

# Improve the Decision Making Process in Human Resource Management using Data Mining Tools

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## Abstract

In present, the HR department is not only responsible for the human resource management and development but also responsible as a decision maker to other department in the organizations. It supports to the department for the solutions of the any decision related problems to achieve the desired goals and objectives of the organisation. The HR department directly support to other department in the decision making process for required achievement or desired goals of the organisation. In this paper, design data mining tools for improve and support to the DSS (Decision Support System) for the decision making process of each department of the organisation to technical support for the complex decisions making process of the related problems. DSS as the based the technical solution of the related problems using data mining tools., for this, the technical tools of data mining (Cube, Clustering, Data mart, Mata data) for the solution of the quick decision support data, cube data, multi-dimensional data and other analysis of the information for the related decision making process. The Strategic information system designs for the dimensional, multi-dimensional, classification of data and clustering of data using data mining tools as data marts, data cubes, Mata data etc for the technical and quick/rapid decision making process in organisations for decision makers. Here the aim of paper to design and develop the Strategic information system and Intelligent Process Automation System for improve Decision Making Process of the Human Resource Management using data mining tools and support to the Decision Support System for further specification of the information. The data mining tools support dimensional data, Classification/ Clustering of data as well as Predicate Analysis and Content based information system using Cubes, Data Marts, and Mata data tools of Data Mining.

**Keywords:** *cube, roll-up, Data mart, Mata data, DSS, EIS, ETL, HRIS, Inextricable Data, clustering, predicate data, SIS, roll-down tile.*

## I. Introduction

It is proposed that we take human resource management to be that part of management

concerned with All the decisions, strategies, factors, principles, operations, practices, functions, activities and methods related to the management of each department of people as employees in any type of organisation (including small and micro enterprises and virtual organisations). Decision making processes in each department for achieving particular tasks in the organisation. Presently decision making is the vital part of the each organisation and HR department is totally responsible to achieves desired goals and objectives of the organisation using appropriate decision making. Here recent Data mining tools are required for the complex decision in the organisation. This research support to the different types of decision of each activity in the organisation carried out by the IT tools of Data Mining to improve the HRM process as a technical support to Decision Making [5, 6]. Here designs the Strategic Information System and further Intelligent Process Automation System to directly support to the decision making in each activities of the each department in the organisation to the decision Makers. The paper will evaluate and improve the role of human resource management using Data mining tools in the strategic process as Strategic Information System for the HR department for the decision making process in organization. The DSS in transformed into the further revision of the information for the technical decision making process like quick decision. Fast data retrieves for rapid decision, classification of data for analysis and models, and specific data/information system using data Marts, cube etc, also transforming information into further higher level abstractions of the information for the Intelligent Process Automation System. Using intelligent Process Automation system the basic predicate analytical information and content based information acquires using the following Data

Mining tools [11]. Data cubes [multi-dimensional data].

Data mart and Meta data is for information specifications.

Classify data using data warehouse ETL tools.

Online Analytical Processing (OLAP).

After the designing data warehouse and data mining tools the abstraction of the information for the different decision making process in the organisations, Using Strategic Information System and intelligent Process Automation System. The following major tasks will be acquired by the above two methods. oracle 9i has the excellent features for the data cube, data marts, meta data dimensional/multi-dimensional for the Intelligent Process Automation System for improve in the decision making process [1].

## II. Problem Definition

Previous research on the HRM was contagious and only related to human resource activities in the organisation, the HRIS (Human Resource Information System) and DSS tools is developed for the required decision making problem solution, but presently HRM is not only under Human resource related activities but also handles all decision making tasks of the organisations. The Decision Support System (DSS), support to the manager to support decision making process to achieve the desired goals of the organisation. The DSS support to the organisation for decision Making process using the Structural Data, Unstructured Data and Semi Structure Data. But it was the not contagious for the Quick decision, Multi level decision as well as complex decision in the present decision makers in the organisation [9, 12]. Aspects of HRM decision making process in the current industries

1. Human Resource Planning 2. Recruitment and Selection/Placement 3. Inductions 4. Decision making role 5. Research role 6. Mediator role 7. Advisory role 8. Representative role 9. Risk Management 10. Conducting performance appraisals 11. Human Resource Audit 12. Total Quality Management 13. Quality of Working Environment 14. Organizational design and development 15. Business transformation and change management 16. Performance, conduct and behavior management 17. Industrial and employee relations 18. Compensation, rewards, and benefits management 19. Training and development (learning management) 20. Responsible

for handling personal information of Employees. And 21. Performance review [5, 6, 7].

