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Development of Product Costing Module in ERP for L&T Kansbahal Works, Kansbhal, Orissa : A Case Study

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Abstract - One need to be very accurate in what the products and services are costing. Inaccurate cost components could cost an organization more dearly. So, to full fill our present and future requirements and ambitions in all respect of life, it is essential enhance our expertise to link the power of today's information technology with the tools of economic theory and business strategy.[2] This paper aims at throwing new lights on various developments and formulate strategy for their implementation.

Keywords— *Business Mapping Report (BMR), Product costing, Dataflow Diagram, Enterprise Resources Planning (ERP), cost overhead, cost centres, Cost variance report, WIP.*

1. INTRODUCTION

Businesses all around the world are increasing their reliance on ERP programs as a cost efficient alternative to their current manual procedures or their piecemeal software applications. [1]

ERP (enterprise resource planning) is an industry term for the broad set of activities supported by multi-module application software that help a manufacturer or other business manage the important parts of its business, including product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, and tracking orders.

Enterprise Resource Planning (ERP) systems attempt to integrate all data and processes of an organization into a unified system. A typical ERP system will use multiple components of computer software and hardware to achieve the integration. A key ingredient of most ERP systems is the use of a unified database to store data for the various system modules. [7]

MRP vs. ERP — Manufacturing management systems have evolved in stages over the past 30 years from a simple means of calculating materials requirements to the automation of an entire enterprise. Around 1980, MRP (Material Requirement Planning) was evolved into a new concept: Manufacturing Resource Planning (or MRP2) and finally the generic concept Enterprise Resource Planning (ERP). [1] [7]

ERP systems now attempt to cover all basic functions of an enterprise, regardless of the organization's business or charter. Non-manufacturing

businesses, non-profit organizations and governments now all utilize ERP systems.

The use of erp module saves time and money without sacrificing accuracy and control. Product costs are analysed quickly and accurately, which empowers the organization with the ability to perform minute analysis and projections of product cost. Few of the many advantages of product costing are:

- Streamlined integration
- Enhanced data accuracy
- Powerful cost analysis
- Automated cost calculation
- Extensive instant reports

Product costing module in ERP has eased out all hassles of costing a manufactured product. Product costing module uses data for valuation from the Production planning (PP) module. The Manufacturing module defines the production process, calculates and tracks product and job cost, and records all of the activities necessary to manufacture products. Stages of the manufacturing are consolidated into a process specification. Actual cost rollups with in the process specification are compared to standard job cost for each lot or batch produced. All manufacturing-related activities (including issue of materials which automatically decreases inventory balances, recording of production outputs which increase inventory balances) are tracked and charged to a Job, thereby determining actual job cost and variances. General Ledger journal

entries automatically created for all transactions. And the lot trace information is recorded from the manufacturing activities.

Among the many benefits of ERP is that data need only be captured once.^[4]

Typically this originates outside of the enterprise and is often communicated via paper documents. Examples include sales orders, supplier invoices, credit notes, delivery notes, remittance advice and every imaginable type of form. And as data entry volumes continue to grow, costs continue to rise and opportunities for savings become more apparent.

By capturing data at source, an organisation loses the costs associated with manual data entry, improves capture cycle times and eliminates errors due to re-keying but in reality businesses continue to create and consume paper. Organisations can decide to implement an EDI program with its suppliers. Another option is to use data capture and document recognition software to replace or complement manual data entry. This class of solution will read data from paper using OCR/ICR and upload directly to information systems with greater accuracy and at a fraction of the cost of human operators.^[4]

The competitive forces prevailing in the world of commerce today require firms to operate as efficiently and productively as possible in order to maintain and enhance market share, profitability and shareholder value. An essential element to achieving success involves the continuous enhancement of knowledge and understanding of the business environment by employees at all levels. This can be accomplished by implementing processes which augment the accessibility and communication of value added information throughout the organization. As a result there has been an increased demand for cutting-edge information technology by businesses in all industries.

2. Brief Description of Larsen & Toubro Limited (L&T)

Larsen & Toubro Limited (L&T) is a technology, engineering, construction and manufacturing company. L&T has an international presence, with a global spread of offices. The company has manufacturing facilities in India, China, Oman and Saudi Arabia. It has a global supply network with offices in 10 locations worldwide, including Houston, London, Milan, Shanghai, and Seoul. Customers include global majors in over 30 countries. It is one of the largest and most respected companies in India's private sector. The company's businesses are supported by a wide marketing and distribution network, and have a strong customer support.

