Decision Optimization and Information Management System for Production Industries

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Abstract

This paper solely dealt with the decision optimization and information management system for production industries in Nigeria. The research design adopted was the descriptive research design. Two research objectives were generated to guide the study, to wit: design of an information management system for decision optimization in the industries, and accurate information support system for production optimization in industries. Findings showed that the valuation data requirement correspond to the respective graphical user interface of the design system used. Furthermore, the study provides better information management system for making decisions. Again, the results showed that production level of industries can be enhanced with optimized decisions. Based on the findings of the study, the following recommendations were made: (1) Industry stakeholders should be informed of the findings from this study through workshop, seminars and conferences; and (2) Improved decisions optimization should be the yearning of any industry that wants to optimize production. In conclusion, the researcher is of the view that if proper sensitization of the industry stakeholders about the findings of the study is carried out, production capacities of our industries shall be increased.

Keywords: Information management, decision optimization, software, hardware, architectural design.

Introduction

Background

The need for improvement in prediction behaviors in complex productions and supply-chain in manufacturing industries engendered the design of applications for making decisions to move the system towards desirable outcomes. The target of any industry is to eliminate chaos from the supply chain and to adjust to demand fluctuations. The disorders due to managerial uncertainty compounded by the increasing degree of information irregularities that exist in the supply chain or value network (suppliers, distributors, retailers, consumers) often contradict the objectives due to different goals of the parties (Shoumen, 2003). This situation creates barriers on the avenue to adaptive business networks of the future. The prime target of supply-chain is to secure large volume purchase commitments that consist of delivery flexibility from manufacturers whose defined goals

are for mass production and to gain advantages of economies of scale. This strategic plan enables them to adapt to fluctuations even though resource utilization plans were based on demand forecast (Shoumen, 2003).

Ragan and Narayan (2011) opined that organizations have adopted information systems in handling repetitive tasks. They further argued that these are intelligent systems for managing data and providing guides for organizations. Similarly, Taylor (2012) states that these information management systems possess the qualities and capabilities to excel at repeatedly doing a monotonous task without variation and without making mistakes, from one transaction to the next. The use of these systems to predict risk, fraud, and opportunity as in decision management systems (DSS) has kept companies profitable despite the risks they face. These decision support systems have allowed companies to increase the value of their customer relationships through a laser focus on opportunity.

According to Brodsky and Wang (2008), the decision-making approach category of decision support systems can be Strategic decision or reactive, Tactical decisions or agility, Operational decisions or predictive. These antics in decisions are based on the value of each decision such as the difference between a good and a bad decision or the number of times such a decision is made by an organization. They use real-time data to provide organizations tremendous results from the agility to respond rapidly to competitive and market changes, avoiding business risks, and to take advantage of narrow windows of opportunity. The effect of this continuous use of real-time data to generate inference by decision support systems enables proficient decisions that help to maximize productions and supply-chain. This enhances continuous refining and improving decision-making approaches in industries. The profound capabilities of Decision Management systems to adapt to changes in supply-chain have allowed organizations to experiment with new approaches, learn from their successes and failures, and continuously improve their business. It helps to provide insights on the likely impact of enhancing funds, resource management or academic policy on academic resources and quality.

Thus, we propose decision optimization and information management system for production industries, an idea that draws from a linear regression model (LRM) or regression analysis model in the field of econometrics that uses raw values to explore the possibilities of maximizing production and supply chain. It is a system that uses real-time data (raw values without clustering or classification) to better understand and respond to changes, further reduce risk and uncertainty in productions and distribution of products. The regression analysis technique is adopted for adaptive and enhanced decisions at the right time based on real-time data (input parameters) which may be acquired from diverse sources (values from the database and values from the user interface). The use of this statistical tool is also for an improved mission in critical operations like supply chain management in establishments and to provide forecasting inventory levels or requirements to match the goal of the establishment. The design of the system is technically based on the use of

unstructured and semi-structured operations in establishments. The claim over data format (data type or variable identifiers) is to provide pre-requisite for processes of the regression analysis technique that make adequate use of real-time data. The transformation of real-time data of the supply chain to extract adaptive values from the database triggers autonomous decision steps capable of concurrent re-planning and execution. Hence, the decision processes of this system are not a single task rather it can be defined as a collection of correlated tasks that include: gathering, interpreting and exchanging information; creating and identifying scenarios choosing among alternatives, and implementing and monitoring a choice. This capability of the system provides flexible operational processes and stimulates process innovation that minimizes the signs of unintended inventory buildup.

Statement of Problem

There have been some identified problems associated with decision making and information management system in production industries in Nigeria. These information management problems in the production industries have hindered the full production capacity of those industries. There is thus fear that if these information management system problems are left unattended to, the full production capacity of Nigerian industries may not be attained. Hence the main thrust of this paper is to design a decision optimization and information management system for production industries in Nigeria in order to reach their full production capacity.

