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Framework for Adaptive Business Intelligence System to Enhance National Economy

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Abstract: The framework for adaptive business intelligence system based on multi criteria business intelligence approach is used to enhance the BIA by applying Multi-Criteria Decision Making (MCDM) technique. The major contribution for MCBI approach is improved business decisions and Business Intelligence Decision Support System (BIDSS) for BIA. MCBI approach presents a methodology to evaluate and select business decisions according to the architecture MCBI framework. This methodology is based on the quantitative and qualitative methodologies to produce recommended decisions. The recommended business decisions are the appropriate and optimal decisions to be implemented. MCBI system consists of five major components: the first component determines business objectives, problem definition and main goals by business owners and BI system stakeholders; the second component collects business data and treatments heterogeneous data, the third component builds unified business databases to perform analytical and mining processing for business data through Business Intelligence Processing Unit (BIPU) in fourth component, finally, the fifth component evaluates the business decisions to select the appropriate and optimal solutions to be implemented. MCBI system aims to manage national economy and make better decisions by using national dashboards in different local resources.

Keywords: Multi Criteria Business Intelligence (MCBI), Business Intelligence Applications (BIA), Multi Criteria Decision Making (MCDM), Business Intelligence Decision Support System (BIDSS), Management Information Systems (MIS).

I. INTRODUCTION

MCBI system for enterprises or governmental organizations has large volumes of databases and data warehouses. They include huge data for products, customers and requirements of local and international markets. They have their policies, organizational structure, departments, employees, agents, outlets and branches of local and international firms to meet the needs of the domestic market and globally specifications. MCBI system based on MCBI approach to maximize the benefits of the BIA, and optimizes the search space for selecting the most appropriate decision to enhance the BIA by applying the MCDM technique.

BIA is used by international companies to serve customers, retails and merchants over the internet all the time. BIA based on Electronic Commerce (EC) techniques, management and intelligent information systems to make better decisions. There are urgent needs to optimize the search space for selecting the most appropriate decision; therefore, the objective of this study is to maximize the output results of the BIA though proposing a new approach named Multi–Criteria Business Intelligence (MCBI) for fulfilling this purpose.

The MCBI approach is used to enhance the BIA by applying Multi-Criteria Decision Making (MCDM). The major contribution of the MCBI approach is to improve business decisions and Business Intelligence Decision Support System (BIDSS) for BIA. MCBI approach presents a methodology to evaluate and select business decisions according to MCBI model. This methodology is based on the quantitative and qualitative methodologies to produce recommended decisions.

MCBI approach consists of a set of models, descriptions and analysis methodologies that systematically exploit the available data to retrieve information, knowledge and advice useful in supporting complex decision making processes according to many criteria and alternatives. We have implemented the MBCI approach on a system named “national food security” as a case study to verify its improvement in the results. The recommended business decisions are the appropriate and optimal decisions to be implemented. The proposed framework for MCBI system consists of five major components

This paper is organized into nine sections as follows: The introductory section introduces the problem under investigation and provides a brief description of the study objective. Section 2, Background on MCBI approach, BIA, MCDM techniques, and survey for related work. Section 3 explains research problem and definition. Section 4 presents research motivation and objectives and section 5presents research Methodology. Section 6 describes the proposed framework for MCBI system, which enhance and handle BIDSS problem based on MCBI approach. Section7 represents the implementing and the deploying of the proposed MCBI framework on food security field, case of cattle numbering project as national project and discuss the obtained results. Also investigate the effect and impact on business decisions in cattle investment projects and others related development fields in Egypt. Section 8 presents evaluation for MCBI framework and a comparative study related with experiment results on BIA and MCBI system. Section 9 indicates the conclusions and the future work.

II. BACKGROUND

The goal of this section is to introduce a survey on the area of Business intelligence background and briefly reviews. This background presents MCBI approach, various definitions for

BIA and discusses previous related common works. The study presents the pros and cons for previous works based on the architecture of MCBI approach to make better decisions for national development especially in Agriculture domain.

Ali et al. (2011), defined MCBI approach as "a set of models, descriptions and analysis methodologies that systematically exploit the available data to retrieve information, knowledge and advice useful in supporting complex decision making processes according to many criteria and alternatives"[1, 23].

BI tools include query, decision support systems, executive information systems and Online Analytical Processing (OLAP) technique to make better decision. BI transforms information into intelligence, intelligence into knowledge to help manager and decision support system to make business decision. Business decision is one or more from proposed alternatives to solve business problem according to requirement criteria [21, 22].

MCBI is an integration model which is produced from the combination between the BIA and MCDM to evaluate the business alternatives / judgments that are affected by more than one criterion to select the appropriate and optimal solution to implement it. Business model has a mathematical model, conceptual model, business life cycle and flow charts to represent the business processes flow through out different business levels which have many criteria, sub-criteria and alternatives [1, 23]. System life cycle for business has all business processes from start to end through the different levels in organization [12]. We will discuss the architecture of MCBI framework in section 6. Figure 1 illustrates the architecture of MCBI approach according to the integration of BIA and MCDM technique.

