GIS and RS Integrated Framework for Supporting Planners and Decision Makers

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Abstract
The power of integrations planning supports decision makers to take the right decision in the right time. In order to have good plan, we should gather different kind of information with different perspectives and sources. The integration between all kinds of information supports decision makers to set the right plans and logic strategies in order to achieve their expected goals.Decision makers may suffer from information leakage, un-integrated information from different sources; information which does not represent the current status of reality and ability to represent information geographically. Decision makers should use modern technologies and tools in order to overcome the obstacles which they may face.Remote sensing and Geographic information system can provide realistic source of data and logic solutions which can support the decision makers to take the right decision in the right time. Decision makers should use remote sensing technology in order to set their future planning and select their right strategies because remote sensing is the science to obtain the date remotely either phenomena like temperature, humidity or even satellite images which provides a realistic representation for the land which may enable the decision maker to track changes which may happened on specific feature or even extract a specific feature and get the different statistics or measurements which definitely important to set the right plans Geographic information system support decision makers by realistic solutions and excellent geographic data representation and even the ability to join and migrate different sources of data to be liked geographically with the related features.
Keywords: Planning, Decision Making, Remote Sensing, Geographical Information System

1. INTRODUCTION

Planning power in various fields, leads to the right decision at the right time. Planning according to the information has been collected from different places gives us the vision and wide-ranging. The integration between all Knowledge like planning, decision making, Geographical information systems (GIS) and Remote sensing (RS). Lead us to have the right decision on time. A lot of problems that face the decision maker while he takes his decision, if it's the ideal decision, can I change it, is it the right time. These entire questions lead the decision maker to be accurate in his decisions and lead to choose the right time. At this point I think when we integrate the GIS and RS to make a plan in helping the Decision Maker in one framework it will be affected. As a case study when we choose a place and have data base we can plan in future what we want in different major like the population and urban and agricultural land. The population will be refers to CAPMAS to make the statutes of the population. The agriculture land and the changes that happen on it will help the Ministry of Agriculture. If all the data is available and real information, it will offer a lot of needs to farmers like what is the exactly land for the cultivation of certain agriculture.

The modern technology of remote sensing which includes both aerial as well as satellite based systems, it or this allow us to collect lots of physical data rather easily, with speed , on repetitive basis, and together with the GIS that helps us to analyze the data spatially, offering possibilities of generating various options (modeling), thereby optimizing the whole planning process. These information systems also offer interpretation of physical (spatial) data with other socio-economic data, and thereby providing an important linkage in the total planning process and making it more effective and meaningful. Recent technological advances made in domain of spatial technology cause considerable impact in planning activities. This domain of planning a prime importance for a country like Egypt with varied geographic patterns, cultural activities, etc. The purpose of using GIS is that, maps provide an added dimension to data analysis which brings us one step closer

to visualizing the complex patterns and relationships that characterize real-world planning, Decision making and policy problems. Visualization of spatial patterns also supports change analysis, which is important in monitoring of social indicators. This in turns should result an improving need assessment.

Urbanization is inevitable, when pressure on land is high; agriculture become low and population increase are excessive, as the case in most of the developing countries of the world. Urbanization has become not only of the principal manifestation but also an engine of change. At or in the 21th century, it has become the center of urban transition for human society. In a way, the urbanization is desirable for human development. However, uncontrolled urbanization has been responsible for many of the problems, our cities experiences today, resulting in substandard living environment, acute problems of drinking water, noise and air pollution, disposal of waste, traffic congestion etc. To improve these environmental degradations in and around the cities, the technological development in relevant fields have to solved these problems caused by rapid urbanization, only then the fruits of development will reach most of the deprived ones.

2.   PROBLEM DEFINITION

GIS tends to produce and accumulate a lot of data over time, providing an opportunity to "make sense" of this data and get more high level information, conclusions, and trends. Remote sensing has been used in spatial database for this purpose also. New methodologies are needed in order to mine more interesting and specific information from the data, new frameworks are developed to harmonize more effectively all the steps of the planning process, new solutions will have to manage the complex and heterogeneous source of information that is today available for the analysts [5]. Geospatial data combines capabilities in data acquisition (RS), data integration, and subject matter expertise to identify important sources of information and integrate geospatial and tabular data accurately and in a way that is easily retrievable.

