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IMPLEMENTING A SUCCESSFUL BUSINESS INTELLIGENCE FRAMEWORK FOR ENTERPRISES

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Abstract: This paper examines the typical tasks undertaken in designing and deploying BI applications to improve quality of interaction between Organization & their customers. Organizations have a great deal of transaction data, from which hidden patterns can be drawn out for predicting product selection and customer behaviour. Intelligent Data Analytics provides powerful and effective tools for problem solving in a variety of Modelling Tasks. Classification & Prediction are crucial for Predictive Modelling and help organizations to proactively manage change. The aim of BI is to improve Business process efficiency by reducing costs without impacting production and also optimizing inventories. BI Deployment simply means getting the information, in a usable format; to the place where it is needed. Choosing an appropriate BI framework is essential for deriving optimal results from Data Mining and Knowledge discovery initiatives.

***Keywords*:** BI, BW, EAM, KPI, SOA, SaaS, DM, BPM, Knowledge Discovery, CIF, CLBA

INTRODUCTION

Organizations Collect, Evaluate & Analyze information at various levels of decision making i.e. Strategic, Operational & Tactical levels. The operational data from various business functions is sourced through OLTP based Software Applications like SAP, ORACLE Applications etc. These applications implement Business specific processes related to each function and track its execution across the enterprise.

These Business Applications typically lack the capabilities [1]-

a. OLAP functionality to provide an analytical perspective of historical, current, and predictive views of business operations typically required at each layer of enterprise.
b. Reflect trends and patterns in data and highlight performance statistics or deviations in business processes.
c. Capability to Slice and dice data to check out business performance from the highest consolidated level to the most detailed level of individual decisions
d. Mask the complexity of heterogeneous data sources and provide complete and consistent access to information throughout the enterprise.

Today's uncertainty requires a variety of ***what-if scenarios*** – the corresponding agility to adapt to the most likely possibilities. The challenge before information managers is to make available data to the people who are best equipped to make decisions. Bill Inmon, president of Inmon Data Systems, introduced his vision of a *closed-loop analytical process* under the name of *Corporate Information Factory* (CIF) in 1998 [2], which have further evolved into *Closed Loop Business Analytics.* CIF describes an information landscape that collects, transforms, standardizes, and stores data from the most disparate operational applications in a company in order to provide this information for analysis and reporting purposes.

This paper presents the BI design framework to achieve these objectives using newly emerging closed-loop Business Analytics Model for enterprises

SURVEY OF EXISTING BI DEPLOYMENTS

Most of the existing BI deployments were initiated to provide customized reports for operational requirements [3]. The results of survey carried out in a manufacturing industry are given in Table 1 with priority for BI objectives marked as Low, High, and Medium.

Table 1: BI Deployment Objectives

BI Objective	Organization Layer	Priority
Aligning IT with Business	Strategic	High
Enterprise Architecture	Strategic	Medium
KPI Tracking	Strategic	Low
Capabilities of legacy applications	Operational	Medium
Information gathering	All Levels	Low
BI Reports development	Operational	High
Requirement Analysis	All Levels	Low

The BI design should have *information gathering* as its primary objective rather than reports gathering at each layer of enterprise. The implementation of above issues is discussed in design of BI framework section.

KEY ISSUES IN BI DESIGN FRAMEWORK

Understanding the capabilities of existing information systems to deliver analytics across enterprise for all functions.

Aligning IT investment with business goals. We need to evolve a process-centric platform for decision making Managing Strategic objectives of IT planning requires

securing a clear mandate for IT landscape to drive business improvements. To obtain an action plan for IT, a Program Portfolio can help in seamless integration with enterprise architecture management (EAM) processes so that architectural risk is minimized and opportunities to migrate, enhance or retire current applications or other IT artifacts are not ignored [4]

Enterprise Architecture is at a level of abstraction that is suitable for planning and for understanding the intrinsic dependency of the IT/Business relationship, for example, the dependency between business capabilities and services. Too much detail, for example, at the level of project planning, only makes the planning process unnecessarily complex and slow Model business operations and extract KPI's across all functions, which are relevant at each layer of enterprise and bring them to dashboards and scorecards for data visualization Calculate costs and provide for required IT budget. Cost management needs to be conducted with an awareness of the enterprise architecture and project portfolio.

