Development of a Dynamic Model for Data-Driven DSS

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ABSTRACT

Over the past decade, Business Intelligence (BI) has been adopted by major corporations around the world. A BI tool’s function facilitates the process of taking decisions for managers. However, decision-making, especially strategic decisions, still remains an ill-defined process locked in the minds of managers. The maritime transport sector depends on documentation, data-based and departmental involvement for taking decisions. This method takes lots of time for checking all the necessary documents for taking a decision and in case of missing data the manager couldn’t take appropriate decisions. The company data could be entered in a computerized system, but there does not exist any software that transforms this data into information that helps the manager for taking decisions. The proposed system focused on providing management levels with a quality assured software packages that facilitate workflow processes and help management to take strategic decisions using business intelligence concepts, major academic system analysis and design techniques to meet the ISO90003:2004 quality standards. It will also use a Data Driven DSS model which is a support system built using a data warehouse and a report and query.

1. INTRODUCTION

BI systems provide a proposal that meet the needs of modern organizations. BI systems tasks are intelligent exploration, integration, aggregation and a multidimensional analysis of data originating from various information resources. Systems of a BI standard combine internal information systems’ data of an organization and integrate data coming from the particular environment e.g. statistics, financial and investment portals and miscellaneous databases. These systems provide adequate and reliable up-to-date information on different aspects of enterprise activities.

The need for using computer systems is to solve semi-structured or unstructured problems. Those problems are characterized by a complex decision-making process and cannot use a particular formula or fixed way to solve. The right way is to collect information relevant to the issue, and then classify, sort and establish associate relations between information. The aim is to arrange the information into a form of easy-to-view and understanding [1].

The Egyptian maritime transport sector depends on documentation, data-based and departmental involvement for taking decisions. This method takes lots of time for checking all the necessary documents for taking a decision and in case of missing data the manager couldn’t take appropriate decisions.

The main objective of the research is to provide an organizational solution which solves major organizational problems which are data management challenge: that is effective way of integrating enterprise applications in real time. The new proposed techniques used here are to provide management levels with a quality assured software packages that facilitate workflow processes and help management to take strategic decisions using a data-driven decision support system.

2. DECISION SUPPORT SYSTEM (DSS)

The definition of DSS, which has evolved since the 1970s and prevails today, was described in Building Effective Decision Support Systems, by Ralph Sprague and Eric Carlson. They define DSS as: “Computer-based systems that help decision makers confront ill-structured problems through direct interaction with data and analysis models [2].

This definition can be taken from the narrow or broad point of view. The narrow view shows the DSS as a system that essentially solve or give options for solving a given problem.

The decision process is structured in a hierarchical manner, the user inputs various parameters, and the DSS essentially evaluates the relative impact of doing x instead of y. The broader definition incorporates the above narrow definition but also includes other technologies that support decision making such as knowledge or information discovery systems, database systems…etc [3].

Data driven DSS – includes file drawer and management reporting systems, data warehousing and analysis systems. Data-Driven DSS emphasize access to and manipulation of large databases of structured data and especially a time-series of internal company data and sometimes external data [4].

3. DATA-DRIVEN DSS

Managers can use systems that access current and historical data to support many decision tasks. When the tasks are performed regularly then a computerized decision support system can potentially increase access to the data and help managers gain insights into organization processes, customer activities, employee performance and organization-wide performance metrics [5].

The key to a successful data-driven DSS is having easy and rapid access to a large amount of accurate, well-
organized multidimensional data. Codd et al. (1993) argued OLAP systems were characterized by [6]:

1. multidimensional conceptual view;
2. link to a variety of data sources;
3. easy for users to access and understand;
4. multi-user support;
5. intuitive data manipulation;
6. flexible reporting; and
7. analytical capabilities.

4. BUSINESS INTELLIGENCE (BI)

In modern businesses, increasing standards, automation, and technologies have led to vast amounts of data becoming available. How to identify and creatively address key business issues is therefore always the major challenge of a BI application to achieve real business impact.

Business Intelligence enables organizations to make well informed business decisions and thus can be the source of competitive advantages through business intelligence gathered effectively and used proactively then the firms can make decisions that benefit the firms.