Kansbahal Works, a unit under the Machinery & Industrial Products Division of L&T, is an Integrated Machine Building Centre with facilities for Casting, Fabrication, Machining and Assembly, complimented by excellent design, engineering, quality control and logistics support. Set up in 1962 as an Indo-German Venture, it merged with L&T in 1982. The business portfolio includes Crushing and Screening systems, Pulp & Paper machinery, Wind mill components, Cast products and various other industrial products. L & T's only foundry facility is located at Kansbahal and is equipped with the latest state-of-the-art facilities to manufacture quality castings in steel, alloy iron, SG/ cast iron, with intricate geometries and large tonnages. L & T Kansbahal Works have complete in-house facilities like technology centre, pattern shop, hand and machine moulding facilities, melting and heat treatment facilities, and complete QA tools.

Machine Shop is equipped with a wide range of machines for Turning (upto 3.5 m dia x 10 m long) , Boring (10 m x 5 m x 2.2 m with 65 T table capacity), Cylinder Grinding (2.5 m dia x 10 m long) and Planning (2 m x 1.6 m x 6 m) of complex welded structures/ castings / forging.. LRIS qualified welders deal with a variety of materials such as carbon steel, low alloy steel, nickel alloys conforming to the different international standards. The Kansbahal Works R&D wing is equipped to carry out process engineering, mechanical design / analysis, 3D modelling, Finite Element Analysis, basic and detailed engineering. A team of 60 highly experienced and qualified engineers focus on customized product development. A dedicated cell called Crushing Technology Centre caters to design and developments of crushers and surface miners.

The Quality System in L & T has been designed and adapted in accordance with ISO 9001. L&T Kansbahal Works have acquired quality accreditation ISO - 9001 certified by DNV and approved by Lloyds Register of Shipping, London and TUV for pressure tested castings CBB (Central Boiler Board) as "Well Known Foundry". L&T's belief that progress must be achieved in harmony with the environment lead to a commitment to community welfare and environmental protection as an integral part of the corporate vision.

3. Business Analysis Report

The Business Survey Document is prepared based on the discussions with users, study of reports, study of existing system and study of present customer, business processes and practices. This also documents solutions to the requirements. Human Resource Management System (HRMS) has two components namely personnel and training.

All the financial transactions involve either a receipt or payment of money resulting in accounting entries. Payments made towards expenses are either relating to manufacturing or administrative activities.

In financial accounts, the expenses incurred for a specific purpose are recorded in total under an account code no allotted for the purpose.

In cost account it is analyzed the expenses by various departments /cost centres and allocating them wherever necessary. The expenses incidental to manufacturing, form part of product cost. This is done through predefined overhead recovery rates. Manufacturing operations involve consumption of raw materials and consumables and through separate issue notes the cost of materials consumed for production gets established.

Costing, Budgeting and MIS is a section of Accounts department, which is responsible for costing of jobs, budgeting activities of different cost centres and generating reports for management information.

Material Accounts is another section, which deals with material accounting and perpetual inventory system. The material Accounts and the financial accounts are not integrated at L & T Kansbahal. The transactions at material ledger do not hit any Financial Accounts. RMC (Raw Material and Component) Ledger is generated only at Kansbahal level.

3.1 Existing System

Currently Costing Department is using 'Job Costing & WIP System' for followings transactions:

- **Labour Cost Accounting:** Calculation of labour cost as per the overheads for respective shops.
- **Material Cost:** Material Cost Accounting as explained below. All the PMI details, Direct Material Expenses, Direct Debits etc.
- **Captive Cost Transfer:** In case of Captive Orders captive cost is booked against respective business unit (Foundry or Industrial Machinery)
- **Job Time Card:** Direct labour booking in all shops for total labour hours booked in a particular order.
- **Monthly Stores credit Entry:** Once the FGN is prepared by a shop the jobs is Store credited and Monthly Store Credit Entry is done in the system.
- **WIP Ledger:** WIP ledger is maintained for ongoing orders which gives the Work In Progress for Individual order

- **Cost Of Sales:** cost of sales is the total cost incurred for an Item, which is to be sold. It is compared with the selling price to get the margin.

- **Finished Goods:** It is the inventory held for sale.

3.2 Material Accounting

Material Accounting department maintains three ledgers to integrate with Financial Accounting. These ledgers are:

- Inventory Ledger
- WIP Ledger
- FG ledger

Material Accounting maintains three following database systems:

- Financial System
- Material Accounting System
- Costing System

Items are divided in two groups

1. Stock items- Items which are routed through inventory, and for which entries are passed in RMC ledger.
2. Non-Stock items –Items that are not routed through inventory, but directly debited to projects. Hence no entry is passed in RMC ledger. However, for imported non –stock items, the transactions are routed through inventory ledger (Where MAR and PMI are sent together).