This research argues that integration of GIS and RS as better method to achieve efficient data changes and intelligent analysis to aid the decision making process and planning. There are a lot of sporadic information to the Decision Maker and planner. The Available information is not linked to the element of place. There is Lack Integration between systems and each other. There is no correlation between different authorities.

The question that research attempts to address is: are GIS and RS enhancements filling the gap between spatial data analysis and decision making and planning?

Taking into considerations literature and technical publications on geospatial information, remote sensing, technology, standards and interoperability, urban planning, decision making and GIS, this research will explore and integrate the GIS and RS to support Decision making and planning. The research will use specifications endorsed by the visualization, evaluation and discovery of geospatial data. Use change detection technique for display geographic data such as, urban encroachment, rivers and roads. Issues of decision making and planning will be discussed in details.

3.   PROPOSED MODEL

An analysis will be performed to assess the impact of GIS and RS on Decision making and planning as a discipline, and on the changing requirements created by the GIS approach to geospatial intelligent analysis. We present the proposed research methodology in the below Figure 1 where spatial data Infrastructure and data interoperability will be the base of our work , we will be able to exchange data through our developed GIS and make intelligent analysis using Remote sensing rule and change detection techniques and perform regression analysis on results.

4.   FRAMEWORK

The proposed framework is monitoring the integration between GIS and RS to support decision making and planning in Figure 2. In this research objectives are to integrate between different systems to support Decision Maker, and to develop a framework to support decision maker and planner using Geographical information System and Remote Sensing, along with addressing the following issues:
-Inability to get data from these sources.
-Poor planning objectives are difficult to overcome.
-Reframing planning objectives late in a study results in lost time and higher costs.
-The importance of planning objectives is not fully appreciated.
-Planners do not embrace innovative approaches to meet planning objectives.
-Decision maker need more detailed data for operation, tactical and strategic decisions to analyses, modeling and forecasting.
-To extract the hidden information and gain the knowledge from different sources of data at two cases:
-        Ability to get the data from these sources.
-        Collect these data it in data base and extract the hidden knowledge from those different sources, and distribute the feedback analysis for the interested users to aid decision making and planning.

Make the analysis at each side containing the data, and gain the knowledge from each side without having the data, and then collect all these knowledge gained from different sources to gain the accumulated knowledge that would be helpful for decision making and planning.

5. CASE STUDY:ANLYSES URBAN ENCROCHMENT AND SUPORT DECISION MAKING FOR PLANNING

The urban encroachment is a global problem affecting all nations of the world. Why? It needs all decision making types Strategic, Tactical, Operational; It Needs continuous planning, It Needs Information System and It Needs Location.

5.1 CASE STUDY AREA

The area of interest at Damanhur city located in the north-west of the Nile Delta belongs to the administrative province of Beheira governorate as shown in Figure 3.This area is selected because it's well-known that agricultural land there is exposed to pressure and erosion caused by urban encroachment. The process of urban expansion will impact directly the agricultural productivity of the productive agricultural lands.

5.2 DATA AND TECHNIQUES

Data Available:
The remote sensing data available for Damanhour city are satellite images of QuickBird (2008) and Worldview2 (2010, 2012, and 2014). The specifications of these images are show in table 1.

Satellite Image Processing:
Geo-correction on the satellite image the accurate registration of the high resolution multi-temporal satellite data is essential for change detection technique shown in Figure 4.
Image classification Land use/land cover classes are typically mapped from digital remotely sensed data through the process of a supervised digital image classification [30; 31]. The supervised classification is applied using ENVI 4.7 software for the classification process. To ensure the accuracy of the land use classes, ancillary data and the result of visual interpretation are integrated with the classification result using GIS. At least 100 training sites are chosen to represent land use classes, such as agricultural land, urban, water and other lands. Thematic land use/ land cover images for the years 2008, 2010, 2012 and 2014 are produced for the study area through supervised classification. To detect the changes before and after the revolution and it impacted on urbanization.