PLANNING FOR BI SYSTEM CAPABILITIES

Business Strategy is formulated at higher level of abstraction and linked to business capabilities at a business function level [5]. Here we should identify which business activities are critical to enterprise success and which need improvement most urgently. After due diligence, the business needs are documented in a meaningful & structured way. Business capabilities are usually the missing link for enabling a business-related view onto IT functionality. This requires a better understanding between Business and IT to enable the business to formulate their requirements in a non-technical yet functionally precise way [6]. Project assessment and portfolio decision making activities are discussed further.

a. Business capability map is drawn to show the gaps in required and actual strength of business activities. On assessment of business capability, a new IT strategic plan is drawn to engender effective decision making.
b. To achieve an effective IT strategy, plan for a common course of action, involving all stakeholders. IT strategy defines the incremental steps or milestones bridging from the as-is landscape to the target landscape defined in the IT strategy. Each step is associated with prospective-realization time periods and approval statuses
c. IT Master Plan is further derived from the central IT planning/enterprise architecture inventory and sends feedback into the inventory when changes occur. It is thus able to represent the IT landscape at any point in time. The master plan is a highly condensed representation of the strategic plan and is an easy-to-comprehend, single point of reference, and hence an excellent medium for discussion at decision boards.
d. In next section EAM implementation is described which has got a profound impact on BI deployment for large enterprises.

ENTERPRISE ARCHITECTURE MANAGEMENT

EAM aims to make an impact analysis to understand the proposed changes early on so as to avoid surprises halfway through an implementation. This improves predictability and reliability in the overall IT plan and also serves to control risk. Analyzing for cost inefficiencies, architectural risk, noncompliance and the general health status of the IT landscape is necessary to ensure that IT can deliver and improve on its support for business initiatives. Assessing the risk entailed in the enterprise architecture is a key element of the IT management process. The analysis of the applications that support certain business processes is an important feed for the overall risk assessment[7]. The key aspects of EAM are discussed here.

a. Targeted portfolio analysis: This gives users quick insight into the risk exposure of applications and allows them to initiate mitigation appropriately
b. Lifecycle Planning: IT standards are set in order to ensure that the IT landscape makes continual progress toward the enterprise architectural vision and is in step with new technologies. Business Processes are streamlined across federated environments by defining standard components and preconfiguring them into standard platforms to be used as the base platform for individual projects
c. Coordinating many Roadmaps: Demands for technology changes are submitted by many stakeholders. These changes can originate from strategy formulation, business capability gap analysis or those coming in on an operational basis, as described in previous sections

Based on BI implementation results for a large manufacturing enterprise, the following weights are arrived at for the above parameters,

Table 2: Objectives for BI System Capabilities

Objective	**Weightage**
BI Data Governance	High
Enterprise-wide data Integration	High
Ability to run Structured queries over Unstructured data	High
Advanced Analytics	Standard
Reducing the gap between Operational Systems and BW	Standard
Social computing & BI	Low
SaaS & Cloud Computing for BI	Low

PROPOSED MODEL FOR BI FRAMEWORK

The primary goal of the closed-loop business analytics process is to enable you to convert operational data into analyzable information from which you can then generate actionable knowledge, to be used to influence the operational systems.

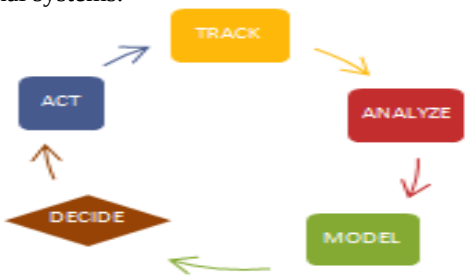

Figure 1: Structure of Closed Loop Business Analytics

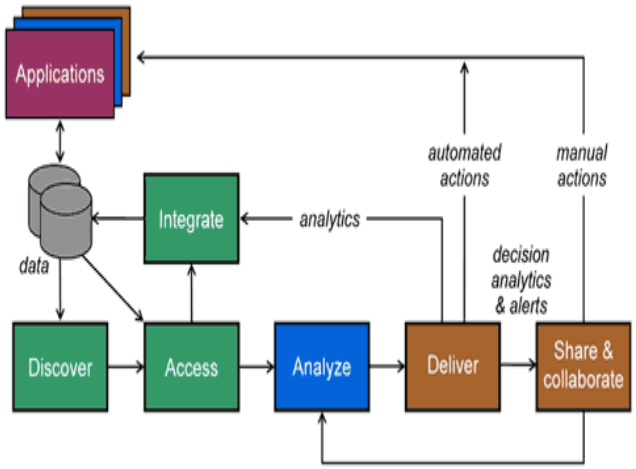

Figure 2: Model for Closed Loop Business Analytics

Phases in Closed Loop Business Analytics (CLBA) are briefly explained below.