Input of the Process:

- 1.MAR (Material Arrival Report)
- 2.PMI (Production Material Issue Note)
- 3.GMI (General Material Issue Note)

Output Of the Process:

- 1.Material Ledger
- 2.Analysis Of Inventory

3.2.1 Material Receipt

Following is the procedure for Material receipt:

1. Material can be of two types, i.e., Non stock and stock

2. MAR (Material Arrival Report) is prepared once the material is recd in the stores
3. Copy of MAR is sent to material accounts department if MAR is for stock type or non-stock type imported items.
4. Material Accounts sends MAR to Accounts Payable group for supplier's bill
5. Accounts Payable group sends the MAR back to Material Accounts with copies of Supplier's bill
6. The MAR is priced by Material accounts group, based on Supplier's bill. If Bill is not available, PO rate is used to price the MAR
7. At the end of the month, the priced material is run for generating material ledger, and the list of priced MAR is available to Accounts for verification
8. Such priced MAR does not generate a financial entry. The inventory Account is updated by Accounts Payable group by voucher booking

3.2.2 Material Issue

Following is the Procedure for Material Issue-

1. The issue from stores can be through two documents-PMI (Production Material Issue Note) and GMI (General Material Issue Note)
2. PMI is made for items issued to specific Work order, GMI is made for items to cost centres
3. PMIs and GMIs are sent to Material Accounting Group, where it is entered into Material Accounting System
4. PMIs and GMIs are priced at weighted average method by the system and Material ledger is updated at the end of the month
5. The PMIs and GMIs do not pass any financial entry by themselves.
6. At the end of the month, All PMIs and GMIs are consolidated and an IV is prepared by Material Accounts, with appropriate accounts (This is the consumption entry), and it is sent to Accounts for entering into the financial system.

3.3 Process of Foundry

3.3.1 Cost Components Of Foundry

Following are the main cost components in case of foundry

- i. Labour Variable Overheads
- ii. Labour Fixed Overheads

- iii. Material Cost For Melting Material
- iv. Material Cost Of Non-stock Items
- v. Material Overheads
- vi. WIP Interest

Labour Fixed Overhead for:

1. Pattern Making
2. Molding Shop

Labour Variable Overhead for:

1. Molding
2. Melting
3. Fettling
4. Heat Treatment
5. AOD

Material Cost For Melting Material:

Actual Melting Cost For Melting Material as per the Monthly Melting Statement

Material Cost For Non-stock Items:

Non-stock items are directly debited to the SWO

3.3.2 Foundry Overheads

1. Machine cost in case of furnaces in H.T. & Melting
2. Labour Cost in fettling, H.T., Melting
3. Additional costs like: Electricity & oil
4. Depreciation
5. Material cost in case of Molding Shop as per the Standard norms decided in Budget. Also in case of Pattern Making Shop material cost is taken care by the Overhead rates.

These overheads are arrived at on the basis of previous experience and the budget for the current year.

3.3.3 Calculation of Labour and Machine Overheads

In the existing system the Labour & Overheads rates are defined for following various cost centres in case of Foundry:

Sr. No.	CC NO	Rate/Hrs/Tins	Description
	302	360	Pattern Making
1	310	400	Hand Molding Fixed OHs
2	311	7500	Hand Molding-CI (Variable)

3	311	9000	Hand Molding-CS (Variable)
4	325	15000	Melting CI unto 6 T
5	325	14000	Melting CI above 6 T
6	325	14900	Melting Alloy CI unto 6 T
7	325	14100	Melting Alloy CI above 6 T
8	325	18000	Melting CS unto 6 T
9	325	19000	Melting CS above 6 T
10	325	17900	Melting Alloy CS unto 6 T
11	325	19100	Melting Alloy CS above 6 T
12	325	4000	Ferro-Manganese
13	330	3000	Fettling CI/SG
14	330	7500	Fettling Alloy CI/SG
15	330	10900	Fettling CS
16	330	11000	Fettling Alloy CS
17	335	4500	H/T CI/SG
18	335	9000	H/T CS/Ball/Man. Steel
19	335	13400	H/T NH/Hi Chrome/Fem.
20	340	12000	AOD for Ferro-Manganese
21	340	12000	AOD for Ferro Castings

3.3.4 Direct Labour Booking

Operation Time Card does direct labour booking in case of Pattern Making & Molding shop. Also if any repairing of a pattern is done in Pattern Shop labour hours are recorded & booked against the SWO.

Refer the screen shots for Job time card for M/C Shop & Fabrication Shop at the end of document. Similarly Job Booking for Foundry is done.

3.3.5 Assignment of material cost to work order in foundry

All the materials in foundry are issued against dummy SWO 60000/00 for melting and 79000 for AOD operation in foundry. Materials are issued and punched in system at stores. Hard copies of PMI or GMI are sent to material account department.

Melting statement input for each month is prepared for SWO 60000 and 79000. This statement contains date wise and stock material code wise actual issues of material against PMI and GMI for these dummies SWO. This information can be taken from system directly.

