651	38.0%

HAL produced 60 aircraft and helicopters, received Phase –II Initial Operational Clearance (IOC) for the Light Combat Aircraft and filed a record of 209 patents. HAL also contributed to two key projects of the Indian Space Research Organization (ISRO) by making structures for the Mars Orbiter Mission and crew module structure for the Human Spaceflight Programme. The Advanced Light Helicopter (ALH)- Dhruv played a critical role in rescue and relief operations taken up during the Uttarakhand floods of July last.

2.1 Supply Chain Management in HAL

Supply Chain Management (SCM) is the process of managing the flow of materials, parts and from the supplier through our processes and on to customer. In supply chain material, information and money flows across the chain seamlessly. The objectives of SCM are: i) Manage the Purchase of customer requirements to receipt of goods, ii) Get the highest customer satisfaction at lowest total cost from supplier's supplier to customer's customer and iii) Minimize the price.

In the light of globalization, long developmental cycle and increasing customer's expectations, SCM is considered as a tool for competitive advantage. The important elements / links of supply chain are: i) Supplies of raw materials / sub-contractors, ii) Internal customer iii) Inspection Agencies and d) External customers. The performance of supply chain is critical for business, cost reduction, total cost of procurement, inventory, lead times and enhanced customer satisfaction level.

The following initiatives are implemented in HAL which significantly improves on supply chain efficiency front: i) Implementation of ERP/IFS Companywide ii) Integration of Materials Management functions (Material Planning, Purchase, Outsourcing and Inventory & Stores) iii) Widening scope for outsourcing iv) Early Involvement Suppliers(EIS) v) Cost reduction through Value Analysis programmes vi) Lean Manufacturing vii) Entering into Long Term Business Agreements (LTBA) and viii) Inventory Study Analysis ix) Implementation of Electronic Procurement (E-Procurement) system etc.Implementation Of Above Initiatives And Its Key Benefits Are Summarized In Table-2.

Table -2 Implementation of Initiatives and its Key Benefits.

Sl.No	Initiatives Implemented	Key Benefits Achieved
i	ERP/IFS	a) On line information b) Integration of process and its measurements and c)Netting internal process etc.
ii	Integration of Materials Management Functions	a) Reduction delays b) Accountability c) Priority of Purchase activities d) Uninterrupted flow of materials across the supply chain and e) Reduction inventory /better inventory control
iii	Widening outsourcing activities	a) Capacity building b) Focus on core activities etc
iv	Early Involvement of Suppliers(EIS)	a) Reduction in development cycle time b) Cost reduction c) Quality improvement
v	Value Analysis/ Value Engineering, QCC, Quality Function Deployment (QFD)	a) Cost reduction, b) Quality improvement, and c) Design improvement etc
vi	Entering into Long Term Business Agreements(LTBA)	To ensure the continuity of suppliers at a pre-fixed price
vii	Lean Manufacturing	Waste reduction through Kaizan, " Do more with less"
viii	Inventory Study Analysis	To identify the various factors contributing to inventory buildup and exercise the control.
ix	Implementation of Electronic Procurement(E-Procurement)	Reduction in procurement lead time, reduction in voluminous paper work, improved transparency, improved wider participation, etc.

2.2 Critical issues in SCM

Some of the critical issues in HAL supply chain management are as follows: i) Obsolescence ii) Export license and iii) Delays in supplies.

The key causes, ffects and initiatives to overcome these issues are as follows:

i) Obsolescence

Causes	Effects	Initiatives to overcome this
a) Change of Technology is more rapid which in turn generates obsolescence in the supply chain. b) Development / Production lead time is more which brings obsolescence in the products. c) Product life cycle is very long.	a) Excessive procurement, which amounts to non-moving inventory. b)Ineffective Production Planning	a) Indigenization and import substitution. b) Entering into Long Term Business Agreements (LTBA) giving forecast requirements. c) Inventory pile up. d) Up gradation programmes.

ii) Export License

HAL's purchase is predominantly from foreign sources from various countries like Russia, United Kingdom, United States of America, Germany, France, South Africa, Israel etc; in view these materials are not available within the country.

