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HYPOTHESES

RESEARCH METHODOLOGY

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RECOMMENDATIONS/SUGGESTIONS

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- Bowersox, Donald J., Closs, David J., (1996), "Logistical Management." Tata McGraw, Hill, New Delhi.
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- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

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- Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

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- Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

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- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

METADATA MANAGEMENT IN DATA WAREHOUSING AND BUSINESS INTELLIGENCE

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ABSTRACT

Business intelligence (BI) is a widespread, complete category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions. A metadata is nucleus for data warehouses and business intelligence. Metadata has been identified as a key success factor in data warehouse projects and business intelligence. It captures all kinds of information necessary to extract, transform and load data from source systems into the data warehouse, and afterwards to use and interpret the data warehouse contents. Metadata provides a large range of benefits. It is used to build productivity, enhancing data quality, and cost saving on business activities and reduces the redundancies. This paper gives an overview of types of metadata, benefits and reasons for metadata management in business intelligence.

KEYWORDS
Metadata, Business Intelligence, Data Warehouse.

I. INTRODUCTION

The term Metadata is defined as “data about data". It describes the content, quality, condition, and other characteristics about data. Metadata helps a person to locate and understand data. Metadata provides data history. It describes the Who, What, Where, Why and How of the data.

II. CREATION OF METADATA

Metadata is created everyday in a real world to set metadata such as food labels, map legends, recipes, library records, information on a CD or DVD, grant proposals, data dictionaries, project reports, 'how-to' guides, and the like. Each of these types of metadata has the same format.

III. TYPES OF METADATA

There are different types of well accepted models to specify types of metadata.

A . Bretheron & Singley (1994) distinguish between two distinct classes: structural/control metadata and guide metadata.

A.1 Structural metadata is used to describe the structure of computer systems such as tables, columns and indexes.

A.2 **Guide metadata** is used to help humans find specific items and is usually expressed as a set of keywords in a natural language.

B. According to Ralph Kimball metadata can be divided into 2 similar categories

B.1 Technical metadata correspond to internal metadata

B..2 Business metadata to external metadata.

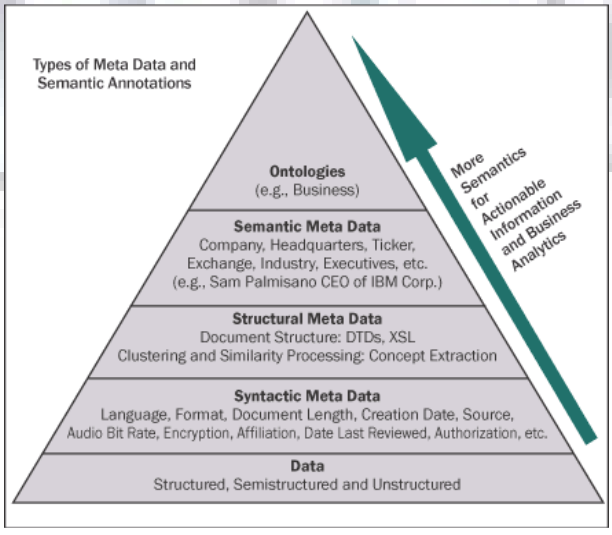
B.3 Process metadata.

C. NISO distinguishes between three types of metadata:

C.1 **Descriptive metadata** is the information used to search and locate an object such as title, author, subjects, keywords, publisher;

C.2 Structural metadata gives a description of how the components of the object are organized.

C.3 Administrative metadata refers to the technical information including file type. Two sub-types of administrative metadata are rights management metadata and preservation metadata.



IV. METADATA USERS

Data developers, data managers, data users, and organizations can use the metadata. To avoid data duplication and to search in existing data, data developers and users are allowed to search in standardized metadata documentation. Parameters of the dataset will be given to data users to evaluate data. It allows searching for data acquisition and transfer in specific geographic locations and gives information. In an organization, metadata secures the value of its investment in data. Metadata manages data productions and planned acquisition in a very efficient manner. Finally, metadata documentation excel people and time. Staff

V. METADATA BENEFITS

Metadata provides value at all levels, data developers, data users and organizations.

A. VALUE TO DATA DEVELOPERS

It avoids duplication, Shares reliable information, Publicizes efforts,-Reduces workload,-Documenting data is critical to preserving its usefulness over time; without proper documentation, no data set is complete.

B. VALUE TO DATA USERS

Makes it possible for data users to search, retrieve, and evaluate data set information both inside and outside organizations, Finding data: determine which data exist for a geographic location and/or topic, Applicability: determine if a dataset meets your needs, Access and Transfer: acquire the dataset you identified,-Data use-how data can be used; if it has restricted use, etc.

C. VALUE TO ORGANIZATIONS

Organizes and maintains an organization's investment in data, Provides for the documentation of data processing steps, quality control, definitions, data uses and restrictions, etc.,Transcends people and time; offers data permanence and creates institutional memory, Saves time, money, frustration.