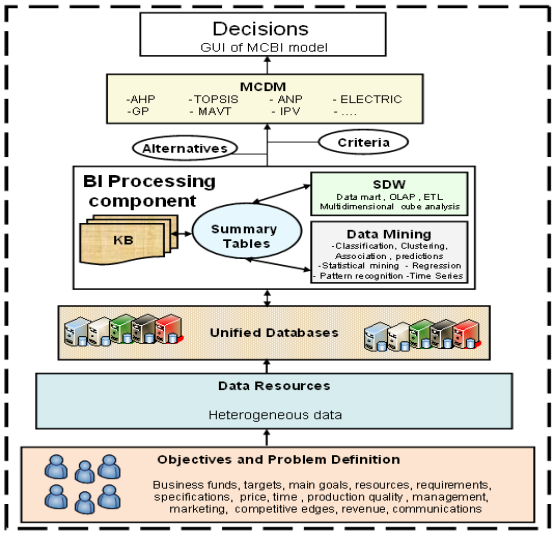

Figure: 1 The architecture model of multi-criteria business intelligence approach [1].

BIA gathers, analyzes, and manages data with large volume to perform mining process for them, to make a good decision. BIIS provide products, services and presents information via reports. The reports is presented to users using different formats by using web applications, or BI client tools, such as Excel or Structure Query Language (SQL) reporting services [9].

The right BI decisions meet the changes in organizational structures, or supporting new modifications in business processes [20]. Extracting and presenting information in a meaningful way is an important key for any business decision application. BIDSS for BIA provide us by the right information to the right people at the right time [19]. BIA produces better decision according to the sets of models and methodologies that exploit the available data [21].

Decision Support System (DSS) is “a computer program application that analyzes business data and presents it so that users can make business decisions more easily” [13]. For any business we find a set of multi criteria affect business decision making process and decision support system. Multi Criteria Decision Making (MCDM) technique is a set of methods which help the decision makers to describe, evaluate, rank and select alternatives according to criteria [11].

In business world every things have a weight and take sorting order and priorities related with our work. MCDM include individual and group decisions. The weighting of MCDM used AHP with and independence criteria and ANP with dependence and feedback criteria from the alternatives [17].

AHP method are simulated the high business goals and strategies that are related with the available alternatives and based on the effected of these criteria. AHP is one famous method of MCDM methods and used to make comparisons with judgments. AHP method helps decision makers to find the one that best alternative that suits their needs and their understanding of the problem [17]. Figure 2 illustrates the structure of the AHP method.

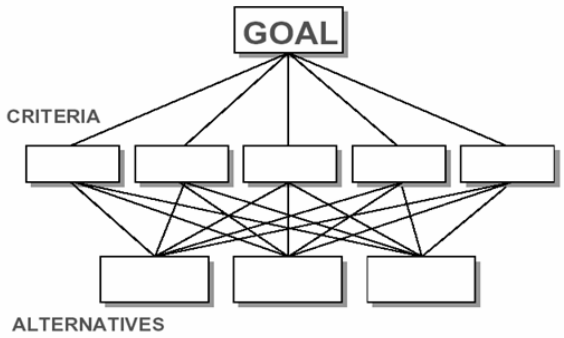

Figure: 2 Hierarchy for Analytic Hierarchy Process (AHP) method [2].

III. RESEARCH PROBLEM AND DEFINITION

In order to maximize the benefits of the BIA; there are urgent needs to optimize the search space for selecting the most appropriate decision. Organizations have many challenges at different organizational levels such as operational level, managerial level and high strategic level. BIA for national or global enterprises have large volumes of data, information and knowledge to produce better decision from many alternatives which related by many criteria based on MCBI approach. The research question focuses on the earlier questions as follows:

a. What is the new architecture of MCBI framework based on the MCBI approach?
b. What is the impact of business decision quality when applying the new integration framework?

IV. RESEARCH MOTIVATION AND OBJECTIVES

The objective of this study is optimized the search space to select the most appropriate decision for BIA to make better decision based on MCBI approach to develop the framework for MCBI system. This framework increases the effectiveness of business intelligence systems. MCBI system is intended to provide business with following benefits:

a. Supporting business strategies
b. Minimizing cost and time
c. Enhancing the organizational structure and business processes
d. Increasing business value, and selecting the appropriate decision for organization.

V. RESEARCH METHODOLOGY

This study uses both qualitative and quantitative approaches to optimize the search space for selecting the most appropriate decision. The qualitative approach will analyze the business data and using the BIPU component to provide MCBI system with information and knowledge. The quantitative approach will use the MCDM techniques to provide qualitative analysis and quantitative decision by using the MCDM methods. The used method is AHP method to support the strategic business intelligent decision.