## III. Review on Decision Support System

**3.1 Decision support systems (DSS)** are defined as interactive computer-based information systems intended to help decision makers utilize data and models in order to identify and solve problems, and make decisions In contrast with decision analysis and operational research, where the emphasis is on making and using decision models, DSS focus on providing information technology for decision makers at various levels in organisations. The emphasis is on providing relevant information and presenting it in a suitable form so as to improve the decision making process and tasks [5, 6].DSS are differentiated into the following types.

Communication-driven DSS: support more than one person working on a shared task,

Data-driven DSS or data-oriented DSS: emphasize access to and manipulation of a time series of internal company data and, sometimes, external data,

Document-driven DSS: manage, retrieve, and manipulate unstructured information in a variety of electronic formats,

Knowledge-driven DSS: provide specialized problem-solving expertise stored as facts, rules, procedures, or in similar structures,

Model-driven DSS: emphasize access to and manipulation of a statistical, financial, evaluation, optimization, or simulation model.

There are three fundamental components of DSS.

Database Management System (DBMS), Model-base Management System (MBMS) , Dialog Generation and Management System (DGMS) [2, 10].

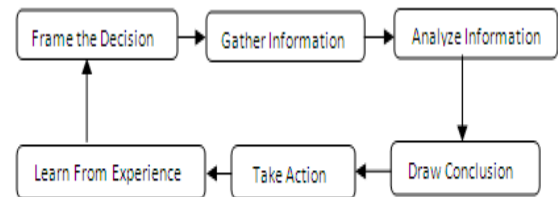


Figure-1 Decision Making Cycles

The below decision cycle denote the process of the any decision taken by the organisation is cycled by the above tasks from frame the decision to take action as well as reengineering after the decision taken

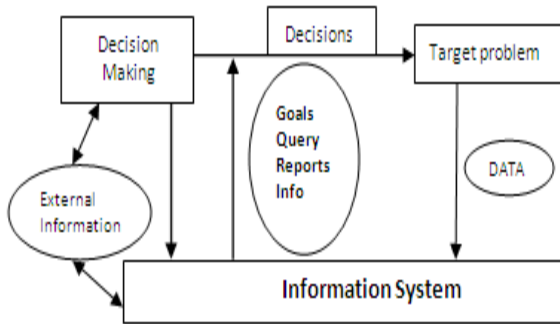


Figure-2 Decision Making Problem solution by DSS

In figure -2 the information for the decision making is also cycled, from designing the target problem to decision making process. Here the external data also gathered for the solutions. After the manipulation of the data and information the result is declared by the query, reports, or information system. The above process of cycle designs the followings information system for the organization [7, 11]. The following tasks to be achieved by the Decision Support System tool to take related decision making processes in the organisation.

1. Information systems.
2. Used in making structured decisions
3. Used when the decision is "semi structured" or "unstructured."
4. Incorporate a database of some sort
5. Incorporate models
6. editing Problem Solving
7. Facilitating Interpersonal Communications
8. Promoting Learning or Training
9. Increasing Organizational Control

### 3.2 Relationship with SIS

Using SIS tools, likes Clustering, Classifications, Mata Data, Data Mart, and Data Cubes (Multi-Dimensional Data). These tools directly support to the Decision Support System (DSS) as well as individual tool also part of the particular decision making processes in the organisations.

### 3.3 DSS and Intelligent Process automation

As well as Intelligent Automation System (IAS) also developed and progress to the decision making process using the Predicate Analysis and Content Analysis for the rapid action decision making process and abstraction of the data using Clustering method for the information specification, for the associations, classification, dimensional, and inextricable of the data.

In the Intelligent Automation System the predicate analysis support to maintenance of the risk factors. End these factors directly support for improves decision making process.