“Summarized melting Statement” contains statement for a month prepared by Melting Shop. It contains different items (material code wise) charged in a month for different alloy groups for a particular heat. These quantities are taken from furnace log sheet. Three columns “Total”, “Qty. Avl “ and “Diff” in the sheet have following significance:

Qty Avl– Quantity actually drawn from stores against 60000 through PMI

Total – Actual material consumed in melting

Diff – Stores credit note or stores return of material unconsumed for the month

Total foundry melting material has been divided into 5 material groups in above-mentioned sheet no. 2 namely return, scrap, Ferro alloy, additives and flux. This categorization is used for forecasting of material. This sheet also contains a section called “Analysis” which contains information about melting loss, additives and slag, metal tapped etc.

Different heads in Analysis section are as follows.

Total Group I to V: Weight of total material charged for each alloy type.

Metal Tapped: Actual liquid metal tapped

Melting Loss = Total Group – Liquid Metal Tapped

PIG/ST Block Returns: Material returned (risers etc)

Total Gross Production = Metal Tapped – PIG/ST Block

Good Production: Actual production booked to various orders

Replacement Production: rework or rejection

Internal production: Production for cost centre

At the month end **weighted average rate** is calculated as shown in the table below for each item in stock master. Let the table below shows for item X.

Date	Receipt Qty.	Issue Qty.	Rate	Value
1 st Jan	10		10	100
2 nd Jan	20		20	400
15 th Jan		10	12	120
29 th Jan		15	12	180
31 st Jan	20		5	100
Total	50			600

Weighted average for item = $600/50 = 12$

At the month end all the material issued will be valued at the rate of 12 as shown in rate column of the table against issue transaction for item X.

This issue rate is generated by material accounts department.

“Cost / Kg Metal Tapped” is calculated:

The sum of quantity against each alloy group is multiplied by respective rate gives the amount for each alloy group. When this amount for an alloy group is divided by total quantity of metal tapped we get “Cost/KG Metal Tapped” of that particular alloy group.

Current months return are used in next month so returns issued in next month will be at the rate of previous month.

CI returns, CYL returns and SG returns are of same category and are priced at same rate.

“Metal cost/KG” which is nothing but Cost / KG Metal Tapped.

3.3.6 Material cost is assigned to a work order

“Daily Production of Foundry” sheet is prepared by foundry planning. It contains the detail of one-month production SWO wise for each material quality and alloy group combination. There are two material quality codes - 01 (Cast Iron) and 02 (Cast Steel). Alloy groups are 463, 479, 468 etc.

In this sheet total weight against each sales work order for each alloy group is provided. The “Cost/KG metal tapped” figure for an alloy group is multiplied by total weight of a sales work order belonging to same alloy group as given in “Daily Production of Foundry sheet” to find the metal cost of that work order.

Cost Of A SWO in Foundry

= Material Cost for Melting Material + Direct Debits for Non-stock Items + Labour Fixed OH + Variable OH + WIP Interest +Material OH

3.3.7 Documents

Followings Documents are required for Foundry Costing

Sr. No.	Description	Gen By	Recd By	Purpose
1	Operation Time Card	Pattern Shop	Accounts	Labour Booking
2	Shift report	Molding	Accounts	Labour Booking
3	Daily Productions Of foundry	Molding	Accounts	Material Costing
4	Labour OH Rates-04	Costing		OH Rates
5	Monthly Melting Statement	Melting	Accounts	Material Costing
6	Material Arrival Report	Stores	Material Accounts	Material Accounting
7	Supplier Bill	supplier	Accounts	Costing

3.4 Process of Industrial Machinery

3.4.1 Cost Components For IM

Following are the main cost components in case of foundry

1. Relatable Overheads
2. Non Relatable Overheads
3. Material Overhead
4. Material Cost For Stock Items
5. Material Cost Of Non-stock Items
6. WIP Interest

WIP For Recovery

3.4.2 Work Order

Cost is collected Work order wise. For production work order, SWO no itself is the Work order.

The types of work orders are:

- Customer Orders received directly
- Customer Orders received through other divisions
- Captive Orders
- Stock Order

A work order is issued for every job for which cost data have to be collected.

The stock material gets accounted against the work order. PMI is the document through which material gets drawn to the work order.

3.4.3 Direct Labour Booking

1. In the existing system Job Costing System is used for entering the labour hours required for every sales work order.
2. The labour hrs are booked by the shop floor people (Only direct workers). The total hrs booked by each cost centre are consolidated for each work order to arrive at total overhead.
3. Job time Card is referred for M/C Shop as well as for Fabrication Shop. Similarly Job Time booking for Assembly Shop is done.

3.4.4 Overheads For IM

Overheads are collection of all expenditure, which are not directly identified with the product.

In KBL, all the expenditures are grouped cost centre wise (Except expenditures of Marketing Cost Centres, which are not taken as overheads, but deducted from margin, either by direct allocation or by apportionment. Service cost centre expenses are then allocated to production cost centres.

The expenditures are salary, depreciation, power, repairs and maintenance etc.

After the expenditures are collected cost centre wise, the budgeted hrs for each cost centre are calculated (labour hrs. or machine hrs,-depending on whether the cost centre is labour intensive or machine intensive).