Aim and Objectives

The aim of this study is to develop a decision optimization and information management system for production industries in Nigeria. The specific objectives of this study include the following:

1. To design a proper information management system for decision optimization in industries.
2. To design an accurate information support system for production optimization in industries.

Method

New techniques for supply chain management and flexible production imply that businesses can perceive imbalances in inventories practically at an early stage and can cut production promptly in response to the developing signs of unintended inventory distribution and build up. Critical study of real-time data or information to improve decisions enables management to enhance the performance of the entire value network and operational process innovation. Thus, this work presents a detailed description of system requirements; system design; architectural design; program design; database design and flowchart design of the proposed system.

System Requirements

The requirements applied for the design, development, and implementation of any proposed software is dependent on the tools and technology to be applied. In this study, the requirements applied were described under the following two headings.

Hardware Requirements

The design and implementation of decision optimization and information management system for production industries using the Gradient descent model and a modern programming tool like visual basic dot Net (VB .Net) framework requires the platform for modern hardware components of the computer system. Theses Hardware configuration components required of the project implementation include the following:

I. Pentium IV, and above with 1Giga Hz or Higher processor speed.
II. 1Gig RAM or Higher that corresponds to Processor Speed.
III. Minimum of 10 Gigabytes (GB) of free hard disk space

Software Requirement

The software requirements for the development of this system using Gradient Descent technique that is implemented in Visual Basic .Net framework are dependent on the following:

I. An operating system like Windows XP Operating System, Windows Vista Operating System or Windows 7 or Windows
II. SDK 3.5 data framework tool for visual studio (especially in Windows 8 Operating system)
III. Microsoft Visual Basic .Net Framework
IV. Graphics Drivers (Optional)

System Design

The fundamental of any application design structure is to solve a significant problem with ease by regular or non-regular computer users who can navigate through the system without difficulty. This design provides the required structure that implements the techniques applied in the system to enable a better usage of the application. The unified modeling language (UML) is used to help define the software functionalities and requirements that support a software development methodology. This UML provided proper stability, reliability, and flexibility in the system. This is illustrated in Fig. 1, below:

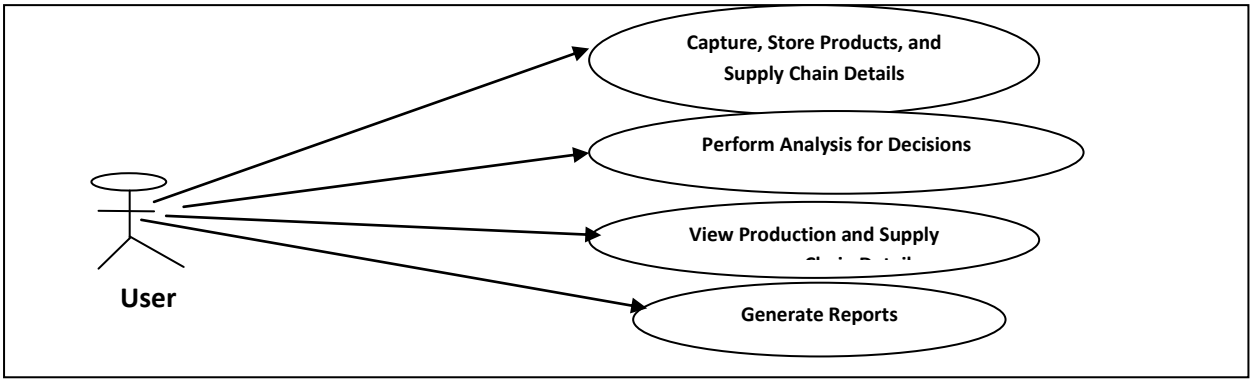


Fig. 1: Use Case diagram of decision optimization and information management system for production industries

A Use Case Model in the diagram above describes the proposed functionality of decision optimization and information management system using the Gradient descent model. The diagram represents a discrete unit of interaction between a user (stick person) and the system. This interaction involves a meaningful work consisting of the actor (i.e. stick figure) and uses cases (i.e. ovals) such as Capture, Store products, and supply chain Details, Maintain Details, Perform Analysis for Decision, View Production and Supply Chain Details, and Generate Reportsshowing the system goals. The actors are the entities that interact with the system, while use cases are the system functionalities of the actors of the system.

Henceforth, Fig. 2 is a representation of the proposed system's UML Class diagram and its functionalities.