- ***a.*** ***Tracking:*** Identify quantifiable data from each business process, from all software modules. From this operational data actionable knowledge is extracted. This also deals with data cleansing, Transformation, Enhancement and Standardizing. The model provides a Unified Architecture that supports all User Groups
- ***b.*** ***Analyzing:*** Analysis Levels should include the following categories of BI information consumers, for whom specific type of BI content is delivered.
  a) Strategic Users: Dashboards, Scorecards
  b) Operational Users: Customized Reports
  c) Tactical Users: Info Users of Web based queries, Portals and other end users.
- ***c.*** ***Modeling:*** Uses the results of OLAP as the basis for Decision Making Model. Rules are created for BI data. There are Classification & Additional Models to support Decision Making
- ***d.*** ***Deciding:*** This phase deals with the Accounting part on results of Analysis & Model. The ability to access all types of information consistently and in an integrated way lays the foundation for solid decision making.
- ***e.*** ***Action:*** This phase provides feedback to Operational Processes in terms actions taken on business decisions in previous phase. This feedback can be automated.

MAJOR ARCHITECTURAL PARAMETERS IN BI DESIGN

BI design should be adoptable to SOA. SOA combines different services to map entire Business Processes of enterprise. Also we need to identify centrally managed services published in different directories of system landscape. SOA conformance entails the following issues.

a. Producing a Service based Reusable application components with Modular Architecture.
b. Achieving integration with Business Process Management (BPM) by defining Integration Brokers
c. Use of Life Cycle Management to link services with Processes i.e. Specifying and Prioritizing Requirements, Modeling, Implementation
d. Scalability: Functional Modularity, Integrating Components, Reusability etc

Master Data Management (Mdm):

MDM includes Texts, Attributes & Hierarchies in data and is sourced from operational systems. Text describes all relevant Master Records. Example: Employee Master, Customer Master, Materials Master, and Product Master Etc. Attributes are related to each business entity i.e. dimensions referred in DataCubes or InfoCubes. Hierarchies do semantic linking of information in defining dimensions in a Version-Specific, Time-Dependant manner. It is relevant to both pure data targets in which Creation or Execution of Queries takes place and data targets on which definable queries are run. The other issues connected with MDM are – Defining Levels of Aggregation for both Extracted and Transformed data. Process variants can be grouped together to schedule Process Flows from OLTP systems to Data Warehouse [9].

Generating Bi Content:

Data is imported from all sources into Warehouse (WH) Repository. Appropriate mechanism is developed to differentiate between Master data & Transaction data. Development of Information Model requires creation of Integral Roles, Workbooks, Queries, InfoSources, Update Rules, Preconfigured data Objects etc. Data Governance Process mandates high degree of data quality, obtained by structuring content behind BI front end

Etl Process Design:

Extract-Transform-Load process is deployed for regular Updation of Business Warehouse. ETL process Extracts Data from Source System, Checks for Consistency and if required Enhances source structure. Data is loaded into target database after Transformation and Homogenization of data. Also data quality is checked by running integrity checks

Capabilities Of Bi Platforms:

Metadata Repository (MR) is central to BI Platforms to display and use information of Metadata Objects (Accessing). Business Reference Objects are generated at the product design stage. This forms dimensions for later use in DataCubes. Planning applications are to be developed beforehand. Planning and analytical services ensure physical storage in BI and processing of data.

Updating of Warehouse can take place in 2 modes, namely flexible and direct. In flexible mode data is updated from its communication structure into any Data Target. In direct mode, we can decide upon data target which gets updated by data acquisition process. By incorporating an update rule the above modes can be combined. Transferring of OLTP data into WH takes place based on scheduling of extraction, delta jobs.

Maintenance Of Data Warehouse:

Maintenance of Data Warehouse (BW) requires checking of various BW data flow activities along with Load Characteristics. Data targets can be provided with different images of data like Before Image, After Image, Additive Image, Reverse Image, and Delete Image. Handling 'Delta Changes in source data' requires Delta Initialization and specifying a policy on whether New or Changed records are sent for updates. Appropriate flag can be set on the delta to decide whether or not the last groups of delta records are to

be loaded into BW. Also decide on strategy for loading Flat Files, Master data and Extractor types. Handling delta changes in data are of utmost important for Warehouse administrators [10]. A suitable strategy is discussed with examples.

Delta Initialization:

For source data extractors supporting delta, we can initialize and perform delta run. Decision on Delta Extraction characteristics could be based on Timestamp, Calendar Day or Numeric Pointers (for example Document No). First we need to identify delta relevant fields. SAP BW extraction types and delta initialization mechanisms are presented below.

Table 3: Various SAP Business Warehouse Data Extractors

Application Specific Extractor	BW Content Extractors	Suited for extracting logistics data
	Customer generated Extractors	These are database specific
Cross Application Extractor	Generic Extractors	Deployed for scenarios where other types are unavailable
	Generic Extractors for specific scenario	Application does not feature its own generic delta extract methods

For Delta Mechanism, timestamp can be used to find delta changes in data for the each mode. The type of mode used depends on specific application content and business reporting requirements.