The company's foreign purchase / import purchase constitutes 80% of the total purchases. Some of the countries stipulate issues of getting licenses for exporting to this aerospace company. In the past there were delays in supply of items owing issues / delay of getting licenses. Whenever there is a delay in getting the export license or denial of export license, the same is being taken up with Ministry at appropriate level.

iii) Delay in Supplies

Reasons	Initiatives to overcome this
a) Long lead time in the development of complex systems b)Insufficient quantity and delays associated with Minimum Order Quantity (MOQ) c) Sometimes licensing issues cause further delay in supplies d) Long lead time in procurement e)Long process time for placement of Purchase orders	a) Entering into Long Term Agreements indicating requirements well in advance. b) Comprising the internal procurement lead time by way of ERP implementation. c) Advance Scheduling and Planning / Better Inventory Control.

2.3 Procurement System followed in HAL

HAL has written down procedures in the form of i) Purchase Manual and ii) Procedure for Sub-Contracting of Tooling / Components. The Purchase Manual was revised during the year 2007 to incorporate issuance of various Commercial and Materials Management Circulars based on Ministry of Defense Directives and Vigilance guidelines. Similarly, the Sub-Contracting procedure was revised during the year 2009 based on experience gained. Both the documents are hosted in the HAL Website. The Purchase Manual stipulates procedure to be followed in respect of Supplier sourcing and Supplier registration after due approval process. Similarly the procedure for Sub-Contracting of Tooling / Components defines procedure for selection of Sub-Contractors/ Outsourcing Suppliers. The approved Vendor lists of both the categories are hosted on the HAL web-site. An advertisement is being issued for registration of suppliers in news papers of all India circulation & on the Company's web-site. Firms desirous of registration shall be issued with prescribed form and the same is available in HAL web-site for the intending Suppliers to down load & apply. HAL Purchase Manual defines the modes of tendering, supplier sourcing, selection, registration, and Evaluation, order processing, banning procedures etc. Divisions are complying with the procedure stipulated in the procurement of materials, services, work design packages etc.

2.4 Implementation of Enterprise Resource Planning –Industrial Financial Solutions (IFS)

Initially, ERP-IFS were implemented on pilot implementation basis covering 3 pilot sites during 2003-04. On successful implementation at all 3 pilot sites, other 16 sites (Roll out sites) were taken

up in the subsequent years. ERP-IFS have been implemented across the company including newly formed profit centres covering 3300 users.

A core Information Technology (IT) team was formed comprising the members from IT design, Management Services, Integrated Materials Management (IMM), IT-Consultant, Marketing, Finance and Corporate Planning for selection of ERP-IFS package. Based on the budgetary quote, IFS Sweden is short listed as the ERP for implementation across the company ensuring commonality of product and process (out of 4 products viz, Oracle, SAP, BAAN, and IFS). Through tendering process, the implementation partner i.e, BAeHAL Software Limited was selected. BAeHAL Software Limited is a joint venture company of HAL, the largest manufacture of aircrafts in Asia and BAE Systems, UK one of the largest Aerospace and Defense companies in the world. The major modules covered are: Financials, Engineering, Distribution, Manufacturing, Maintenance, Human Resource, Payroll, MRO etc.

2.4.1 ERP Implementation Issues

The biggest challenge in ERP implementation, next to change management is management of the transition from old system to new ERP system. Since ERP system is an integrated system a cut over has to occur at a time which results in minimum disruption to the normal business. Unlike traditional IT software project where we continue to use the old software along with new one as a fall back process, in ERP system it is not feasible as it is transaction based in character and affects all the integrated system in real time. The process of testing and acceptance, production support readiness, migration of data, and setting up of security of users has to be appropriately planned to achieve one stop switch over to new ERP system (Appuswamy,2000).

HAL faced quite a number of implementation issues with regard to "signing off,' hand holding, implementations in roll out sites, customization, and migration of data from MRP-II legacy system., training of personnel and familiarization, Nevertheless these difficulties, the company has implemented ERP system successfully.

2.4.2 Major Benefits Envisaged

The summary of major benefits envisaged is detailed in table-2 below.

Table-2 Summary of Major Benefits Envisaged

Tangible	Intangible
Reduction in delivery time.	Adoption of best business practices
Reduction in inventory	Standardization of business processes across the company.
Controlling cost & time overrun of projects	Facilitates management initiatives like Six Sigma, Lean manufacturing, TPM, etc.
Better repair maintenance spare parts support	
Improved manpower productivity	Improved customer relations
On line monitoring of WIP inventories (such as material and labor)	Faster & high quality MIS reports, improving the quality of decisions
Avoidance of shortages	Automation of redesigned business processes.
Integrated engineering change management.	