## IV. Material and Methods

### 4.1 Decision Support Systems (DSS):

Decision Support Systems (DSS) are a specific class of computerized information system that supports business and organizational decision-making activities. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions. DSS components may be classified as

1. Inputs: Factors, numbers, and characteristics to analyze
2. User Knowledge and Expertise: Inputs requiring manual analysis by the user
3. Outputs: Transformed data from which DSS "decisions" are generated
4. Decisions: Results generated by the DSS based on user criteria [8, 9].

### 4.2 MIS [Management Information Systems]

Management Information Systems (MIS) is the term given to the discipline focused on the integration of computer systems with the aims and objectives on an organization [10].

### 4.3 Central Data Warehouse

#### 4.3.1 ETL- Extract-Transform-Load

Short for Extract, Transform, Load; three database functions that are combined into one tool that automates the process to pull data out of one database and place it into another database.

**Extract** -- the process of reading data from a specified source database and extracting a desired subset of data.

**Transform** -- the process of converting the extracted/ acquired data from its previous form into the form it needs to be in so that it can be placed into another database. Transformation occurs by using rules or lookup tables or by combining with other data.

**Load** -- the process of writing the data into the target database [3].

#### 4.3.2 Use an ETL tool to:

1. Simplify the process of migrating data 2. Standardize the method of data migration 3. Store all data transformation logic/rules as Meta data 4. Enable users, managers and architects to understand, review, and modify the various interfaces 5. Reduce cost and effort associated with building interfaces (custom coding in conventional languages could cost 2 - 5 times as much)

##### 4.3.2.1 Extraction

Multiple sources, multiple extract types, Log-based extraction, Snapshot-based extraction Trigger-Based extraction, Extract in files or databases

#### Extract from Operational System:

**Design Time:** Create/Import Data Sources definition, Define Stage or Work Areas, Validate Connectivity, Preview/Analyze Sources, Define Extraction Scheduling

**Run Time:** Connect to the predefined Data Sources as scheduled; Get raw data save locally in workspace DB

##### 4.3.2.2 Transformation

Eliminate inconsistencies in the data from multiple sources, Convert data into a consistent, standardized form Fold/Unfold, Cleanse, Merge/Purge, Aggregate, Calculate, Data type conversion, Data content audit, Null value handling, Customized transformation

#### Transformation for Design time and run time

##### Design Time

Specify Criteria/Filter for aggregation, Define operators (Mostly Set/SQL based), Map columns using operators/Lookups, Define other transformation rules, Define mappings and/or add new fields

##### Run Time

Transform (Cleanse, consolidate, Apply Business Rule, De-Normalize/Normalize) Extracted Data by applying the operators mapped in design time, Aggregate (create & populate raw table), Create & populate Staging table

#### 4.4 Cubes

In this section we shall introduce the notion of cubes, basic cubes and multidimensional databases. The cubes are the basic entities of the model, whereas basic cubes are cubes with the most detailed data. A multidimensional database is a set of dimensions, dimension levels and a basic cube. We define a basic cube  $C_b$  as a 3-tuple  $\langle Db, Lb, Rb \rangle$

- $\square Db = \langle D1, D2, Dn, M \rangle$  is a list of dimensions ( $Di, M \square$ ).  $M$  is a dimension that represents the measure of the cube.

- $Lb = \langle DLb1, DLb2, DLbn, *ML \rangle$  is a list of dimension levels ( $DLbi, *ML \square$ ).  $ML$  is the dimension level of the measure of the cube. We demand that all the dimension levels are at the lowest level of their respective dimensions ( $\square \square DLb \square \square Lb, level(l) = 1$ ). We also demand that  $ML$  is multivalued.
- $\square Rb$  is a set of cell data -i.e. a set of tuples of the form  $x = [x1, x2, ..., xn, *m]$ , where  $\square \square i$  in  $[1, ..n]$ ,  $xi \square dom(DLbi)$  and  $*m \square \square dom(*ML) [1, 2]$ .

#### 4.5 Data Mart

A **data mart** is a subset of an organizational data store, usually oriented to a specific purpose or major data subject that may be distributed to support decision making. Data marts are analytical data stores designed to focus on specific business functions and decision for a specific community within an organization. Data marts are often derived from subsets of data in a data warehouse, though in the *bottom-up* data warehouse design methodology the data warehouse is created from the union of organizational data mart. Example [1,3].