VI. METADATA , DATA WAREHOUSE AND BUSINESS INTELLIGENCE

Metadata Management is not a pure BI subject, though it has many applications around BI components like Data Warehouse and OLAP. Metadata Management serves every possible stakeholder within an organization. It can be used even by people who have never seen a computer. ERP systems are as much a stakeholder for Meta-data project as a data Warehouse.

Data warehouse (DW) is a repository of an organization's electronically stored data. Data warehouses are designed to manage and store the data whereas the Business Intelligence (BI) focuses on the usage of data to facilitate reporting and analysis.

The purpose of a data warehouse is to house standardized, structured, consistent, integrated, correct, cleansed and timely data, extracted from various operational systems in an organization. The extracted data is integrated in the data warehouse environment in order to provide an enterprise wide perspective, one version of the truth. Data is structured in a way to specifically address the reporting and analytic requirements.

An essential component of a data warehouse/business intelligence system is the metadata and tools to manage and retrieve metadata. Ralph Kimball describes metadata as the DNA of the data warehouse as metadata defines the elements of the data warehouse and how they work together.

Kimball defines three main categories of metadata: Technical metadata, business metadata and process metadata. Technical metadata is intially definitional while business metadata and process metadata are primarily descriptive.

Technical metadata defines the objects and processes in a DW/BI system. The technical metadata includes the system metadata such as: Tables, fields, data types, indexes and partitions in the relational engine, databases, dimensions, measures, and data mining models in its data structure. Technical metadata also defines the data model. It also gives reports, schedules, distribution lists and user security rights to the users.

Business metadata is content from the data warehouse. The business metadata describes about the the data from where it comes, what is the content of data in the data warehouse. Business metadata may also serves as documentation for the DW/BI system. Users who browse the data warehouse are primarily viewing the business metadata.

Process metadata is used to describe the results of various operations in the data warehouse. Within the ETL process all key data from tasks are logged on execution. This includes start time, end time, CPU seconds used, disk reads, disk writes and rows processed. When troubleshooting the ETL or query process, this sort of data becomes valuable. Process metadata is the fact measurement when building and using a DW/BI system. Some organizations make a living out of collecting and selling this sort of data to companies - in that case the process metadata becomes the business metadata for the fact and dimension tables. Process metadata is in interest of business people who can use the data to identify the users of their products, which products they are using and what level of service they are receiving.

VII. REASONS FOR METADATA MANAGEMENT

A. DATA QUALITY

Data quality is driven by a common set (and common understanding) of data standards, domain standards, business rules etc. If the systems follow the common standards (creating same checks, controls, table structure) there can be a big gain on data quality. Metadata repository:

- Provides the details on the data standards to follow
- Enforces the adherence to the standards as defined in the repository.

B. IT SYSTEMS PRODUCTIVITY

On the basis of data standards, business rules, and models etc. exist in the metadata, one builds productivity on following counts:

- Automatic creation of the tables and models: Systems can pick-up the details from the metadata repository and build the components. This will save time and effort to firstly creating the models and then build them.
- Avoid cost of mistakes and iteration: One may not have to go through the pains of change controls, if your design is built from common standards

C. AVOIDING INFORMATION CONFLICT ISSUES

By using metadata repositories and enforcing common standards and calculation formulae, the reports and dashboards will have a greater probability of reflecting same figures. This will avoid board room time waste on find which are the correct figures.

D. REGULATORY COMPLIANCE

With all the above benefits, one can expect that business will be able to produce correct reports faster and cheaper.

E. BUSINESS PROCESS MANAGEMENT AND ITS CASCADING IMPACTS

With every change in business processes, one can find the cascading impact on various components like policies, business process documentation, business rules, configuration and set-up changes in IT systems. For example if a new business process allows a sales manager to manage more than one outlet, it will have a cascading impact on the set-ups, software changes, ETL and dimensional models..

F. HANDLING ANY KIND OF CHANGE MANAGEMENT

Whenever anything changes with-in an organization environment, metadata repository helps you to understand the impact. For example, if you want to change 'maker checker' control policy, Metadata repository will be able to tell you on which all systems, database, business processes you have to change.

G. BETTER ESTIMATIONS AND BUSINESS CASE MANAGEMENT

With metadata repository telling you the impact of a requirement and also providing some efficiency gains, one can do a better estimate of the cost of making a change.

H. MAKING SCALABLE AND EXTENSIBLE MODELS

This is not a direct benefit of Metadata repository, but it supports it. Smart modelers (with solid business knowledge), can help create models (for example Foundation Dimensions and Facts in Dimensional Model of a data warehouse) which can quickly respond to the changes. A metadata helps you to manage this modeling.

I. REDUCE REDUNDANCY

With all the data elements maps stored in the metadata repository, one can identify the redundant data and processes, and work on their reduction OR elimination.

VIII. METADATA MANAGEMENT

Metadata management is the set of tools and processes by which we maintain a unified reference to the details on all data, information and knowledge existing within an organization. A metadata repository contains this information at various levels of details (from contextual to implementation), and aspects (function, timing, location, history of changes…) of the data existing in all forms (automated and non-automated...) within an organization.