VI. THE PROPOSED FRAMEWORK FOR MCBI SYSTEM

Users of MCBI system are experts and strategic decision makers in different business domains. These business areas such as the industry, agriculture, medicine, economy…etc. The technology and tools that used to implement MCBI system as follows:

a. Client /Server technology to access MCBI system through internet media to provide an organization with better decision at right time for right people.
b. Web 0.2 platform to develop BIDSS component for MCBI system based on the proposed MCBI framework.
c. Database Management System such as SQL, Oracle database

MCBI framework presents the infrastructure of MCBI system as shown in figure 3. MCBI system consists of five components as follows:

a. Business objectives and problem definition component.
b. Business data resources component.
c. Unified business databases component.
d. Business Intelligence Processing Unit (PIBU) component.
e. Evaluation and selection the appropriate and optimal business decisions component.

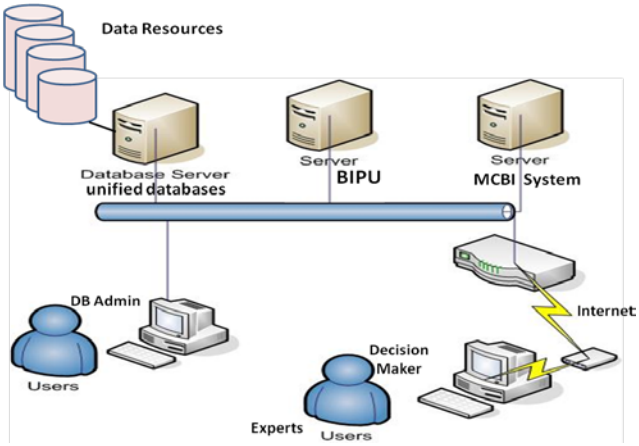

Figure: 3 The framework of MCBI system

The integrated framework of MCBI approach aims to answer for the research questions and present the following contributions:

a. Design new Business intelligence framework.
b. Support the cooperation and transaction processing for sharing data through media resources between MCBI information system and other information systems.
c. Encourage business investments and developments for national economy to satisfy the self-sufficiency from requirements on domestic levels to achieve the globalization conditions of competition and revenue for national organizations.
d. The study aims to add a new trend for BI systems to encourage the investments and national business developments in developing countries.
e. The study aims to reconstruct Egypt economy after the events of white revolution which happened at January 25, 2011. Also, the study presents the infrastructure for MCBI dashboards in various development and investments areas such as agriculture, industry, learning, morality, irrigation, energy, transports, communications, social Communities based on good manners and morals...etc.

VII. THE IMPLEMENTING AND THE DEPLOYING OF THE PROPOSED MCBI FRAMEWORK

The framework of MCBI system aims to support strategic decisions for national investment and development projects in Egypt. The deployment of case study in the area of cattle production has been adapted to prove the concept of applying MCBI in national development. The research case deals with the introduction of new multi- criteria business intelligence system in Egyptian cattle projects. We will start with a brief discussion and explanation for the problems of the Egyptian cattle development projects as a research case. This research case is related with the problem of national food security to satisfy the self-sufficient of requirements of red meat. BOVIS is Management Information System (MIS) to provide an electronic numbering and registration for Egyptian cattle and buffalo wealth [3, 14].

Egyptian cattle and buffalo information system (BOVIS) data are not complete and not proportional with the real

numbers of available cattle and buffalos in Egypt. The sorted data is not integrity based, non-completed and is not able to present a general view and methodology to determine development requirements for cattle projects in the current and future times. BIDSS and decision making process for MCBI system based on MCBI framework which has multi-dimensions data that are related with business fields. MCBI model has summarized data and facts to develop national investment projects as BIA. The summarized data and facts have many alternatives which are related with many business criteria. We can make better BI decisions by applying the AHP method to make weight, rank for business criteria to evaluate and select the most appropriate alternative to implement it.

MCBI system for Egyptian livestock's investment projects will cover the food gap and narrow the difference between supply and demand in Egyptian society to achieve food security from requirements and red meat. This type of national investment aims to satisfy self-sufficiency from needs in any area such as agricultural crops, fruits, vegetables, lands, water, energy ... etc. The industrial and agricultural development by MCBI system conforms and meets with parallel development directions for local requirements. The development for national organizations based on the foundations of global and regional competition in different fields such as: population, education, irrigation, energy, politics, economy and other national security fields.

The study will apply the MCBI approach to increase the effectiveness of BIDSS for MCBI system of BOVIS to support and provide the strategic decision making processes for cattle and buffalos investment production projects. MCBI system aims to make parallel development for business areas which participate to satisfy the sufficiency of needs. The case study is interested in the development of Egyptian livestock's and animal production to achieve self-sufficiency from red meat in agriculture domain in Egypt.

BOVIS information system has 2,357,418 heads from cattle and buffalos since the starting of project at 2003 until September 2011[3]. The analysis processes for BOVIS project is made by using data warehouse analysis services to design and build database which includes cattle facts [18]. These facts related with Egyptian governorates, number of registered heads, cattle types, cattle sex types, etc. As well as these facts and analysis don't present any methodology to development the cattle production, cattle care and treatment in Egypt.

BOVIS information system serves cattle registration, slaughter and vaccination only. Cattle numbering and registration project need to other related areas to make national investment according to national strategic plan which has many criteria to present main national policies. The related areas with cattle development in Egypt such as Egyptian population and the amount of population increasing, size of livestock and amount of increase specially in cattle and buffalos wealth, area of agricultural lands which can be grown in the future, crops types, water, energy resources, education, social , Economy and Politics.