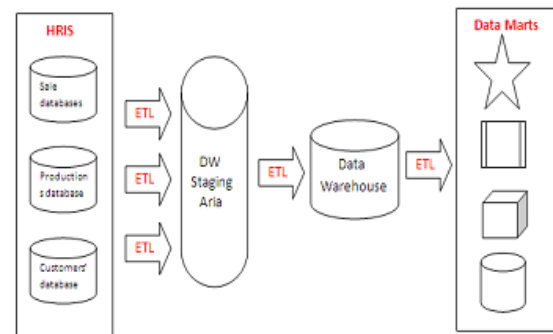


Figure-3 Data Mart Abstraction

#### 4.6 Strategic Information System (SIS).

SIS Support to all departments of the organisation to solve any complex decision related any tasks of activity. The SIS information is divided into the specific parts and arranged in the desired mechanisms to used and support directly for any decision making process related to planning, organizing, staffing, directing, leading, controlling and monitoring in the organisation. SIS focuses on the Intelligent Process Automation for decision making, dimensional data retrievals for

current/rapid/quick decision process, cube (multi-dimensional), statistical solution for also decision making in HRM in different activities of the organisation .

#### 4.7 Intelligent Process Automation (IPA)

The main goal of the SIS models to acquires the predicate analysis and content analysis data for the quick and cubic decision making process. Also visual, graphical, and monitorized data acquired by the Intelligent Process Automation

The following decision making tasks is acquired by the Intelligent Process Automation:

##### 4.7.1 Fast data retrieves as

1. Data cubes (Design multidimensional data Analysis) 2. Data marts (Search Specific Data) 3. Predicate analysis (Cubic Data, Analytical Data, Statistical Data, Formal Data analysis, Review of Data etc)

##### 4.7.2 Content analysis

(1) Graphical Data (2) Futures of data (3) Formatted Data etc

##### 4.7.3 Quick decision making process

Clustering of data (pattern-analysis, decision making, Grouping of desired data)

Classification of data (Grouping of desired data, Classification of Data)

**4.7.4 Support of Oracle 9i** (For cube (Multi-dimensional data) acquired, Predicate analytical information / alerting information, Content analysis based data acquired A predicate analysis is a conditional expression that, combined with the logical operators AND and OR, makes up the set of conditions in a WHERE, HAVING, GROUP BY, CUBE, ROLLAP ON clause AND ALL clause. In SQL. A predicate that can exploit an index to retrieve rows from a table is called sargable. This name comes from the phrase search argument-able. Predicates that involve comparisons of a column with constants, other columns, or expressions may be sargable.

#### 4.8 Applications

Oracle 9i to above SQL New Features as like

New "pivot" SQL clause - The new "pivot" SQL clause will allow quick rollup, where you can display multiple rows on one column with SQL. MS SQL Server 2005 also introduced a pivot clause. Laurent Schneider notes that the new SQL "pivot" syntax is great for converting rows-to-columns and columns-to-rows.

## V. Experiment and Result

### 5.1 Strategic Information System to improve Decision Making Process

The SIS (Strategic Information System) focuses and support for the decision makers to achieves the following types of information to improve the decision support system (DSS) of the decision making process.

#### 1. Multi-dimensional Data

Access the cubic data from the data ware house server for the complex Decision making process

#### 2. Quick Decision Process Data

Using the Clustering and classification tool it supports the quick access of the data from the Data or Data mart.

#### 3. Abstract Data/Information

The information abstracted using the Mata data and data marts tools for the required Information for the decision making processes.

#### 4. Mata Data

The information abstracted using the Mata data tool for the required Information for the decision making processes.

#### 5. Inextricable Data

Dimensional (Cubic) and classification (Clustering) of the data to be achieved for the requirement specification

#### 6. Clustering of Data

It consists of the collection of the related object of the same classification and data marts. This types of information required for the association and classification of the decision making process.

#### 7. Data Cubes

Access the dimensional and multi-dimensional data from the data ware house Server for the complex decision making process

### 5.2 Intelligent process Automation

In Intelligent process Automation system include predicate analysis, content analysis, information alerting and monitoring, as well as visualizations of the data and information, to directly support quick decision and fast data retrieves from the data base as

well as from data warehouse tools as data marts, data cubes, ETL data warehouse etc.