Table 4: Delta Mechanism deployed in SAP BIW

Delta Mode	SAP Application Types
PUSH	Delta records are directly pushed into delta queue when transaction is completed in OLTP systems
PULL	Pull delta data from applications into BW system

DATA VISUALIZATION TOOLS

Choosing right tools helps in generating tabular, Cross-tabular reports with gauges and graphs. Dashboard based business intelligence systems do provide managers with access to powerful analytical systems and tools in a user friendly environment & reports key organizational performance data and options on a near real time and integrated basis as shown figure 3 below.

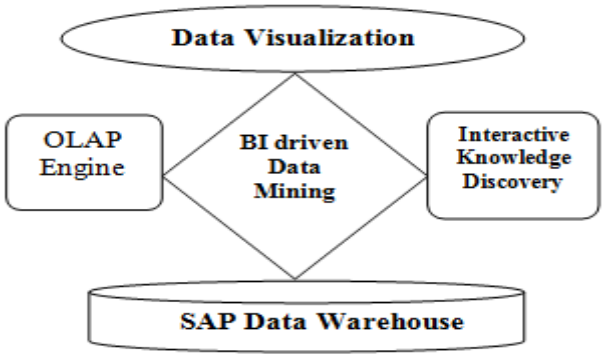

Figure 3: Data Visualization Tools for SAP BI Systems

With these design considerations we could implement a basic CLBA Model to feed BI analytics back to operational systems [11], as shown below.

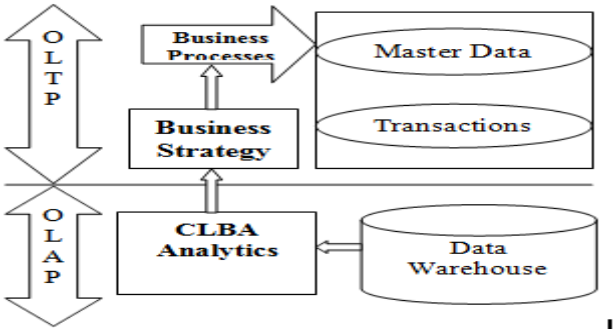

Figure 4: Model for CLBA Analytics feedback to OLTP

With this CLBA Model end users will be able to view summary information and then drill down into detail that is specific to their business process. The underlying measures that enable this analysis must be consistent across the enterprise [12]. Decision making with CLBA Model is given in figure 5.

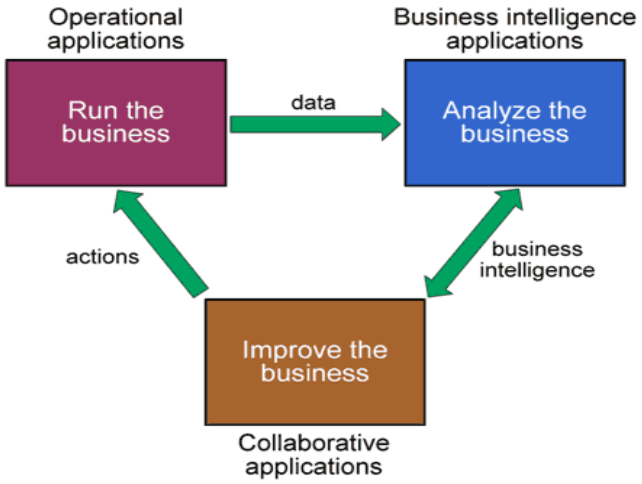

Figure 5: Decision Making with CLBA Model

CONCLUSIONS

Designing the BI Content form operational sources forms the bedrock for robust enterprise reporting and analysis by all levels of management. The BI landscape should be scalable and user friendly. BI is central to many ERP and other operational systems and requires Cross-Application Planning, Investment Planning and complete Business Consolidation. Enterprise Business Intelligence landscape should be designed to provide Historical, Current and Predictive views of Business Performance. Placing strategic information in the hands of decision maker's aids productivity, empowers users to make better decisions, and improves customer service, leading to greater competitive advantage. BI helps organizations build KPI based performance management System which would result in business driven information infrastructure that reflects the key information needs of the organization, as detailed in CLBA model. Some of the most important insight from a BI system can come from discovering how interdependencies impact outcomes across an organization. Integration of data and data analytics across the organization leads to custom analytics that can identify root causes of issues. Data mining is an integral part of knowledge discovery process. The output of Data Mining can be coupled with optimization

techniques which in turn can help in designing efficient DM algorithms for Decision Support Supports. As with any initiative that requires change management, a successful BI implementation requires senior leadership support, training and communication throughout the enterprise

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