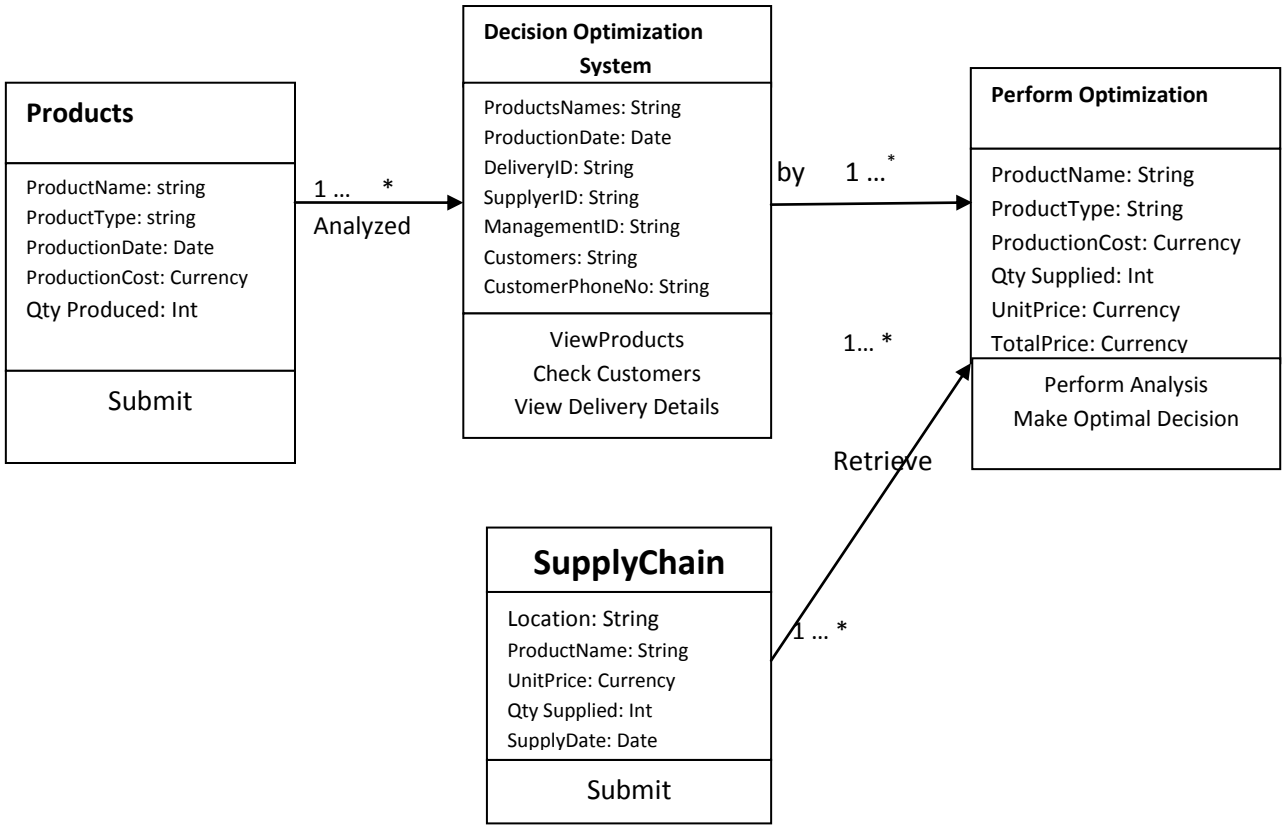


Fig. 2: UML class diagram of Decision Optimization and Information Management System

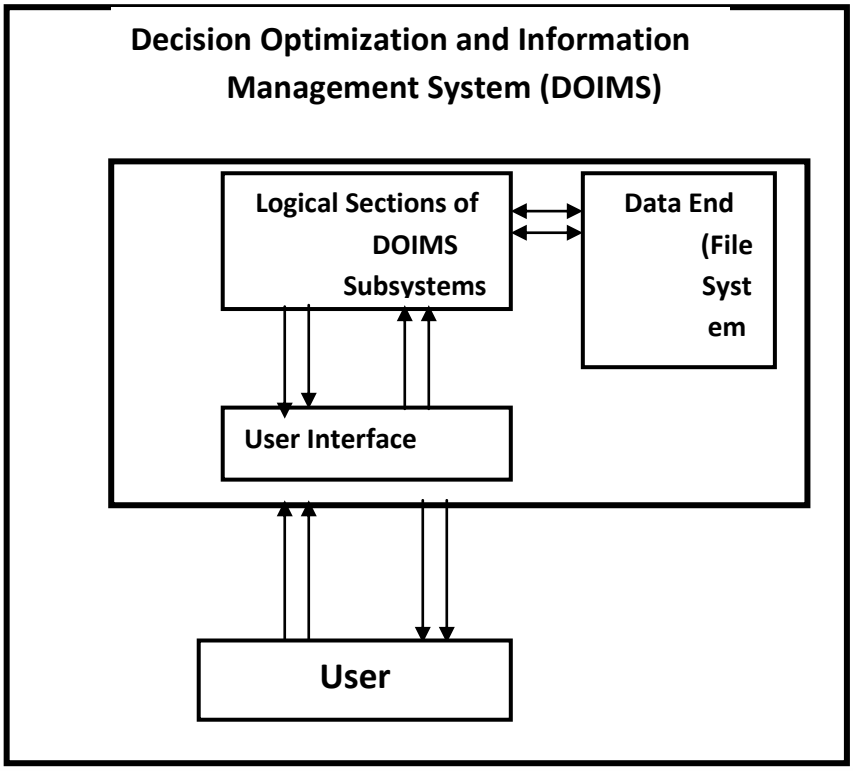
The diagram above is a simple content model showing the associative class of Decision Optimization and Information Management System that has class names, attributes, and methods which indicate that PerformOptimization object maintains a waiting list of zero or more quantities of products produced, supplied, and analyzed before decisions are made and taken. The Analyses by association evaluates the minimal production cost for Supply Chain object for products and provides information for SupplyChain class.