**Predicate Analyzed Data like** Logical data, Rollup data, Cube (multi-dimensional) data, Multi dimensional Data Generations, Analytical Data, Formatted Data analysis, Review of data..

**Fast data retrieves from like** Data cubes – Multi dimensional Data Generations, Data marts – Specific Data retrieves of employees and performances

**Quick decision making process data / information like** Clustering of data, Classification of data. **Content based data like** Graphical Data,

Futures of data, formatted data, Types of decision based data, Alerting and monitoring of the data

Basic tasks are to be achieved from the Strategic information system and Predicate Analysis for improve decision making processes of HR department. 1. Complex decision making process 2. Technical helps to the decision makers/ manager 3. Quick/ rapid decision making process 4. Support to the RAD model

Multi-dimensional and cube related data retrievals 5. Fast data or information retrievals from the data mining tools 6. Predicate analysis for the required solutions

### 5.3 SIS Model for Decision Making Process

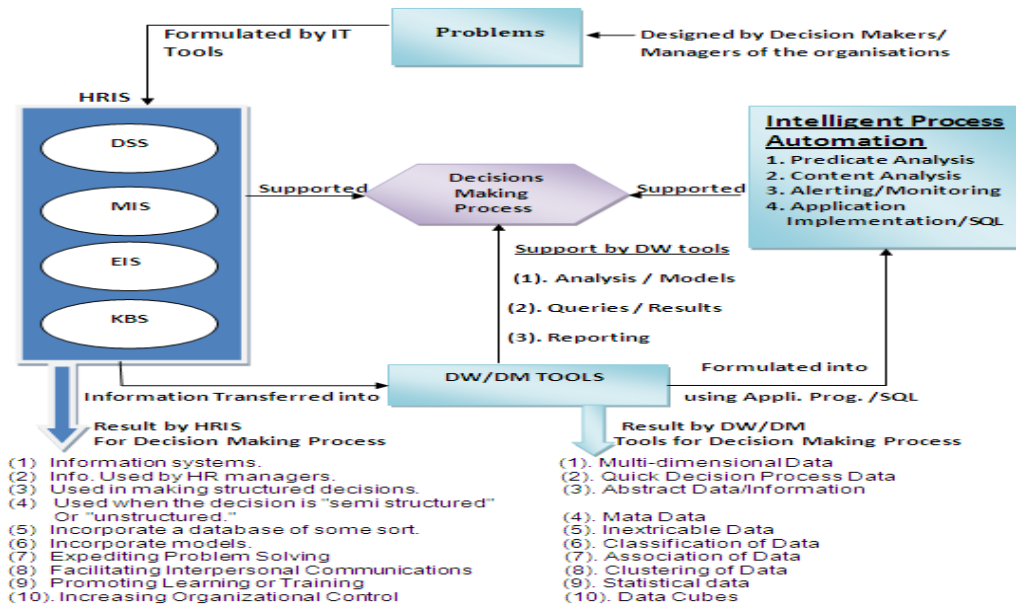


Figure-4. Strategic Information System model

Using SIS model the decision making problem is firstly formulated into the human resource information system using HRIS tools (DSS, MIS, EIS, KMS) for the solution of the structural, semi-structural and unstructured decision making process. The related information is transferred into data warehouse, data mining tools of the further specifications of the information to acquire required decision making process or solution of decision