Overhead rate for a cost centre

$$= \frac{\text{Expenditure of the cost centre}}{\text{Budgeted Hr for the Cost Centre}}$$

Relatable Overhead

Relatable overhead is that portion of the overhead, which is spent in the effort of production, like salaries, depreciation etc.

Relatable Overhead rate for a cost centre

$$= \frac{\text{Relatable Expenditure of the cost centre}}{\text{Budgeted Hr for the Cost centre}}$$

Non relatable Overhead

Relatable Overhead: Relatable overhead is that portion of the overhead, which is not, spent in the effort of production, like Expenditures on colony, welfare expenditure etc. It also includes notional expenditure like Interest on Working Capital etc.

Non Relatable Overhead rate for a cost centre

$$= \frac{\text{Non Relatable Expenditure of the CC}}{\text{Budgeted Hr for the Cost centre}}$$

3.4.5 List of cost centres

Following is the list of Cost centres and respective overheads:

I. Machine Shop

Sr. No	CC No	Cost Centre	Relatable OH	Non Relatable OH	Total In Rs/Hr
1	103	Turning Medium	455	45	500
2	120	Drilling	455	45	500
3	125	Drilling Radial	364	36	400
4	130	Not Available	455	45	500
5	110	Turning – VWF & POREBA	455	45	500
6	136	Slotting Machine	455	45	500
7	140	Not Available	455	45	500
8	142	Vertical Milling	455	45	500
9	143	Floor Milling	455	45	500
10	145	Grinding	455	45	500
11	174	Turning	455	45	500
12	115	Turning-Retrofitted Lathe	455	45	500
13	150	Boring – Floor Type-SKODA	1136	114	1250
14	152	Boring – Floor Type	1136	114	1250
15	180	CNC Slant Bed Turning Centre	682	68	750
16	156	Boring	500	50	550

		Table Type			
17	170	Plainer	682	68	750
18	158	CNC Borer	1091	109	1200
19	160	Vertical Boring Light	636	64	700
20	173	Facing Lathe	455	45	500
21	175	Facing Lathe SPAOF	909	91	1000
22	176	Grinding	909	91	1000
23	100	Marking	364	36	400
24	162	Vertical Borer	1136	114	1250
25	181	PAMA Machine	3182	318	3500

II. For Fabrication Shop

Sr. No	CC No	Cost Centre	Relatable OH	Non Relatable OH	Total In Rs/Hr
1	205	Marking	364	36	400
2	210	Fitting	364	36	400
3	215	Welding	364	36	400
4	216	Assembly	409	41	450
5	220-1	Gas Cutter	364	36	400
6	220-2	Plasma Cutter			
7	225	CNC Operation	546	54	600

III. Assembly Shop

Sr. No	CC No	Cost Centre	Relatable OH	Non Relatable OH	Total In Rs/Hr
1	178	Dynamic Balancing	773	77	850
2	195	Assembly	409	41	450

3.5 Manufacturing Accounting

Once the production is complete, and FGN is raised WIP account is credited and FG account is debited with the cost of the product.

If a work order involves production of multiple items and these items are store credited separately, the cost of each such item is arrived manually.

The accounting is as follows

WIP ledger and Financial Accounts are not integrated. Hence JV/IV for every transaction has to be passed manually.

Material consumption: The material is issued to work order through PMIs. This updates the material cost in the work order after month end processing. A manual entry is passed (an IV) to give effect to consumption account. WIP account is debited by the program, crediting 'Direct Materials and Direct expenses Offset' Account

Material Overhead Recovery (WIP built up):

WIP relatable overhead Dr

Applied material Overhead (Offset Account) Cr

Shop Relatable Overhead (WIP Build up)

WIP Relatable OH Dr

Fabrication Mfg Shop OH (Offset Account) Cr

Assembly Shop OH (offset account) Cr

Machine Shop Mfg OH (offset account) Cr

Finished Goods Addition:

Finished Goods Prime Cost Dr

Finished Goods Relatable OH Dr

WIP Prime Cost Cr

WIP Relatable OH Cr

Finished Goods Sold:

Cost Of Sales Dr

Finished Goods Prime cost Cr

Finished Goods relatable OH Cr

Captive work (job done by IM for Foundry or vice versa)

WIP Prime Cost Dr

WIP Relatable OH Dr

WIP Prime Cost Cr

WIP Relatable OH Cr

Supplement Cost For Closed Jobs:

Post Completion Cost Dr

Bought Out Components Cr

Expenses chargeable to jobs Cr

Travelling Expenses Cr

Goods Sold Directly from WIP

Cost Of Sales Dr

WIP Prime cost Cr

WIP relatable OH Cr

3.5.1 Documents

Followings documents are involved in case of Industrial Machinery Costing

Sr. No	Description	Gen By	Recd By	Purpose
1	Material Arrival Report	Stores	Accounts	Material Accounting
2	Direct Debits	Accounts	Costing	To check the accuracy of WIP ledger
3	Material debits			
4	Cost of sales	Costing	Costing	To arrive at the cost of goods sold
5	Stores Credit Note	Completion Centre	Costing	To arrive at the production value for a month.
6	Captive Casting Transfer	Foundry	Costing	To get the credit in the PMS in the profitability of foundry
7	Check list for captive castings	Costing	Costing	
8	Consumption Voucher	Costing	Accounts	To pass the financial entry for consumption & inventory account
9	Supplementary PMI statement	Costing	Costing	To find the cost incurred for a work order after its closure.
10	Supplementary For Direct Debits	Costing	Costing	To find the cost incurred for a work order after its closure.
11	Time Card Entry	Shop floor	Costing	Labour hours booking
12	Estimated break up sheet	Estimation	Costing	To calculate the estimated cost

3.6 Reports

Under the cost centre accounting system, actual expenses incurred by all the departments under various expense groups are established. Periodical reports are released to the departments to enable them to know the areas of adverse variances and institute control measures. The details of expenses so collected are categorized under manufacturing units, supporting services units and

other departments. These details help the management to determine the overhead recovery rates for future years.

From the records maintained at costing departments, cost data to the manufacturing departments broken down in terms of materials, manufacturing overheads etc is given by costing departments.

Some of the Reports that are applicable for Foundry as well as Industrial Machinery are described as follows:

3.6.1 Cost Sheet

As & when the job is completed, the department releases the cost sheet, which has broken down into the various elements of cost. Refer the enclosed screenshots at the end of document for cost sheet for completed /work in progress orders.

The cost sheet contains following fields:

Header level Information: The header level information consists of following information:

- i. Customer Name
- ii. Production description
- iii. SWO No
- iv. Delivery Date
- v. Position as on -----(The required date)
- vi. Sales value: Sales value indicates the selling price of the end item.
- vii. Transfer Price: TP is the indicator of cost of total manufacturing cost as well as other expenses like engg. and design charges.
- viii. Rejection Cost: The cost for rework or rejected job through extra labour hours
- ix. Total cost: Addition of all the cost

Cost Of Performance Summary: It consists of

- Estimated cost: Estimated cost is derived from estimated break up sheet and estimated hours for shop overheads.
- Actual cost is derived from actual material consumption through PMIs, Material Overheads, and Direct Debits in case of Non-stock materials, direct expenses.
- Variance: The difference between Estimated and actual is the variance for the order.

Following elements of cost are considered for Estimated as well as actual cost:

- Direct Materials cost

- Captive Transfer cost
- Material Overheads
- Direct expenses cost: It includes direct debits as well as direct expenses.
- Shop overheads
- Interest On WIP
- Travel On Jobs: Travelling expenditures
- Total cost for estimated and actual cost

Analysis Of Direct Materials:

Estimated cost for direct Material and the actual material consumed during the production is analyzed.

3.6.2 Cost Variance Report

Cost variance report consist of

- i. SWO No
- ii. Customer Name
- iii. SC-SV: Sales value for Stores credited items
- iv. SC-TP: Transfer price for Store credited items
- v. Production cost:
- vi. Relatable Overheads
- vii. Non relatable Overheads
- viii. WIP Interest
- ix. Supplementary Cost
- x. Estimated cost
- xi. Total cost
- xii. Cost Variance

Following Table gives the list for existing Reports

Sr. No	Description	Gen By	Recd By	Purpose
1	Sales & Margin Summary	Costing	Marketing	To find out the margin for SWO
2	SV/TP store credited for monthly basis	Costing		
3	Effective Recovery report	Costing	All shops	To find out the effectiveness of shops
4	Idle Hours Report	Costing	All Shops	Loss because of

				Idle hours
5	Shop utilization report	Costing	All shops	
6	Costing Profit & loss	Costing	Shops	Profit/loss due to Mfg.
7	Cost Sheet	Costing	All Shops	To find out Variance
8	Cost Variance report	Costing	All shops/Marketing	To find out the cost variance

4. Data Flow Diagram

A Data flow diagram (DFD) is a significant modeling technique for analyzing and constructing information processes. DFD literally means an illustration that explains the course or movement of information in a process. A DFD illustrates technical or business processes with the help of the external data stored, the data flowing from a process to another, and the results. Data flow diagrams present the logical flow of information through a system in graphical or pictorial form.

Fig 2 DFD for Product Costing

Data flow diagrams have only four symbols, which makes useful for communication between analysts and users. A DFD usually comprises of four components. These four components can be represented by four simple symbols. These symbols are explained as follows:

- External entities (source/destination of data) are represented by rectangles/squares;
- Processes (input-processing-output) are represented by Circles

- Data Flows (physical or electronic data) are represented by arrows
- Data Stores (physical or electronic) are represented by open-ended rectangles.