MCBI system determines the main criteria, sub-criteria and alternatives from the business owners, mining technique, SDW and experts [1]. Figure 4. Illustrates the applying of AHP method on MCBI system for the development of cattle investment projects

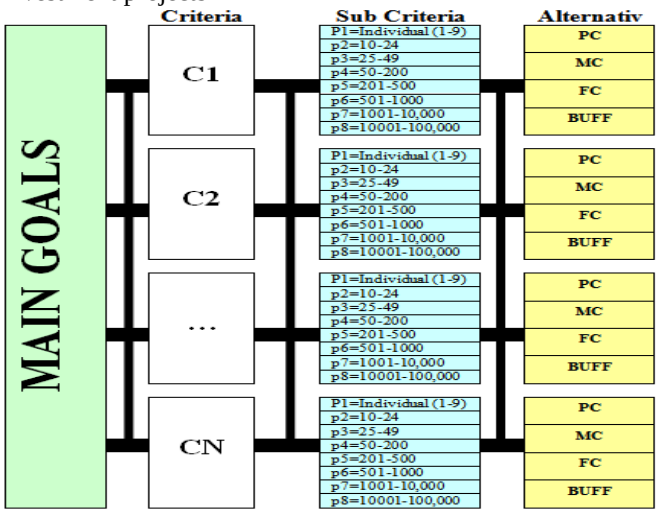

Figure: 4 The structure of AHP method for MCBI system.

Business criteria and alternatives are evaluated by using AHP preference table. As well as, these criteria have high priorities to set a scores or weights [17]. The main goal is made development for cattle and buffalos production projects according to the following Main Criteria (MC): Cattle and Buffalos Development (CBD), Plants and Crops Development (PCD), Water Development (WD) such as resources and usage, Regional Development (RD), population increasing rate (PIR), Time schedule of development (TSD), Energy Development (ED) such as resources, industry and usage, Industrial Development (ID), Transportation and Communications Development (TCD) and other Sciences Development (SD). Table 1, illustrates the preference values for main criteria.

Table:1 The preference values for main criteria

Main Criteria	CBD	PCD	WD	RD	PIR	TSD	ED	ID	TCD	SD
preference values	*9*	*9*	*9*	*9*	*7*	*7*	*5*	*5*	*3*	*3*

Table 2. Illustrates the pair wise comparison matrix among main criteria based on main criteria

Table: 2 Main Criteria (MC) weights for MCBI system

Pref		9	9	….	3	3	∑ Rows (Weights)
Pref	MC	M1	M2	M….	M9	M10	
9	M1	1	1	…	3	3	0.137
9	M2	1	1	…	3	3	0.137
9	M3	1	1	…	3	3	0.137
9	M4	1	1	…	3	3	0.137
7	M5	0.77	0.77	…	2.33	2.3	0.106
7	M6	0.77	0.77	…	2.33	2.3	0.106
5	M7	0.55	0.55	…	1.66	1.66	0.075
5	M8	0.55	0.55	…	1.66	1.66	0.075
3	M9	0.33	0.33	…	1	1	0.045
3	M10	0.33	0.33	…	1	1	0.045
Total							1

The development criteria (Main Criteria) have 8 types of investment projects as sub-criteria from project1 (P1) to project 8 (P8). The cattle and buffalos are the alternatives of cattle investment projects as shown in figure 4. The recommendations of cattle experts according to the new development and investment cattle projects in Egypt as the following structure for cattle and buffalos heads in investment projects. Table 3 presents the cattle experts recommendations for new development and investment cattle projects in Egypt and illustrates new structure for cattle and buffalos heads in investment projects.

Table: 3 New structure for cattle heads in investment projects

CATTLE INVESTMENT PROJECTS	category	Project	Heads density	Average. Of Head No.	Projects No.	Heads No.
	SMALL PROJECTS	P1	h<10	4	37500	.15M
		P2	10<=h<25	10	15000	.15M
		P3	25<=h<50	25	6000	.15M
		P4	h>=50	50	6000	.3M
	LARGE PROJECTS	P5	500<=h<100	500	300	.15M
		P6	h>=1.000	1000	600	.6M
		P7	h>=10.000	10000	200	1.5M
		P8	h>=100.000	100.000	50	4.5M
Total					65650	7.5M

Experts knowledge, recommendations, mining classifications and facts are produced from previous four components of MCBI system and, these facts as: Pi is the type of project based on the number of cattle heads, $1 \le i \le 8$ from the survey of development cattle production in Egypt which conclude

$$P_1 \subseteq P_2 \subseteq P_3 \subseteq P_4 \subseteq P_5 \subseteq P_6 \subseteq P_7 \subseteq P_8 \quad (1)$$

$$P_m = \bigcup_{i=1}^{m-1} N_{pi}\ P_i \quad , \text{ where } 2 \le m \le 8 \quad (2)$$