Change Detection Technique
In the study area, the field observation and measurements have supported the classification that showed the changes in land use between the four years. The post-classification change detection method is one of the most common, accurate and quantitative techniques [6]. In this study, post-classification technique is applied. This comparison technique is proved to be the most effective technique, because data from two years are separately classified, thereby minimizing the problem of normalizing for atmospheric and sensor differences between different years. Urban land use class is extracted from the classified images, and then cross-tabulation analysis is carried out to study the spatial distribution and areas of land use changes in 2008, 2010, 2012 and 2014. ArcGIS 10.1 software is used to estimate the difference of urban land area between study area years and to highlight areas added to urban landscape from agricultural land and from the adjacent other lands separately.

5.3 DISCUSSION OF RESULTS

The result of the change detection is analyzed using Arc Map, ArcGIS 10.1. Statistical means show that there are both positive and negative changes as shown in Figure 5. The percentage changes between the four years are shown in Figure 6.this statistical support decision making and planning.
As an example of supporting decision making and planning:
Urban encroachment affects strategic crops 60% of agricultural area is cultivated by strategic crop, due to urban encroachment this percentage is decrease, so we have to maintain or even increase the agricultural area which is cultivated by strategic crop.

OPTION 1: Recommendations solutions for Decision Makers Figure 7
- The area can be a good extension for the strategic crop cultivated area mainly from east direction.
- The area is semi far from urban condensation mainly from west direction
- The Area is far from the main Road which may effects on the transportation cost

OPTION 2: Recommendations solutions for Decision Makers Figure 8
- The area seems is not a good extension for the strategic crop cultivated area, it lays in the expected urban encroachment extension.
- The area is so near to urban condensation mainly from west direction
- The Area is near to main Road which is a good advantage for this location

OPTION 3: Recommendations solutions for Decision Makers Figure 9

- The area seems is not a good extension for the strategic crop cultivated area; it has surrounding area which can be added in future.

- The area is so far from urban condensation mainly from west direction

- The Area is near to main Road which is a good advantage for this location

Decision maker track all options that he have depending on GIS and RS results to plan what is the area that will be more accurate. The integration between GIS,RS framework led decision maker to select option 3 which is the most economic and applicable planning solution