2.5 Implementation of Electronic Procurement System

The company has adopted implementation of E-Procurement system companywide to improve the transparency in Procurement process in line with the directives of Central Vigilance Commission (CVC) &Ministry of Defense (MoD) for all types of tenders with effect from September 2011 with the following main objectives.

1. To bring more transparency in the procurement system
2. To provide centralized unified platform in the vendor registration
3. To provide opportunity for wider participation
4. To make submission of the bids by the bidders / suppliers easier.

This initiative is taken by this company to facilitate the bidders for easy submission of their bids and bring more transparency, reduce cycle time, on-line provision of addendums and changes to documents to bidders/ suppliers and also on-line acknowledgement of bids. E-Procurement is an automated web based procurement process, where the complete end-to-end transactions from indent creation to payment can be performed. E-Procurement creates a win-win situation for the buyer and seller by reducing the cost of doing business and by setting up a healthy competition between suppliers.

2.5.1 Salient Features of E-Portal

HAL has taken special care to build in highest level of security in E-Procurement Portal and this is completely owned by and managed by HAL. E-Procurement portal of this company may be visited at https://eproc.hal-india.com. The company's E-Portal has got the Secured Socket Layer (SSL) certification by *Verisign*. Helpdesk has been deployed for any clarifications from suppliers / vendors & HAL users.

Considering the sensitivity involved in defense procurement, the highest level of IT security has been embedded in E-Portal of HAL. The portal takes care of key security concerns like ' Privacy', 'Authentication',' Integrity of data' ,and ' Non-repudiation' through the state of art technology. To strengthen 'Privacy, and 'integrity of data', bids /documents uploaded by bidders will be encrypted (through Digital Signature Certificate (DSC)) and the same would be retrieved and decrypted only by authorized company's users through their DSC.

To participate in E-Tenders of this company, vendors are required to get themselves registered with HAL E-Procurement system at https://eproc.hal-india.com. For registration vendors are required to obtain DSC Class-III with the organization name from the empanelled Certifying Authorities (CAs) of India.

Information's with respect of Buyer / User detailed Help Manual, Systems Requirements, Users Requirements and procedure for registration in the E-Procurement System are being hosted and updated time to time at E-Procurement Portal.

2.5.2 Overview of Implementation Issues and Benefits

A dedicated E-Portal was made operational to operate all types of tenders of IMM, Outsourcing, and Works in a phased manner. The Solution Provider was selected through tendering process.
Phase-I - Registration with E-Portal (Empanelment of Vendors), E-Tendering, Integration with ERP, and Payment Gateway Integration

Phase-II - E-Auctioning (Reverse and Forward Auctions),
Phase- III – Contract Management, Catalogue Management.

Key issues are a) Digital Signature Certificate Class-III b) Vendor registration and empanelment c) Training of Company's users and bidders /suppliers. Some of the Proprietary foreign vendors have

expressed their inability to avail DSC Class III to register in E-Portal Key benefits are a) Companywide on line vendor registration b) Vendor directory shared among the Divisions /Units, c) Reduction voluminous paper work d) Reduction in cycle time for order processing / placement of orders d) faster generation of MIS reports, d) Wider participation and improved competition e) Availability of vendors' credentials f) Better transparency etc.

2.5.3 Integration of ERP with E-Procurement System.
The competent authority in Ministry of Defense has been reviewing the progress on the E-Procurement in Defense Public Sector Undertakings (DPSUs) and Ordinance Factory Board (OFB) periodically. During one of the review the authority has directed that all the DPSUs and OFB should have on line bill tracking system and details of pending payment details.

In this regard, a steering committee at Corporate Office level along with core team constituting IMM &IT representatives from Divisions have been constituted to interface ERP-IFS MM module seamlessly with E-Procurement System. Indent management, release of Purchase Order, Follow Up, Receipt of materials, and MIS on pending bills / on line bill tracking etc .were taken up on priority as part of integration process. The committee is required to interact with E-Procurement implementation partner M/. Antares Systems and M/s.BAeHAL along with IFS (ERP Solution Provider) for interfacing with E-Procurement System. Task has to be completed on time bound manner.