Where NPi are project numbers of project type Pi , for any Project of type Pm is union of projects types P_{m-1} and the number of cattle heads for project of type P_m are $N_h(p_m)$ and satisfy equation 5.

$$\forall P_m : N_{h_{mim}}(p_m) \le N_h(p_m) < N_{h_{max}}(p_m) \quad (3)$$

The total number of investment cattle projects is p, where

$$P = \sum N_{pi} = N_{p1} + N_{p2} + N_{p3} + \ldots\ldots\ldots\ldots + N_{pn} \quad (4)$$

The general form which express for total number of investment cattle projects are P.

$$P = \sum_{i=1}^{n} N_{pi} \quad , \quad 1 \le n \le 8 \quad (5)$$

According to mining classification technique we able to classify the cattle development project according to project types (Capacity, investment amount, Reclaimed areas), cattle types, cattle sex, project in region, cattle in region, Cattle type, project type in region … etc. The union of projects type p_{i-1} performs a new project type Pi, Where total numbers of investment cattle projects are P in Egyptian governorates are

$$P = \sum_{i=1}^{27} \sum_{j=1}^{8} a_{ij} \quad (6)$$

Where a_{ij} are Number of cattle projects of type j In Egyptian governorates region i. Table 4 illustrates the requirement from red meat in Egypt in the period from 2010 to 2017 and in addition the predicted calculations in 2050 [4,5,6,7,8].

Table: 4 red meat Requirements in Egypt from 2010 to 2050

Year	E.P. (10^6)	Red Meat (1000Tons)	75% Cattle meat (1000Tons)	No. of Cattle Heads For markets (10^6)
2010	79.5	866.6	649.9	3.250
2011	81	882.9	662.2	3.311
2012	82.5	899.3	674.4	3.372
2013	84	915.6	686.7	3.434
2014	85.5	932	699	3.495
2015	87	948.3	711.2	3.556
2016	88.5	964.7	723.5	3.616
2017	90	981	735.8	3.679
2050	140[1]	1526	1145	5.725
2050	155[2]	1690	1267	6.335

Table 5 illustrates the relationship between current and future amount of red meat and MCBI study to provide the sufficiency amount of red meat productions to cover the increasing in population [4,5,6,7,8,15]. The percentage of required red meat according to the real situation, MOALR study and MCBI study. These studies explore the available amount of red meat production at the current and future times according the current Egyptian livestock's at 2010 [5, 6, 7, 15]. The study performed surveys and questioners to investigate and obtained on the required data and knowledge. Business knowledge acquires from experts or from experience [16]. Figure 5 and 6 illustrate the mean average for requirements of red meat and populations increasing with time as a graphical visualization for MCBI system.

Table: 5 Red meat Rating % from Cattle projects based on Real situation, MOALR and MCBI studies

Project	Heads No.	Rating %
P1	.15M	2
P2	.15M	2
P3	.15M	2
P4	.3M	4
P5	.15M	2
P6	.6M	8
P7	1.5M	20
P8	4.5M	60
Total	7.5M	100

1 At the case of minimum population increasing rate in Egypt at 2050 [4].
2 At the Case of maximum population increasing rate in Egypt at 2050 [4].

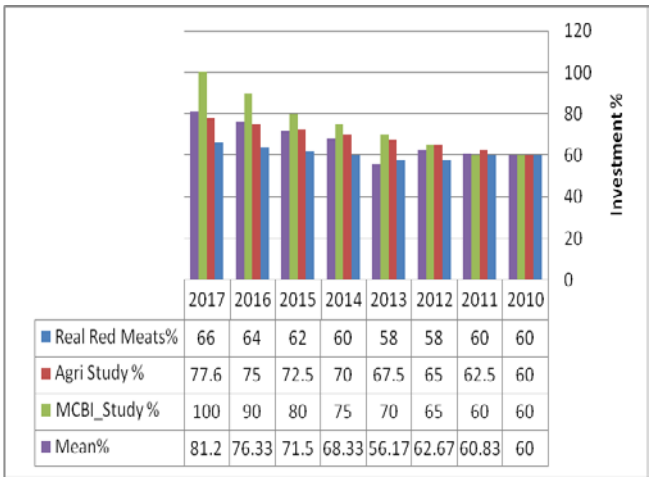

Figure: 5 Red meat investment studies, states and mean with time

Figure 6 illustrate the relationship between the requirements of red meat and populations increasing and mean average of required red meat with time as a graphical visualization for MCBI system.

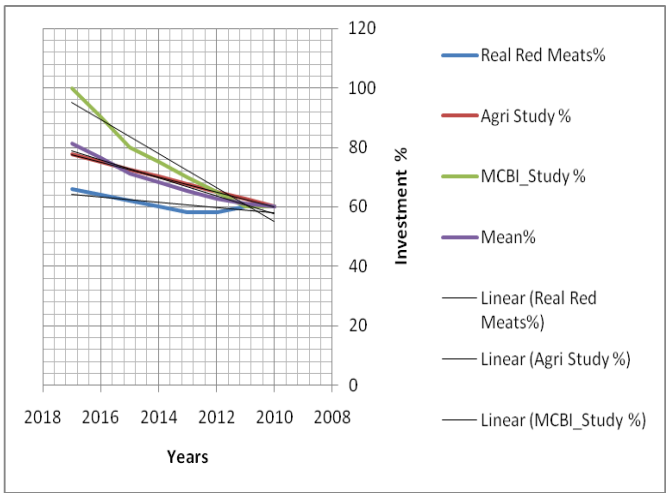

Figure: 6 Red meat investment studies and states with time.