A. Metadata Detail Level

Metadata is recorded at different level of details and also from different perspectives. The level of detail ranges from the contextual level to implementation level. The type of metadata includes functional, timing, location, ownership etc..

A.1 Level of Detail

- **Contextual:** This provides the back-ground to the meta-data object and its various aspects. It provides a general ground setting and the 'unstructured' knowledge one needs to have as one goes into the next level of details.
- **Conceptual:** This provides the description and high-level detail about the object. For example detailed description of the business process OR Data structure
- **Logical:** This provides logical level details on the metadata object. For example detailed business process diagram OR Detailed Data model
- **Physical:** This provides the physical level details of the metadata object. For example detailed business process, like the person responsible for a process, the location at which the business process is executed.
- **Implementation:** This provides the execution and implementation details of the metadata object. For example, the implementation details of a business process- Who carries out the process..?

A.2 Aspect of Meta-Data

- **Function:** The functional details of the metadata object.
- **Timing:** When a particular metadata object is executed.
- **Location:** Where the metadata object is executed from OR where it is stored OR maintained?
- **History and version change:** What has been the history OR creation OR changes?
- **Ownership:** Who owns the various activities done with the meta-data object?
- **Security:** Security matrix around the metadata object

A.3 Examples of combinations of Level + Type

A.3.1 Contextual Metadata Level

Contextual + Functional: Purpose of the business process, How it fits into the overall business process framework? What is the importance and criticality of the business process to the business?

Contextual + Timing: Why the timing is important for various operations on the data? What happens, if the data is not processed as per the given timing?

Contextual + Location: Why the location is important for storing the business process?

Contextual + History and version Change: What is back-ground of the changes done to this structure? Why those changes were needed and what was their criticality?

Contextual + Ownership: What is the strategy behind defining the ownership the way it is?

Contextual + Security: Why we have defined the security in a given way? What happens, if the security is not followed?

A.3.2 Conceptual Metadata Level

Conceptual + Function: The high level description and detail of the business process. For example a level 1 and 0 of the business process documentation. More focus on commentary than the diagram.

Conceptual + Timing: What is the high level timing of various operations done on the data (online operation vs. batch-operations, prior to certain set of operations, key linkages with other operations...)

Conceptual + Location: High level description of the location of the data structure. Is the data stored in different locations (data table partitioned and stored in different locations)?

Conceptual+ History and Version Change: High Level detail on the changes done to the data structure and associated business rules? When were the major changes done? What was the purpose behind each change? Did that change include a large migration?

Conceptual+ Ownership: Who is the owner of the business process? Why is he the owner of the business process? Who are the owners of the sub-processes, and why? What are the rights and responsibilities of the owners?

Conceptual+ Security: What are principles followed for defining the security matrix for the given data table OR data group?

A.3.3 Logical Metadata Level

Logical + Function: Functional specs of the business process to the last level of detail.

Logical + Timing: Business specs on the various timings on operations done on the data. For example, when will the commission calculations on the commissions table to be applied? The business specs should also cover the reasoning behind these timings.

Logical + Location: Details on business location of the business process documentation. This includes the paper copies of the process, the copies on the website, image scans etc.

Logical + Ownership: The details on business and IT ownership of the data, and the purpose and reasoning behind the ownership.

Logical + Security: The details on the business and IT security matrix, and the reasoning.

A. 3.4 Physical Metadata Level

Physical + Function: Program specs for the automated business process.

Physical + Timing: Timing of execution of each component of the data. For example, the timings and the triggers which lead to access, updation and addition to the data.

Physical + Location: The drawers, the website servers, the network drivers where the master copies of the business process are lying.

Physical + History and version: The history of the migration and changes done to the data table.

Physical+ ownership: The ownership of the data in terms of business owner, where does he sit OR located, the contact details. Same information should be available about the IT owner. Also define the back-up and the other stakeholders.

Physical+ Security: The access security matrix at the server, column, row and table level, for different operations (accessing, updating, adding...)

A.3..5 Implementation Metadata Level

Implementation + function: Actual program specs for creating the data.
Implementation + Timing: Implementation process for executing the business process.
Implementation + Location: The place where the table creation will be run.
Implementation + History: The history of changes done to the table structure.
Implementation + Ownership: Who will do the table creation?
Implementation + Security: Who has the access to create and test the table structure once a change is done?

IX. BUSINESS INTELLIGENCE

BI is a set of tools and processes to generate intelligent and actionable information to the audience. It starts from retrieving data from the source transactional systems and data repositories, transforming and integrating the data, and finally loads it in the form so that BI end-user tools can generate the information. Business intelligence applications can be:

- Mission-critical and integral to an enterprise's operations or occasional to meet a special requirement
- Enterprise-wide or local to one division, department, or project
- Centrally initiated or driven by user demand

X. CONCLUSION

Metadata management is core to building intelligent and high-performing enterprises. It benefits all facets of an organization including business process management, BI, IT management, performance management and so on. There is a cascading impact on better business performance, employee satisfaction and customer satisfaction.

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