5 Implementation

The deployment of an ERP system can involve considerable business process analysis, employee retraining, and new work procedures.

5.1 Implementation Approach : Challenges

Minimization of

- _ Implementation time
- _ Implementation costs
- _ Repetitive developments
- _ Risk

Maximization of

- _ Implementation benefits
- _ Return on Investment
- _ Proof of concept
- _ Flexibility

5.2 Implementation Strategy

There are two main implementation Strategies:

1. Big Bang

All geographical locations and organizational entities are brought up with all planned functionality at once

- All functions at all sites go “live” at once
- Typically feasible only in small and mid sized operations with relatively few sites
- All encompassing Big Bang versus local Big Bang

2. Phased Implementation

- Staged implementation site by site, etc.
- Pilot (“proof of concept”) and roll-out

Similarly the solution can be developed by using either of following two strategies

1. Simple ---> Complex

Development of a solution for a small, but representative part of the business and scale up in

subsequent roll-outs

2. Complex ---> Simple

Development of a solution covering almost the complete functionality and roll-out of a repository to more

There is no single “preferred” approach. The unique requirements of each organization dictate which approach is most suitable. The careful analysis of the numerous options and the selection of the most appropriate approach is the key for a successful, time and cost effective implementation.

The Problem of ERP Implementation

The success of an ERP solution depends on how quick the benefits can be reaped from it. This necessitates rapid implementations which lead to shortened ROI periods. Traditional approach to implementation has been to carry out a Business Process Re-engineering exercise and define a “TO BE” model before the ERP system implementation. This led to mismatches between the proposed model and the ERP functionality, the consequence of which was customizations, extended implementation time frames, higher costs and loss of user confidence.

Because of the need to adapt the generic software to the specific needs of the firm, ERP vendors were required to provide tools and utilities that will allow the firm’s in house IT personnel or independent consulting firms to customize the software. Customization and implementation of ERP software became an industry on its own. The industry standard is 3 to 5 between amount spend on software purchase versus amount spent on software customization and implementation services [1]

“There is No Magic in ERP Software: It’s in Preparation of the Process and People,” [3]

ERP system logic is sometimes illogical, functionality is missing, functions perform poorly and so on.^[3]

Because of their wide scope of application within a business, ERP software systems are typically complex and usually impose significant changes on staff work practices. Implementing ERP software is typically not an “in-house” skill, so even smaller projects are more cost effective if specialist ERP implementation consultants are employed. The length of time to implement an ERP system depends on the size of the business, the scope of the change and willingness of the customer to take ownership for the project^[7]

To implement ERP systems, companies often seek the help of an ERP vendor or of third-party consulting companies. These firms typically provide three areas of professional services: consulting, customisation and support^[7]

5.4 Implementation Scenario

There can be two scenarios:

1. Comprehensive Implementation Scenario: Here the focus is more on business improvement than on technical improvement during the implementation. This approach is suitable when: Improvements in business processes are required. Customizations are necessary. Different alternative strategies need to be evaluated. High level of integration with other systems are required. Multiple Sites have to be implemented.
2. Compact Implementation Scenario: Here the focus is on technical migration during the implementation with enhanced business improvements coming at a later stage. This approach is suitable when: Improvements in business processes are not required immediately. Change-minded organization with firm decision making process. Company operating according to common business practices. Single site has to be implemented. [5]

6. Customization

The Customization is the process of extending or changing how the system works by writing new user interfaces and underlying application code. Such customizations typically reflect local work practices that are not currently in the core routines of the ERP system software.^[7] Customization is done to align the engineering needs of the organization with ERP

The costing in L &T, Kansbahal has mainly three components. First one is the material cost, second is labour and overhead cost and the third one is the sub-contracting cost. None of the ERPs are designed the way the costing is done at Kansbahal and hence some amount of customization is needed to take care of these requirements.

The standard provisions in ERP do not have facilities to capture all dimensions of equipment (finish dimension as well as raw dimensions). here. The Bill of material prepared by engineering department has six dimensions for the product –rd1,rd2,rd3 for raw material and fd1,fd2,fd3 for finished material. In shop floor and stores department, customization has been done to include to all six dimensions of the material.

In material requirement planning, common items i.e. stock items are checked quarterly in live project list. Quantity of specific items is computed and checked against its stock position in inventory. The Purchase order is placed for required quantity of specified stock items. In the Erp used, There was no direct way to classify products into two categories i.e. stock and non stock items. The extra fields available in the specific table are customized for type of material i.e. stock or non stock material. Moreover reports containing description of materials are also customized to include type of material.

The engineering department places the requirement of certain items in terms of area but purchase department procures in terms of weight, hence suitable conversion is required to convert quantity of material from sqm to kg. This is known as *conversion factor*. The material issue process is customized to include conversion factor.