Stackowiak et al. (2007) define Business intelligence as the process of taking large amounts of data, analyzing that data, and presenting a high-level set of reports that condense the essence of that data into the basis of business actions, enabling management to make fundamental daily business decisions. [7]

(Cui et al, 2007) view BI as way and method of improving business performance by providing powerful assists for executive decision maker to enable them to have actionable information at hand. BI tools are seen as technology that enables the efficiency of business operation by providing an increased value to the enterprise information and hence the way this information is utilized. [8]

Zeng et al. (2006) define BI as “The process of collection, treatment and diffusion of information that has an objective, the reduction of uncertainty in the making of all strategic decisions.” Experts describe Business intelligence as a “business management term used to describe applications and technologies which are used to gather, provide access to analyze data and information about an enterprise, in order to help them make better informed business decisions.” [9]

(Tvrdíková, 2007) describes the basic characteristic for BI tool is that it is ability to collect data from heterogeneous source, to possess advance analytical methods, and the ability to support multi users demands. [10]

Zeng et al. (2006) categorized BI technology based on the method of information delivery; reporting, statistical analysis, ad-hoc analysis and predicative analysis. [11]

5. SYSTEM DEVELOPMENT LIFE CYCLE (SDLC)

SDLC is a conceptual model used in project management that describes the stages involved in an information system development project, from an initial feasibility study through maintenance of the completed application [12]. Various SDLC methodologies have been developed to guide the processes involved.

The proposed system applied SDLC phases.

The methodology used in this research is the Dynamic Systems Development Model (DSDM). The nine principles of DSDM are: [13]

- Active user involvement.
- Empowered teams that the authority to can make decisions.
- A focus on frequent delivery of products.
- Using fitness for business purpose as the essential criterion for acceptance of deliverables.
- Iterative and incremental development to ensure convergence on an accurate business solution.
- Reversible changes during development.
- Requirements that are base lined at a high level.
- Integrated testing throughout the life cycle.
- Collaboration and cooperation between all stakeholders.

6. SOFTWARE QUALITY

Phil Crosby gives four absolute of quality. They are: [14]

1. Definition of quality: Conformance to requirements
2. System of quality: Prevention

The term “absolute” indicates a parameter which does not change. Conformance to requirements (or meeting stated and implied needs) in a software organization. Remaining focused on requirements right from the project’s proposal stage, throughout the development life cycle and during maintenance and support phases is the only way out to succeed in software business.

The second absolute is the system of quality which is the system of implementing quality, i.e. conforming to requirements and improving on our effectiveness on an
ongoing basis is an approach based on principle of prevention.

The next absolute of quality: the standard of quality. We need a standard against which our performance can be compared. Phil Crosby defines the performance standard of quality as ‘zero defect’. Zero-defect is a standard which everyone, including the customer and supplier, can understand well.

The forth and last absolute of quality is its measurement. Measurement of quality is needed to get management attention, to set priorities in order to decide where corrective/ preventive action is required and to benchmark with past performance and with other organizations.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Accessibility</td>
<td>the extent to which data is available, or easily and quickly retrievable</td>
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<tr>
<td>Appropriate</td>
<td>amount of data the extent to which the volume of data is appropriate for the task at hand</td>
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<tr>
<td>Believability</td>
<td>the extent to which data is regarded as true and credible</td>
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<tr>
<td>Completeness</td>
<td>the extent to which data is not missing and is of sufficient breadth and depth for the task at hand</td>
</tr>
<tr>
<td>Concise representation</td>
<td>the extent to which data is compactly represented</td>
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<tr>
<td>Consistent representation</td>
<td>the extent to which data is presented in the same format</td>
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<tr>
<td>Ease of manipulation</td>
<td>the extent to which is easy to manipulate and apply to different tasks</td>
</tr>
<tr>
<td>Free of error</td>
<td>the extent to which data is correct and reliable</td>
</tr>
<tr>
<td>Interpretability</td>
<td>the extent to which data is in appropriate languages, symbols and units, and the definitions are clear</td>
</tr>
<tr>
<td>Objectivity</td>
<td>the extent to which data is unbiased, unprejudiced and impartial</td>
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<tr>
<td>Relevancy</td>
<td>the extent to which data is applicable and relevant for the task at hand</td>
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<tr>
<td>Reputation</td>
<td>the extent to which data is highly regarded in terms of its source or content</td>
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<tr>
<td>Security</td>
<td>the extent to which access to data is restricted appropriately to maintain its security</td>
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<tr>
<td>Timeliness</td>
<td>the extent to which data is sufficiently up-to-date for the task at hand</td>
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<tr>
<td>Understandability</td>
<td>the extent to which data is easily comprehended</td>
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<tr>
<td>Value-added</td>
<td>the extent to which data is beneficial and provides advantages from its use</td>
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7. ISO 90003:2004