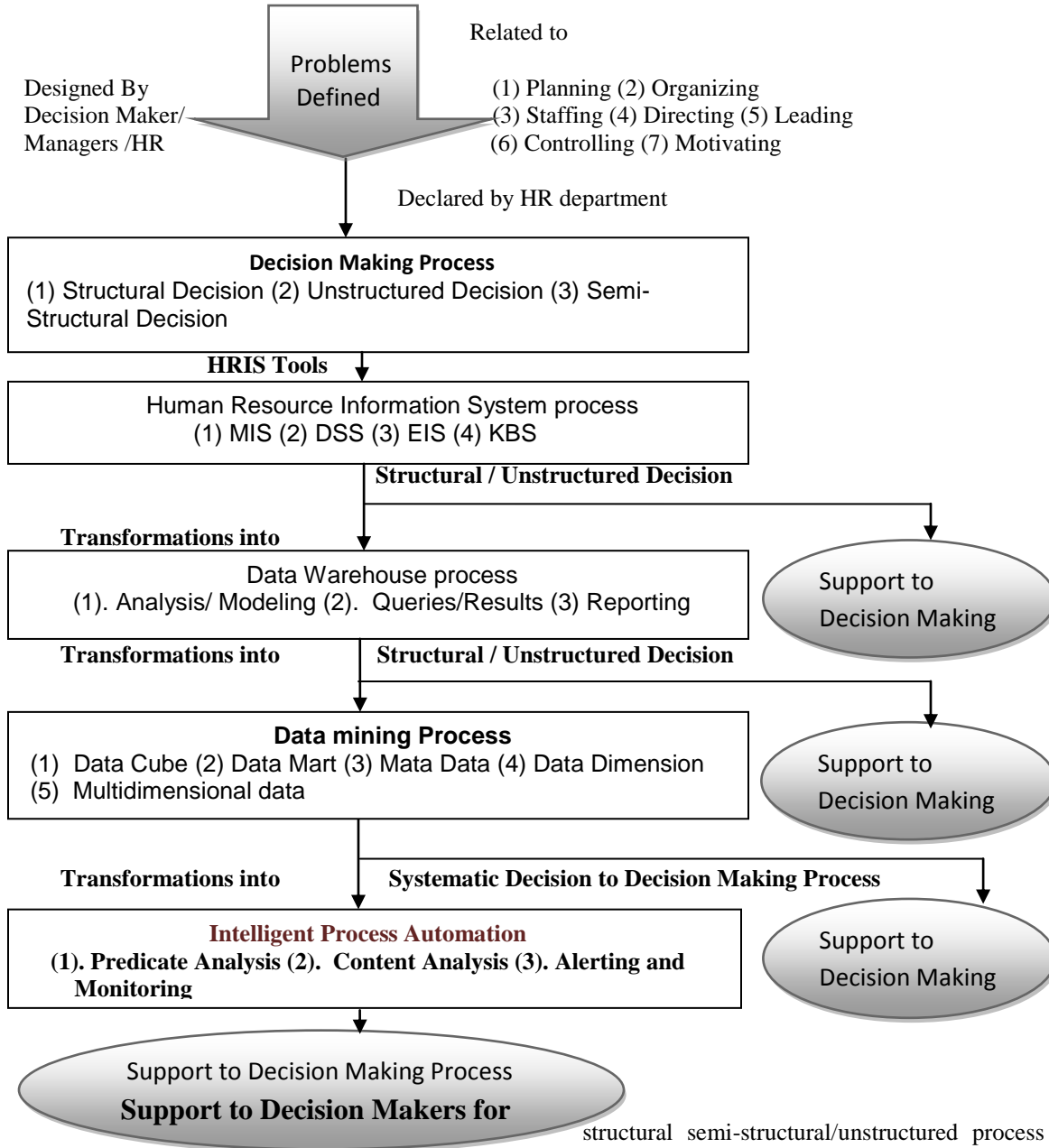
making methods. The data warehouse and data mining process tools produce the related information for decision making process like classification of data, dimensional data, multi-dimensional data (cubes), statistical data analysis, for the quick and cubic decision making process in the organisation. Intelligent process Automation support as rolls up (Drill up), Drill down (Roll down), Slice and Dice and Pivot. This all are the OLAP operations



like are (1) Rank (2) dense rank (3) ntile (4) percent rank (5) row number (6) percentile cont (7) percentile

disc (8) ratio to report etc are directly supported for the decision making process.

#### 5. 4 Layers of the SIS



#### Decision Making Process

The modern HRM process is layered by the different Data mining tools for acquire different type of information for different types of decision making in the organisations. The decision is formulated into the

structural semi-structural/unstructured process after the formulation the HRIS system tools is supported to the above three types of decision making process. In third layer, the HRIS is transformed into the data warehouse process for the further specification of the information to acquire more decision making process as classification of the information, tabular of the information, clustering of the information and

extracted information. Using the third layered the HRIS information is abstracted, transformed, load and refreshed by the data warehouse tools. This information is directly supported for the complex decision making process. Layer four is designed data cube (for multi-dimensional data), Mata data and

dimensional data for the complex decision making , as well as quick decision making process, and multi dimension data acquires for the fast data retrievals from the data marts, data cube and intelligent process automation.