Steel plates are one of the stock item. The Thickness of steel plates is not uniform, they come with some variations in the thickness. The maximum weight variance of 10% is acceptable in procurement of steel plates. Hence Receipt module is customized to take care of weight variance.

The Bill of material needs to have link with procurement of that item and it is done through customisation. There are many finer requirements in procurement module with regard to type of procurement and hence some amount of customisation is done here.

The tax structures in ERPs made by western guys lack Indian laws and hence customisation in that space is inevitable. It includes making an invoice to a customer and making a payment to a vendor through cheque too. The connectivity through net payment to vendors is achieved through customisation.

6.1 Role of Costing Professionals and the Costing system

Once a system is put in place, the feeling comes to our mind that what could be the role of so many persons in that department. For example, the costing department in L&T had five people before going for ERP implementation. The system can not replace all but now due to better system in place the department is manned by three persons.

Organisations do not have a large IT Team who will be able to support the ERP implementation across all locations and require the services of ERP consultants, who have a good domain knowledge; a good knowledge of the ERP system; a good understanding of various business processes; guiding them thru the implementation course.

7. Conclusions and Future Directions

With ERP one can manage all of the resources required to produce a product - in every stage of the manufacturing process – with unlimited inputs and outputs. Bills of material need to reflect components used in the factory, input quantities need to be accurate and sufficient allowance needs to be made for component waste as well as scrap/rejects. Routings need to reflect process steps in the factory, resource and capacity requirements must be based on achievable standards based on best practice.

Erp solution offers a flexible framework to enable and support real-time business change - whether proactive through continuous business innovation, changing business processes and unique practices in order to out- manoeuvre the competition or reactive in response to government regulations or competitor innovation.

Currently, L & T is not having proper integrated system and business performance data to the top management is not available on line. L & T Management wants to have data on line so that they shall be able to monitor the performance of the business

There are following performance issues with JD Edward ERP package

1. The ERP package, JD Edwards provide less number of reports which are not enough to carry our data query efficiently
2. The people of costing department found documentation of JD Edward complex and not user friendly.
3. The through put time is very high.
4. Security needs to be provided to ensure that once status changed can not be changed to a lower status. This was not dealt during CRP. For example, Engineering department should not be able to change status from 110 to 105 for a released PR.
5. As PR can be prepared in JD without making supplementary parts list, hence shops will not be able to know the relation between the Parts List and the PR seeing a Parts List already released to shop by Planning. In view of this, it was decided that a comprehensive report is needed for the shops/Engineering to correlate between the PRs released and their link between the Parts List items based on the JD item number and the source type (BUPR, BOPR, ICPR etc.) of the P/L.

Current ERP program suffer from a number of shortcomings which make it especially difficult for organization to enjoy the tremendous benefits of ERP:

- (a) Customization is costly, time consuming and, in many cases, impractical. This leads to a situation in which the organization must change many of its work processes and to adapt to the ERP program rather than the other way around.
- (b) Implementation of an ERP project is a long process, exhausting precious time of the firm's key people and usually interfering with the on going firm's operations.
- (c) Poor training and inappropriate preparation of the firm's personnel results in poor usage of the system and insufficient exploitation of the new technology.^[1]

Organisation should acquire flexible ERP information technology that can accommodate rapidly changing business conditions. The high-velocity flow of information needed to support action up and down the supply chain is a major step forward^[3]. One should focus on their business strategy and not just software selection and implementation. Many problems are reinforced by contradictory objectives and performance measures that actually create inconsistent.

When ERP implementations fail to deliver, it's usually because management hasn't taken the time to structure the organization to take advantage of these systems.^[3] No amount of information technology will correct these problems. Companies need a well thought-out. Comprehensive process to help plan, guide and control the entire ERP implementation effort.^[3] The ERP software search, evaluation and selection process must be done right to minimize this risk.^[3]

Data capture using OCR embedded within workflows has become a mature and effective technology. Solutions are robust and straddle the gap between corporate data systems and document based processes, offering security, audit, reporting and management functions that fit within corporate regulatory environments - delivering a measurable return that is unique amongst most IT solutions^[4]

The best project is well thought out and fully researched. It is not limited to a budget and timeline, but focuses on tasks, owners, goals, and milestones. It begins at the time of software selection and goes well beyond go-live. And although most projects will stumble along the way, successful implementations that actually end on time and on budget are quite possible if managed properly^[6]

7.2 ERP Systems - The Future

The Internet represents the next major technology enabler which allows rapid supply chain management between multiple operations and trading partners. Most ERP systems are enhancing

their products to become "Internet Enabled" so that customers worldwide can have direct to the supplier's ERP system^[5]. Recognizing the need to go beyond the MRP-II and ERP vendors are busy adding to their product portfolio. BAAN for example has already introduced concepts like IRP (Intelligence Resource Planning), MRP-III (Money Resources Planning) and has acquired companies for strategic technologies like Visual Product configuration, Product Data Management and Finite Scheduling.^[5]

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