2.5.4 High Level Implementation Architecture
A high level architecture has been developed for interfacing data flow between ERP-IFS and E-Procurement System. Tender elements flow from ERP-IFS to E-Portal and Bid/Comparative Statement flow from E-Portal to ERP-IFS. Intermediate Server Mechanism has been provisioned for transferring the payment data from ERP-IFS to E-Procurement Server. Fields for mapping and SQL scripts are prerequisites for pushing / pulling of data.

The high Level Architecture for Interfacing ERP-IFS and E-Procurement System diagram is placed below in figure 1.
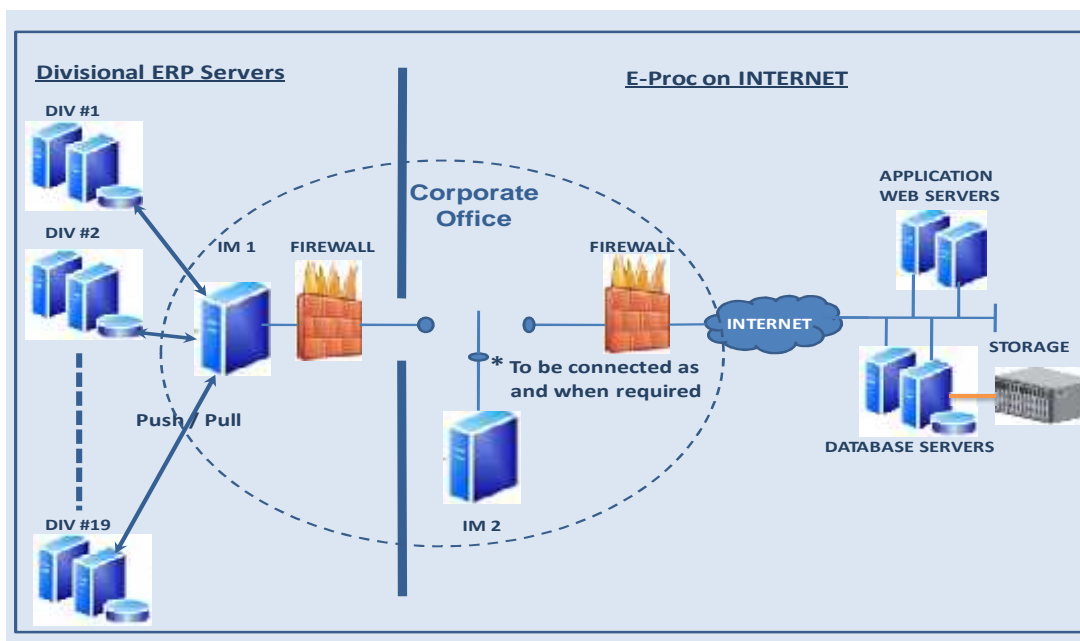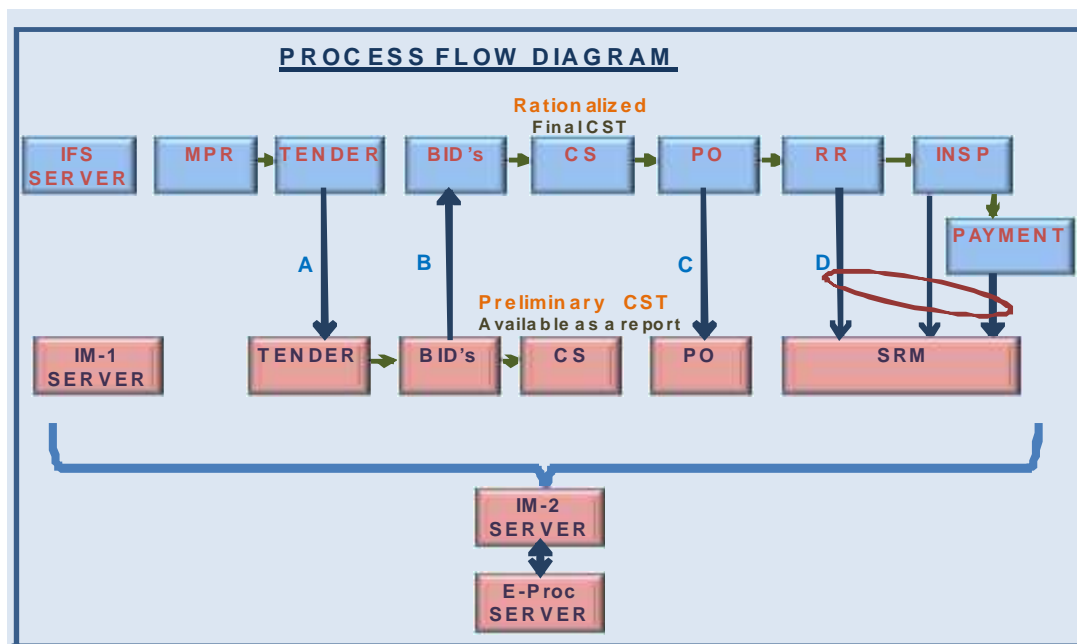