The case study of MCBI system for cattle investment project has 9 main criteria, 8 sub-criteria, and 4 alternatives. Business Intelligence Processing Unit (BIPU) analyzes business data to extract the facts by using analytical tools and mining techniques. The weight values of alternatives and sub–criteria determine directly by experts and decision makers. The weight values for main criteria represent into main criteria matrix weights: Sum the row totals = 118.26. Normalizing by dividing the row sum by the row totals to compute the weights of criteria. Table 6. Illustrates the number of heads in new different types of cattle and buffalo's investment projects and the weights of Sub-criteria in new cattle and buffalos projects put direct by experts and strategic decision makers in table 3. Also, table 6. Illustrates the sub- criteria weights based on MCBI survey, Rating % and real world. Alternatives weight determine directly by the current situation and decision makers

Table: 6 No. of Cattle heads and weights in new investment cattle and buffalos projects (sub- criteria).

Project (sub-criteria)	Heads No.	weight	Rating %
P1	.15M	0.02	2
P2	.15M	0.02	2
P3	.15M	0.02	2
P4	.3M	0.04	4
P5	.15M	0.02	2
P6	.6M	0.08	8
P7	1.5M	0.2	20
P8	4.5M	0.6	60
total	7.5M	1	100

A. Decisions evaluation step:

AHP method evaluates strategic businesses decisions to select the suitable and optimal decision to implement. MCBI system has Weights for 10 main criteria, 8 Sub- criteria and 4 Alternatives. The next step calculates the ranking results which have 320 values (10 x 8 x 4 = 320 decisions/solutions). Then make groups for main criteria which have a same weight to be 4 types as shown in table 7.

Table: 7 Main criteria weights (Rating %) after grouping step

Main Criteria	**Rating %**
CBWD (Cattle), PCD (Plant), WD (Water), RD (Region)	13.6
PIR (population), TSD (Time)	10.6
ED (Energy), ID (Industry)	7.6
TCD (Tran&Com, SD (sciences)	4.6

Also we make groups for sub criteria which have the same weight to be 5 types put directly by decision makers and experts as shown in table 8. And alternative are 4 types put directly as shown in table 9 and figure 4.

Table: 8 Sub-criteria weights after grouping step

Projects of Sub –Criteria	**Sub -Criteria**	**Rating %**
P8	S1	60
P7	S2	20
P6	S3	8
P4	S4	4
P1, P2,P3,P5	S5	2

Table: 9 Average percentage of cattle types in cattle projects (Alternatives Weight)

Cattle Project Alternatives	Average percentage
Pure Cattle (PC) Baladi	10%
Mix Cattle (MC)	43%
Foreign Cattle (FC)	10%
Buffalo (Buff)	37%

MCBI system generates 80 output results from evaluation process. Where the main criteria are 4, sub criteria are 5 and alternatives are 4 weights to perfume (4×5×4) =80 decisions to implement one of them according to conditions and selection priorities. Table 10. illustrates the evaluation process results for MCBI system.

Table: 10 The evaluation results for MCBI system

C1 S(1..5) A(1..4)			
M-C %	S-C	Alt.	Result $\times 10^2$
13.6	0.6	0.43	3.5088
	0.6	0.37	3.0192
	0.6	0.1	0.816
	0.6	0.1	0.816
	0.2	0.43	1.1696
	0.2	0.37	1.0064
	0.2	0.1	0.272
	0.2	0.1	0.272
	0.08	0.43	0.4678
	0.08	0.37	0.4026
	0.08	0.1	0.1088
	0.08	0.1	0.1088
	0.04	0.43	0.2339
	0.04	0.37	0.2013
	0.04	0.1	0.0544
	0.04	0.1	0.0544
	0.02	0.43	0.117
	0.02	0.37	0.1006
	0.02	0.1	0.0272
	0.02	0.1	0.0272
C2 S(1..5) A(1..4)			
M-C %	S-C	Alt.	*Result* $\times 10^2$
10.6	0.6	0.43	2.735
	0.6	0.37	2.35
	0.6	0.1	0.636
	0.6	0.1	0.636
	0.2	0.43	0.9116
	0.2	0.37	0.7844
.....	……	…..	……
C4 S(1..5) A(1..4)			
M-C %	S-C	Alt.	*Result* $\times 10^2$
4.6	0.6	0.43	1.1868
	0.6	0.37	1.0212
.....	……	…..	……

B. Decisions selection step:

All output decisions from previous evaluation step are ready to implement after satisfy investment conditions such amount head in investment project, investment location, amount of fund and …etc. Arrange the produce decisions from the evaluation step in table 9 to select the optimal and appropriate solution/choice which satisfy business conditions and achieves business targets.