### 5.5 Proposed SIS Architecture

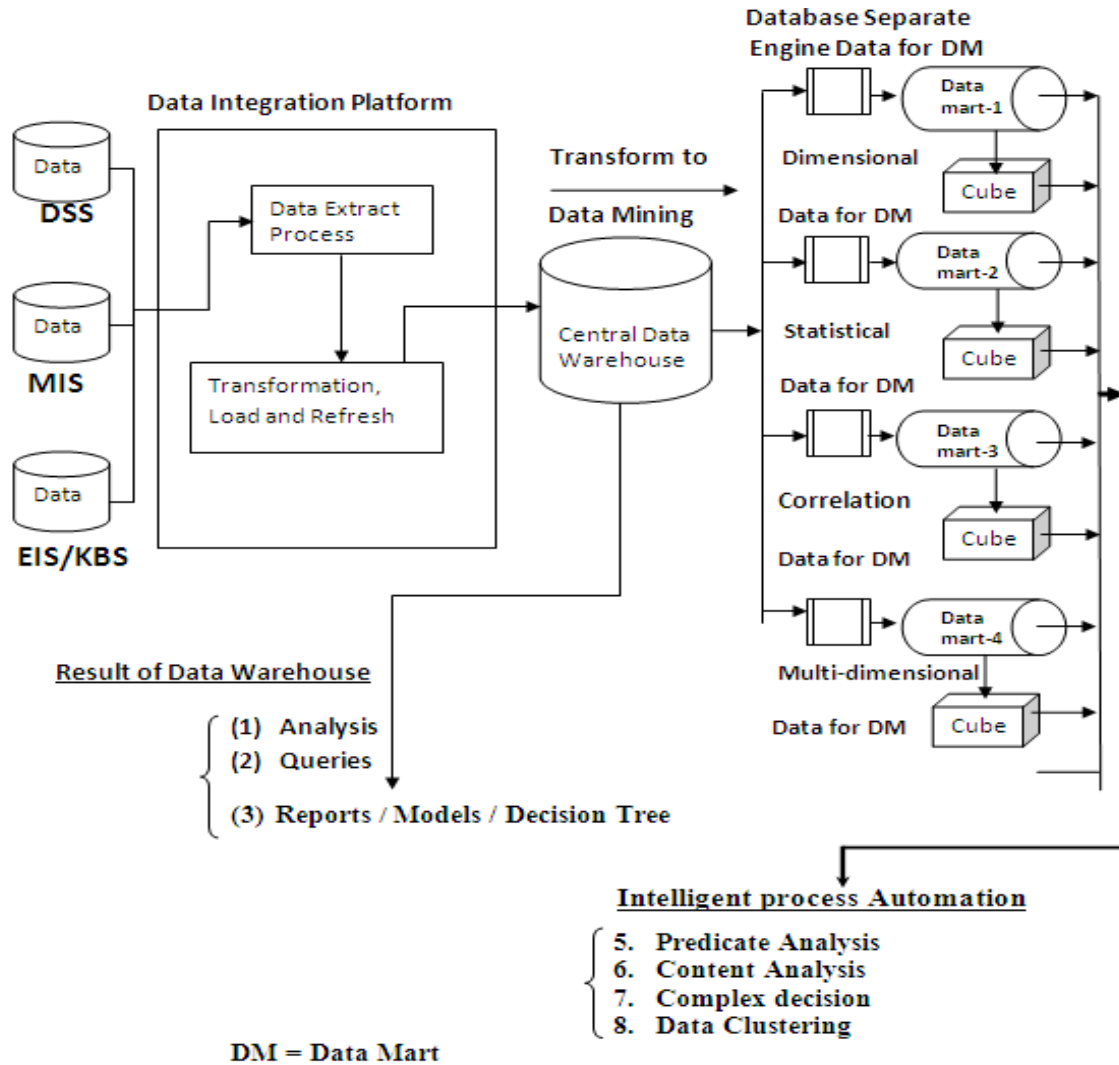


Figure-5, SIS Architecture

The SQL aggregate functions and the GROUP BY operator produce zero-dimensional or one-dimensional aggregates. Applications need the N-dimensional generalization of these operators. In SIS defines that operator, called the data cube or simply cube. The cube operator generalizes the histogram,

cross-tabulation, roll-up, drill-down, and sub-total constructs found in most report writers. The novelty is that cubes are relations. Consequently, the cube operator can be imbedded in more complex non-procedural data analysis programs. The cube operator treats each of the N aggregation attributes as a



dimension of N-space. The aggregate of a particular set of attribute values is a point in this space. The set of points forms an N-dimensional cube. Super-aggregates are computed by aggregating the N-cube to lower dimensional spaces.