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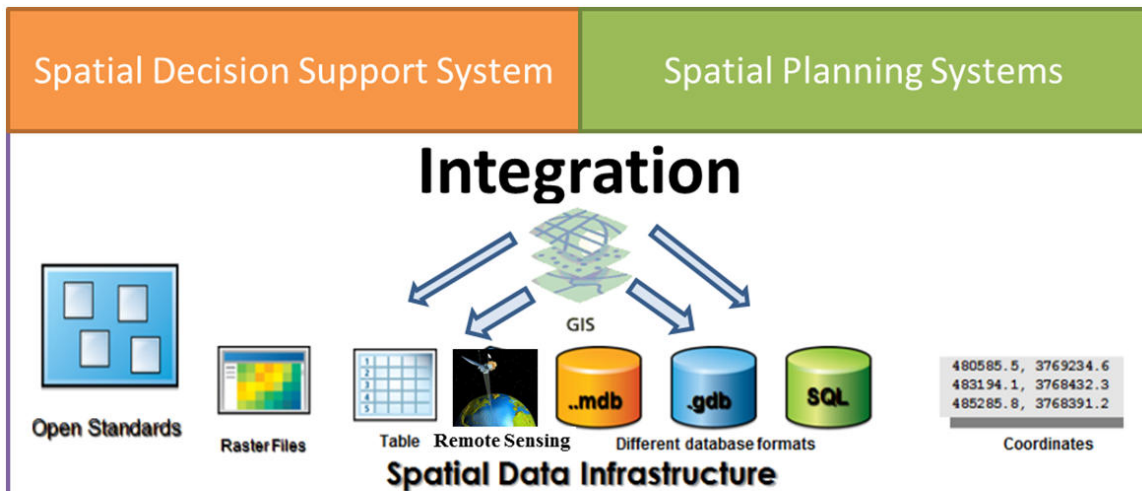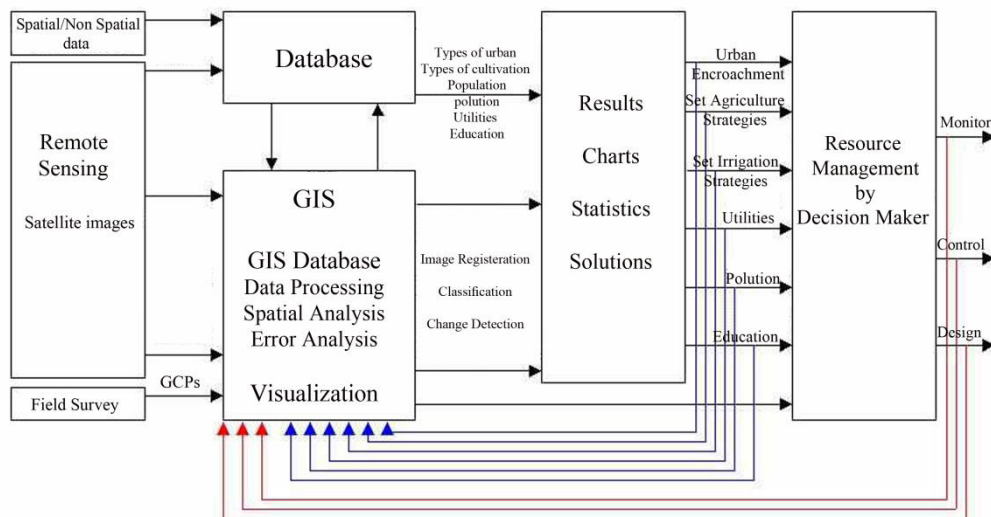**Figure 1 PROPSED METHODLDES**
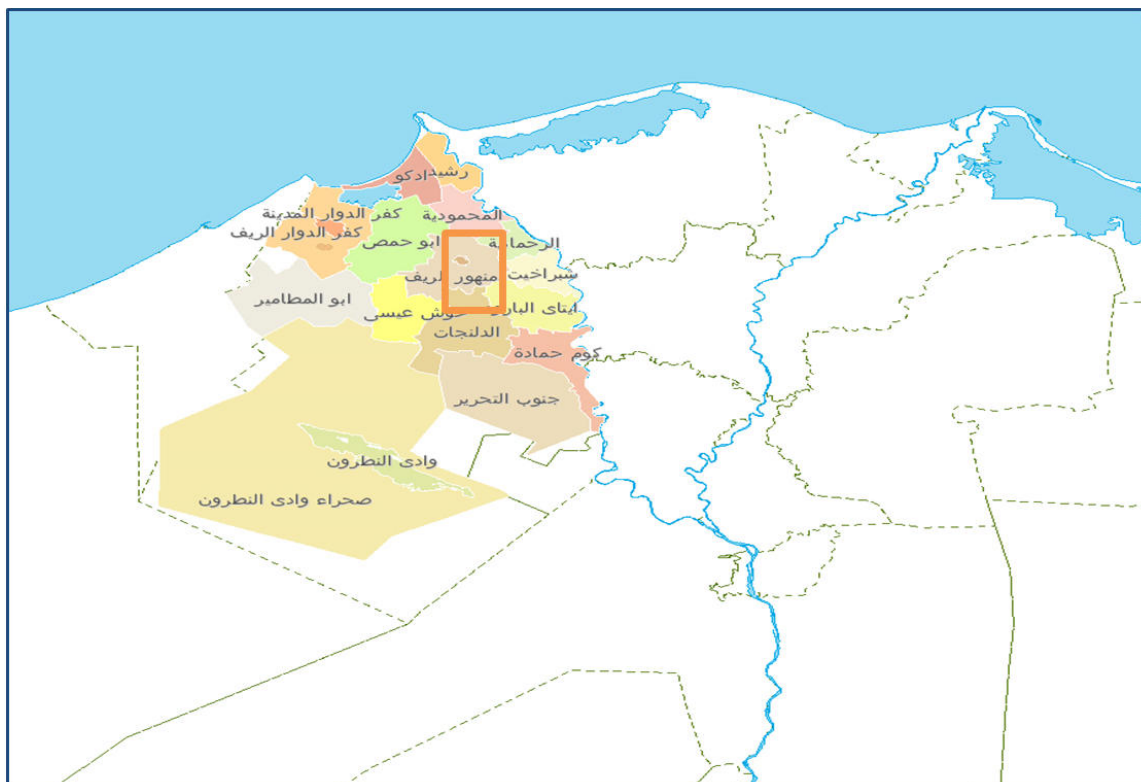