ISO/IEC 90003:2004 Provides Guidance for organizations in the application of ISO 9001:2000 to the acquisition, supply, development, operations, and maintenance of computer software and related software services. [16]

ISO 90003 is appropriate to many types of software i.e.: software related to software services such as the system proposed in this paper which is related to maritime services.

ISO product realization covers everything associated with creating the product:

- Planning
- Customer-related processes (requirements management, review, and customer communication),
- Design and development (planning, reviews, verification and validation, control of changes),
- Purchasing
- Product servicing (including installation, operations, and maintenance)

Benefits of ISO/IEC 90003 is summarized on the application of authoritative guidance which:

- Reduces risks and consequence of failure.
- Promotes better communication and understanding between parties.
- Improves visibility and traceability.

Another benefit of the ISO/IEC 9000-3 is that it is independent of:

- the technology
- the life cycle models
- development processes
- sequence of activities, and
- organizational structures used by an organization

“control of monitoring and measuring devices.”
8. THE SYSTEM MODEL

Main tasks that are to be faced by the BI systems include intelligent exploration, integration, aggregation and a multidimensional analysis of data originating from various information resources. Systems of a BI standard combine data from internal information systems of an organization and they integrate data coming from the particular environment e.g. statistics, financial and investment portals and miscellaneous databases. Such systems are meant to provide adequate and reliable up-to-date information on different aspects of enterprise activities.

The main focus of the proposed system is on implementing the BI to support decision making on the top level management.

The system is implemented to meet the ISO 90003:2004 standards in every phase of the SDLC in parallel with the BI procedures. SDLC stages used in this model are basic phases defined by certain activities; these phases are: Initiation phase, System Concept development Phase, Planning Phase, Requirements Analysis Phase, Design Phase, Development Phase, Integration and Testing Phase, Implementation Phase, Operations and Maintenance Phase, and Disposition Phase.

The new innovation in this research is integrating SDLC activities with BI activities while benchmarking each activity by ISO standards. Each activity involves a measure or more in ISO standards. Moving from instant and intuition decision making toward objectivism decision making is a main goal in order to narrow the gap between decision maker and classic information system. Because of a lot of paper work and documentation involved in maritime companies the research is tended to be a data-driven decision support system.

The system is designed bearing in mind some points like making decisions under time pressure; monitoring competition; and carrying out constant analyses of numerous data and consider different variants of organization performance.

Maritime transport companies suffer from the lack of decision support systems designed especially for decision makers in this field. In the data gathering phase the researcher found a lot of external variables (i.e. new laws or governmental roles) that affect the decision making processes and cannot be handled in the proposed
system. Such variables will limit the proposed system into the internal variables only.

At the analysis phase the researcher focused in removing data that are found in the IS and that are not important from the perspective of the analyses applying the consistency measure of the ISO model; finding relations between data in different information systems; describing the logical structure of data that are found in the system; much attention should be paid not only to their structure in the base but also to the relation with business processes described; finding places that allow for generating errors in data (a possibility that data are inconsistent); and finally finding limits of IS applicability (which data cannot be reported out of IS, e.g. due to erroneous logic of source bases).

A lot of processes involved in the system so the researcher had to focus on the data flow diagram design before continuing any further steps in the design phase. So it was very critical to summarize all processes with the system into a well-designed data flow diagram.

After the data gathering and analysis phase the researcher moved to the design phase limited by business intelligence rules as shown in the model. Although the main key to successful BI system is consolidating data from the many different enterprise operational systems into an enterprise data warehouse, very few organizations have a full-fledged enterprise data warehouse. This is due to the vast scope of effort towards consolidating the entire enterprise data.

A layer of data presentation is an important element of BI systems so it was necessary to pay much attention to designing an interface. Development of interfaces were based on internet web browser to integrate all BI tools into a single interface isolating the user from the tools used in the underneath layers of the system.

A lot of system testing tools had been applied in each phase bearing in mind the system performance, usability, reliability, usability, and consistency.