On the other hand, the Retrieve association between PerformOptimization class and Supply Chain class is bidirectional because the Supply Chain class objects know production and delivery details credit they retrieve and perform Optimization objects know what were retrieved for analysis.

Architecture of the System

The architecture of the decision optimization and information management system that uses gradient descent consists of the User Interface section; data end section and code section that also consists of applications' connection string for data transmission. The Interface section of this architecture consists of the User Interface where User(s) interacts with the system's real-time of the data end via the logical section. The logical section is comprised of the modules and classes that perform actions in the system. On the other hand, the data end is the storing medium such as the MySql database technology that is deployed to storing and retrieval of data. This is illustrated below.

System Architectural Design for Decision Optimization and Information Management system



Program Design

The program design of this research work involved techniques applied to implement the system. These include:

1. Description of the Proposed System
2. Input / Output Design
3. Database design.

The design of the decision optimization and information management system involves creating patterns that depend on the proposed system description that implements the architectural design that shows the relationship of the database and the user interface of the system. These are described below.

Description of the Proposed Decision Optimization and Information Management System

There is no substitute for analysis of production and supply-chain of any production firm. The key to the success of an application structure is the ease with which professional or non-professional users can navigate through the system without difficulty (Hoffmann, 2010). This provides the users (experts and non-experts) with different management techniques within seconds and allows better usage of the application.

However, the proposed Optimization and Information Management System uses the gradient descent technique to capture the complexity of real-time values of products and supply chain involving product names, quantity demanded and supplied; cost of individual product; and anomalies that may affect supply chain performance. This technique implementation helps to perform analysis and generates information index for optimization and is often used as black-box optimizers to determine the weakness and strengths of cost function from a dataset. It also displays the decision and finally stores it for future references.

Results

In the course of evaluation, different data types (values) were used in order to test the actual program or the integrated modules. Test data were used in evaluation to check the inputs and expected outputs from the system. In this study, evaluation value (data) requirements were drawn up based on the functional requirements that were due for evaluation of individual module. This involves data that corresponds to the respective Graphical User Interface of the system.

The results show simply the corresponding output data that is produced from the input data in the actual program or the integrated modules and the Gradient Descent analysis technique. The result of the evaluation of this study helped to provide better production material for specified product-type at any production level and expected outputs of the system.

Discussion

The Automated Decision Optimization Management System for Production Industries (DOMSPI) implemented in this research study is an application consisting of menus with some modules coded

together that directs the user to perform management tasks and production optimization. This Decision Optimization Management System for Production Industries (DOMSPI) can allow users to create production details, supply details, and view production information. It also has the features that enable the system to evaluate the Gradient Descent Values of production using varying raw materials and simultaneously estimate the best production raw material for specific production of products.

Moreover, the DOMSPI typically consists of classes and knowledge bases that are used to actualize its managerial tasks. These classes and knowledge bases are structured to dynamically reflect the experts-decision making in production and management. The knowledge base was specifically structured with pointers referencing respective descriptions of action that corresponds to the expectation value of gradient descent generated from the production rule of raw materials. These classes also consist of objects and sets of instructions coded together that provided performance in the system.

Conclusion

The automated Decision Optimization Management System for Production Industries (DOMSPI) was implemented in visual basic application, using Visual Studio .NET Framework that has tools to supports the design and event-driven objects and classes used in the system. This system has the capability for uploading production details, supply chain details, and optimization of productions in the industry. The DOMSPI allows users to electronically create real-time data of production and supply of products and services provided by manufacturing industries such as Solive Oil Nigerian Limited and store the real-time values in the database, thereby replacing the manual document management production optimization in industries. The DOMSPI is easy to use with user interface and estimates the overall processing time in optimizing and generating decisions for the management.

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