At the open fund case (large investment and project type): the recommended decision is C1S1A1. MCBI present other recommended decisions according to the investment projects specifications. Table 11 illustrates the arrangement of decisions/ solutions which obtained by MCBI system.

Table: 11 Solutions arrangement for MCBI system

Sorting MCBI solutions / Decisions $C_N S_N A_N$ from 1 to 80			
Decisions	**Weight $\times 10^{-2}$**	**Decisions order**	**Weight $\times 10^{-2}$**
C1S1A1	3.509	C1S1A1	3.509
C1S1A2	3.019	C1S1A2	3.019
C1S1A3	0.816	C2S1A1	2.735
C1S1A4	0.816	C2S1A2	2.35
C1S2A1	1.17	C3S1A1	1.961
C1S2A2	1.006	C3S1A2	1.687
C1S2A3	0.272	C4S1A1	1.187
C1S2A4	0.272	C1S2A1	1.17
C1S3A1	0.468	C4S1A2	1.021
C1S3A2	0.403	C1S2A2	1.006
C1S3A3	0.109	C2S2A1	0.912
……	……	……	……
C2S1A1	2.735	C3S1A4	0.456
C2S1A2	2.35	C1S3A2	0.403
C2S1A3	0.636	C4S2A1	0.396
C2S1A4	0.636	C2S3A1	0.365
……	……	……	……
C3S1A1	1.961	C3S2A4	0.152
C3S1A2	1.687	C4S3A2	0.1362
C3S1A3	0.456	C3S4A1	0.13
C3S1A4	0.456	C1S5A1	0.117
C3S2A1	0.653	C3S4A2	0.112
C3S2A2	0.562	C1S3A3	0.109
……	……	……	……
C4S1A1	1.187	C1S4A3	0.054
C4S1A2	1.021	C1S4A4	0.054
C4S1A3	0.276	C2S4A3	0.0424
C4S1A4	0.276	C2S4A4	0.0424
C4S2A1	0.396	C4S5A1	0.0396
C4S2A2	0.34	C4S3A3	0.0368
C4S2A3	0.092	C4S3A4	0.0368
C4S2A4	0.092	C4S5A2	0.034
C4S3A1	0.158	C3S4A3	0.0304
…..	….	…..	…..

MCBI system generates the recommended decisions according to the investment projects specifications. The recommended decision at open fund case (large investment project type in large area and have high numbers of cattle heads) is C1S1A1.Table 11 makes arrangement for business decisions / solutions that obtained by MCBI system to enhance BI decisions by applying AHP method. The optimal and appropriate solutions are arranged as follows C1S1A1, C1S1A2, C2S1A1 …. N solution based on the investment current situation.

VIII. THE EVALUATION FOR MCBI FRAMEWORK

The main challenge of MCBI system it is ability to enhance business intelligent decisions for BIA. According to the previous chapter MCBI system has 10 main criteria, 8 sub-criteria, 4 alternatives for cattle development projects to produce 320 results to implement the optimal one.

Business intelligence processing unit is extracted facts from business databases. And save it in summary tables of MCBI databases. Business alternatives and criteria determine by business stockholders in surveys.

The output decision generate by MCBI system after evaluation and selection process according to business values of current situation in tables 4 and 5 (i.e. decision C1S2A1 means C1 is a parallel development for Cattle, plant, water, region) and recommended development project type is S2 or project 7 (P7) and preferred types of cattle are A1 = Mixed cattle (MC).

$$P_7 = \bigcup_{i=1}^{6} N_{pi}\ P_i$$

This study presented MCBI approach as a methodology to evaluate business decisions for MCBI system which enhanced the decision making process for BIA. This methodology increases the effectiveness of BIDSS for BIA through different business levels. The following figures will be explained the Graphic User Interfaces (GUI) for BIDSS of MCBI system. Figure 7 illustrates MCBI system Authentication by using User name and password to satisfy the identification and validation for MCBI system.

Figure: 7 MCBI system authentication by using user name and pass word

Figure 8 illustrates Add, Edit, Update and Delete processes for MCBI users.

Figure: 8 Add, Edit, Update and Delete processes for MCBI users

Figure 9 illustrates user cases management sub-system for MCBI system. Figure 10 Add, Edit, Update and Delete processes for Main Criteria of MCBI system

Table: 9 User cases management sub-system for MCBI system.

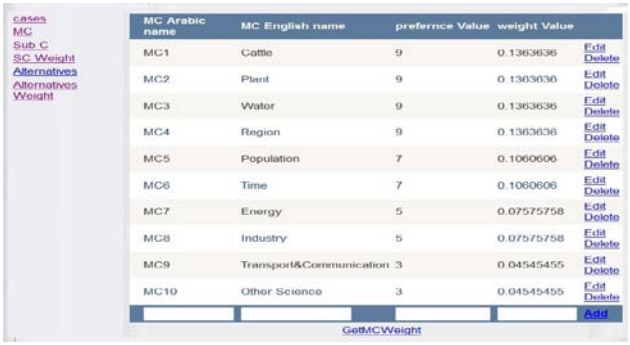

Table: 10 Add, Edit, Update and Delete processes for Main Criteria of MCBI system

Figure 11 Illustrates Add, Edit, Update and Delete processes for sub criteria of MCBI system. Figure 12. Illustrates Add, Edit and Delete processes for alternatives based on MC and SC of MCBI system.