Figure-1 High Level Architecture for Interfacing ERP-IFS and E-Procurement System.

The Process Flow Diagram for Interfacing ERP-IFS and E-Procurement System diagram is placed figure 2 below**.**

2.5.5 Brief Description of the Integration Process and Requirements

Figure-2 Process Flow Diagram for Interfacing ERP-IFS and E-Procurement System.
Intermediate Servers (IM) are required to interface ERP-IFS and E-Procurement Portal. One each is used on Internet and on Intranet. Oracle Data Base Link is used to interconnect the ERP-IFS through job scheduler to push data to ERP Servers. Java Data Base Connectivity drivers and https protocol are used for pulling the data from ERP Servers to E-Procurement. Non-Standard ports are used for connecting the servers. Both the IM are assigned static IP Addresses. Only required ports should be opened. Operating systems used in both IMs are Linux/Unix. The required level of fire wall protection is provisioned. Tools like web sphere, JBoss, Change Data Capture / Archive log in ORACLE are applied.

2.5.6. Electronic Governance and Value Added Benefits to Stakeholders

The various stakeholders of E-Governance includes i) Citizen ii) Government iii) Business and iv) ICT Industries. The E-Governance benefits to Government include law and policy making, regulation and provision of services to constituents. The E-Governance benefits to Citizen include increased transparency leading to reduced corruption, better quality of life, easy access to information on government programmes and agencies, avoidance of multiple government agencies i.e single window system. The key benefits to Business are i) increased velocity of business ii) ease of doing business with government etc. Finally, the key benefits to ICT Industry is businesses spanning across its segments such as software, hardware, networking, storage, security, Consultancy IT Education, Training, and facilities management.

3. Successful implementation of EPS by other Companies.

The Government of Kerala now has been planned to bring all the 37 state-owned public sector undertakings under the e-tendering and e-procurement portal of the National Informatics Centre (NIC). All the state-owned enterprises floating tenders above Rs.25 lakh will do it through e-tendering and a common e-procurement facility in the first phase Electronic procurement and e-tendering in Public Sector Undertakings (PSUs) will ensure fair, transparent and speedy transactions in the procurement. The company Malabar Cements in Palakkad has won the bid to procure fly ash, a

raw material for cement production and saved over Rs.9 Crore by avoiding middle men. Through e-procurement, the company has also made profits worth Rs.70 lakhs in procuring cement bags. The Kerala government has issued directives to all state-owned public sectors undertaking to implement e-procurement system in their procurement process.

The Government of India had already issued directives to all ministries to implement e-procurement system in their procurements across all PSUs/subordinate offices under the administrative control of their ministries. Accordingly, Ministry of Defense, Government India issued directives to all Defense Public Sector Undertakings (DPSUs) to implement e-procurement system in all their procurements. Further, a high level was monitoring the progress of implementation of electronic procurement system in public procurement.

4. Conclusion

This company has successfully implemented ERP-IFS, E-Procurement and interfacing the ERP-IFS with E-Procurement across the company on Outsourcing mode. Outsourcing is used as a tool for achieving better economies of scale, increased efficiency & productivity, reduced cost less or no investment in technology & infrastructure. Outsourcing frees an organization from investments in technology, infrastructure and people that make up the bulk of a back end process. It also helps in increasing the productivity & efficiency by concentrating more on core activities such design, building up of aircrafts, maintenance, repair and overhaul etc. Core Competencies are the fundamental strength of any organization which should be identified and cultivated in order to build new products & market opportunities. Outsourcing however, possesses some risk which needs to be addressed critically. i.e loss of sensitive data & confidentiality, quality of service, legal problems etc.

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