9. SAMPLE OF APPLIED BUSINESS RULES

In the following there are presented the proposed rule patterns, accompanied by examples regarding an ordering system.

Send sales lead to specific agent.
Print shipping declaration data.
Prepare Routing Order.
Accept customer feedback on offer.

10. TOOLS USED

BI tools are seen as technology that enables the efficiency of business operation by providing an increased value to the enterprise information and hence the way this information is utilized. Selection of a BI tool may turn out to be a difficult task. At present companies offer a wide range of products beginning from simple reporting technologies up to sophisticated BI platforms [17]. While choosing a BI tool, it is necessary – like in the case of purchasing other IS – to take the following criteria into consideration: functionality, complexity of solutions, and compatibility. It is also necessary to remember that organization's informational needs will evolve. Therefore, BI tools should be up-to-date enough to meet enterprise’s expectations in a few years to come.

Taking in mind quality standards the researcher used the tools which given highest evaluation and rank in the market. For the operating system the reliability, security and flexibility were not an option. So the researcher selected the Oracle Linux Enterprise. Testing the system under Linux OS was a great experience not so easy to get it up and running at the beginning for some technical problems during installation and a lot of requirements were taken into consideration while system setup.

Using the top ranked Oracle Business Intelligence Enterprise Edition 11g (OBIEE) is a comprehensive business intelligence platform that delivers a full range of analytic and reporting capabilities. Designed for scalability, reliability, and performance, Oracle Business Intelligence Enterprise Edition 11g delivers contextual, relevant and actionable insight to everyone in an organization, resulting in improved decision-making, better-informed actions, and more efficient business processes. The complete system was developed using Oracle tools for all the SDLC phases; for the database the researcher relied on Oracle Database 11g Release 2 Enterprise Edition, at analysis and design phases Oracle SQL Developer data modeler was used. And finally Oracle Warehouse Builder 11g used to build the data warehouse.

11. EVALUATION

As a Data-Driven approach some criteria that should be considered include the following: [18]

1. Capabilities—examine the functions that a DSS product can perform and how important they are to the decision support need of targeted users. Determine if the package can be customized and in what ways. Does it meet the need? Does it provide the desired support?

2. Ease-of-use—the ease of learning and using the capabilities of a product to accomplish tasks. Ease of use is in the mind of the user so ask users to assess this criterion.

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3. Ease of installation and operation—how easy is it to configure, deploy and control use of a product. Is it easy to transfer information to and/or from other company information systems? Are there potential technical implementation problems?

4. Performance—what is the speed or capacity of the product when performing its functions. In addition, part of the performance criterion should be software reliability.

12. CONCLUSION

Powerful transaction-oriented information systems are now commonplace in every major industry, effectively leveling the playing field for corporations around the world. Companies have an increasing amount of data in historical data stores and that is creating storage and retrieval problems. Sadly, much of the historical data is of poor quality and source systems often need to be updated and improved as part of a data-driven DSS project. In some cases, new data collection systems may need to be designed and implemented prior to implementation of a data-driven DSS.

To remain competitive, however, now requires analytically oriented systems that can revolutionize a company’s ability to rediscover and utilize information they already own. The business intelligence (BI) has evolved over the past decade to rely increasingly on real time data. The BI systems auto-initiate actions to systems based on rules and context to support several business processes. Helping managers monitor operational performance or gain “intelligence” from historical data is a worthwhile purpose for data-driven DSS. Such systems will be especially important in global enterprises. These distributed organizations generate data in many operational systems and the only way to gain a “single version” of the truth is to create an integrated decision support data store that is accessible to all decision makers no matter where they happen to be physically located. These analytical systems derive insight from the wealth of data available, delivering information that’s conclusive, fact-based, and actionable.

Enterprises today demand quick results. It is becoming essential nowadays that not only is the business analysis done, but also actions in response to analysis of results can be performed and instantaneously changes parameters of business processes, especially in decision making processes. Small and medium sized enterprises can also benefit from data-driven DSS, but the data store is unlikely to be a large-scale data warehouse. A database on a web accessible server may provide the appropriate enabling technology. One general conclusion is to identify what decisions will be supported and who might use the proposed data-driven DSS. The paper suggest a new technique in measuring BI based on ISO standards, technology requirements, designing and implementing business intelligence with a new BI technique.

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REFERENCES