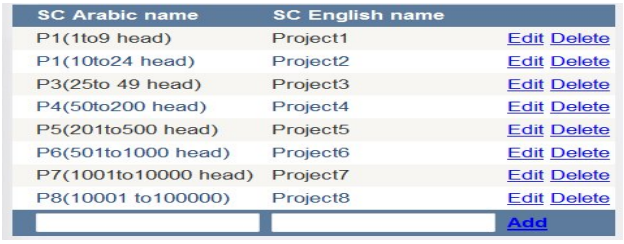

Table: 11 Add, Edit, Update and Delete processes for sub criteria of MCBI system

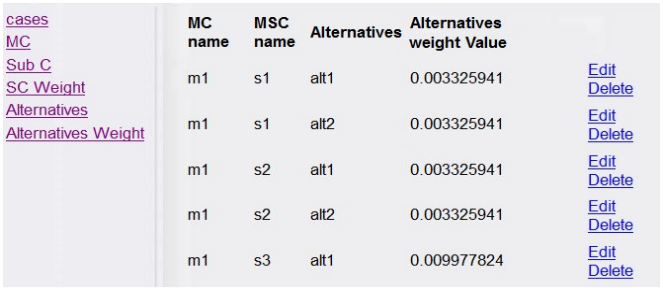

Table: 12 Add, Edit and Delete processes for alternatives based on MC and SC of MCBI system.

Table 13 illustrates the comparative study between applying BIA and MCBI System to present the impacts of applying MCBI system that has many items such as; data, database, DW, national investment, experts, Education, Transportations, Communications, political effects , other sciences , amount of investments, efficiency, effective, save time, Human Resources (HR), production , parallel development , IDSS , DM , business model follow , Data mining processes , analytical tools , applications dimensions , integration of extensions . Table 12 illustrates the comparative study between applying BIA and MCBI System

Table: 12 The comparative study between applying BIA and MCBI System

No	Item	BIA	MCBI
1	Data	Complete and related with specific areas	Complete and related with several areas
2	Data base	Integrity forever and concerned with specific type of data and data relation ships	Integrity forever and concerned with several types of data and data relation ships
3	TP	media	Large
4	Data mining	- Present mining to development in specific investment areas - According to BIA targets and experts vision for business priories and rules to select the implement solutions - Help to make Improvement and development in specific related areas	- Present mining to development in several investment areas - According to BIA targets and related criteria , alternatives and experts vision for business priories and rules to select the implement solutions - Help to make Improvement and parallel development in specific related sectors areas
5	MDW	Specific SDW	Large SDW
6	amount of investment	Low to media investment	Media to high investment
7	applications dimensions	Limited dimensions	Large dimensions
8	analytical tools	Analysis in limited areas	Analysis and Linkage between different areas
9	Data mining processes	Limited and complex	Large and complex
10	IDSS	According to business rules and knowledge base, criteria and expert priorities.	According to business rules , knowledge base , MCDM
11	Efficiency	High in specific and limited areas	High in large, multidimensional areas
12	Effective	Media	High
13	Save time	Small to media	Media to large
14	HR	Small to media	Media to high
15	Production	Specific and high	Large and high
16	Parallel development.	investment in specific fields	Large investment in different fields
17	Integration of extension	Limited integration for new dimensions and allows to add integrated sub- dimensions	Integrated for ever for any new dimensions or sub dimensions
18	Business flow	Specific and have automated multi combination flows	Multi specific and Parallel to create automated complex flows
19	other science	Limited cooperation	large cooperation
20	Experts	Need limited number of experts in specific areas	Need large number of experts in different specific areas
21	Education types	Specific education in specific fields	Parallel specific education types in different fields
22	Transportations	Require private or limited Transportations tools	Require National or large Transportations tools
23	Communication	Require private or limited communication network architecture	Require national or large transformation network architecture
24	Political effects	Specific vision	General vision
25	national investments	Limited scale	large scale

IX. CONCLUSION AND THE FUTURE WORK

This section includes the conclude remarks that are interpreted from this study to present recommendations.

a. MCBI framework can be used as a new BIA technique that will be deployed for both national and international development business.
b. MCBI system presents simultaneous development vision to cover food security gap in the rates of population increasing in current and future situations.
c. MCBI system will be able to satisfy domestic developments, in which it meets the globalization competition through communications media.
d. MCBI system can be considered as a nucleus to increase the economy of developing countries.

In the future, we hope to implement the systems of MCBI framework in different development business areas such as industry, agriculture and reclamation, educational, medicine, petroleum, manufacture, constructions and buildings, communications, the side effects of medicines on diseases and human parts. Design dashboards for national investment projects in developing countries based on the globalization competition.

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