Data analysis applications look for unusual patterns in data. They categorize data values and trends, extract statistical information, and then contrast one category with another. There are four steps to such data analysis:

**Formulating** a query that extracts relevant data from a large database,

**Extracting** the aggregated data from the database into a file or table,

**Visualizing** the results in a graphical way, and

**Analyzing** the results and formulating a new query. Visualization tools display data trends, clusters, and differences. Some of the most exciting work in visualization focuses on presenting new graphical metaphors that allow people to discover data trends and anomalies. Many of these visualization and data analysis tools represent the dataset as an N-dimensional space.

## 5.6 Experimental sample Result using C#.NET and Oracle 9i

Using this application there are three dimensional data cube information generates related to the risk registration record for the further decision making process onward. Using this cube the decision maker identify that what categories are high of the risk, and how can mitigate it.

### 5.6.1 Cube (for example)

Find out the increments in payment of the employee on per employee and per branch with grand total and subtotal of each branch for the particular year [4].

#### Synopsis

Tables:	EMP_MASTER
Columns:	BRANCH_NO, EMP_NO, INCREMENT
Technique:	Function: SUM(), Operators: CUBE(), Clauses: GROUP BY

*Example of by the query*

**SELECT** BRANCH\_NO, EMP\_NO, SUM  
(INCREMENT) **FROM** EPM\_MASTER  
**WHERE** Date **BETWEEN** '01-04-2008' **AND** '31-3-2010'  
**GROUP BY** CUBE (BRANCH\_NO, EMP\_NO);

This cube is most requires to HR department for the solution of the employees activities manipulations for the further decision. Here main tasks in depict into the Operational task combo box as clock time of employees, increment, salary and appreciate of the employees for the actor based decision making process in the organisation.

### 5.6.2 Result: This is the sample example of the one cube:

Branch\_no Emp\_no SUM (increment)

		<b>69400</b>
<b>main</b>		<b>25900</b>
main	EMP001	7500
main	EMP002	7500
main	EMP003	5500
main	EMP004	5400
<b>branch-A</b>		<b>15500</b>
branch-A	EMP005	6500
branch-A	EMP006	4500
branch-A	EMP007	4500
<b>branch-B</b>		<b>18800</b>
branch-B	EMP008	4500
branch-B	EMP009	3500
branch-B	EMP010	3400
branch-B	EMP011	4000
branch-B	EMP012	3450
<b>branch-C</b>		<b>9200</b>
branch-c	EMP013	4500
branch-c	EMP014	4700

## VI. Conclusion and Discussion

The overall research is based on the technical and systematic classification of the information and data

to be used and support directly to the HR department and other managers to the organisations for the appropriate decision making of related activities to be carried out as the bases on the organisation goals and objectives. The current HRM is not only responsible for the human resource activities in the organisation, but also involved in the other departmental activities solution using appropriate decision making process. Decision Support Systems (DSS) are a specific class of computerized information system that supports business and organizational decision-making activities. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions. The research paper is based on the improvement of the DSS tools using the data ware house and data mining tools to directly support to the decision making process in the any activities in the organisation. So, further specification is required in the information and Data mining tools to be improved for the solution of the complex and quick decision making process. The Strategic Information System and Intelligent Process Automation System are designed for the technical support and applicable support to the decision making process activities in the organisation. Here the aim of paper to design and develop the **Strategic information system** and **Intelligent Process Automation System** for improve Decision Making Process of the Human Resource Management using data mining tools and support to the DSS (Decision Support System) for further specification of the information. The data mining tools support dimensional data, Classification/ Clustering of data as well as Predicate Analysis and Content based information system using Cubes, Data Marts, and Mata data tools of Data Mining. Using the Data mining tools and predicate analysis as well as content analysis tools directly support to the manager or HR department decision making process to solves desired problems to achieve specific goal and objectives.

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