Figure 9 PROPOSED FRAMWOEK

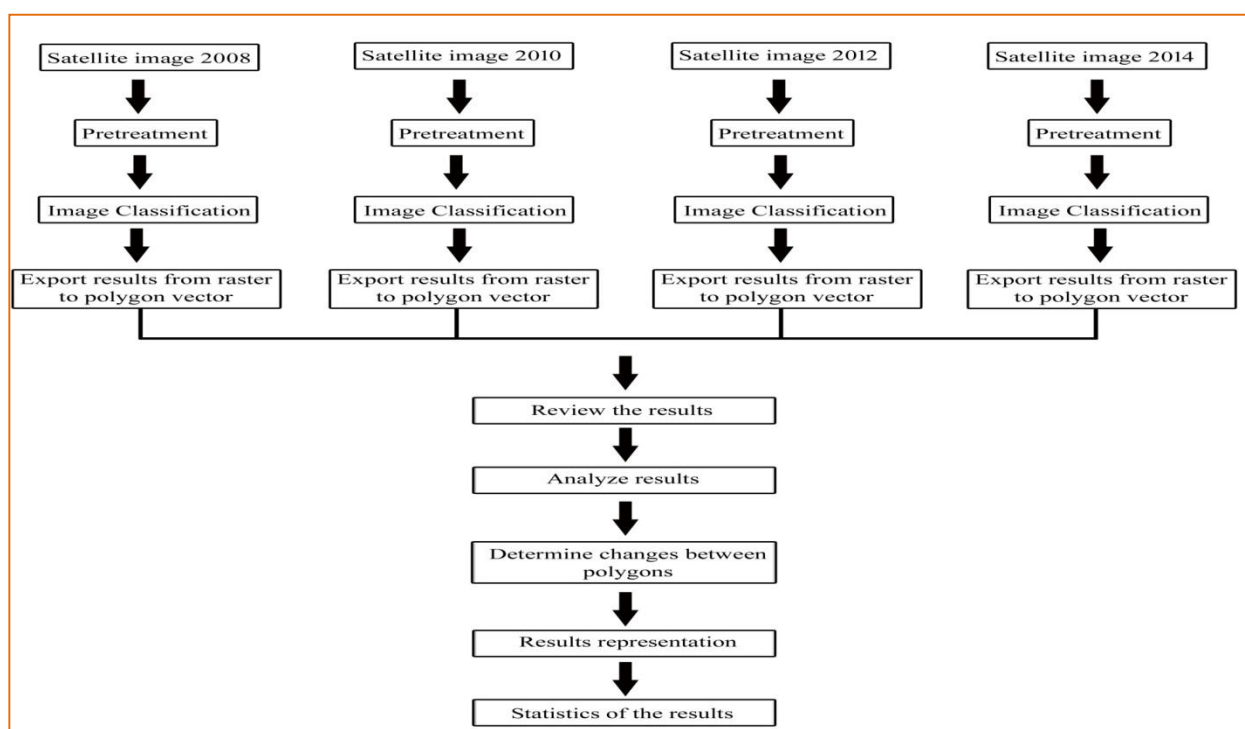**Figure 10 A map of Damanhur city- Beheira governorate Delta Egypt**

Figure 11 Methods of Change Detection Techniques
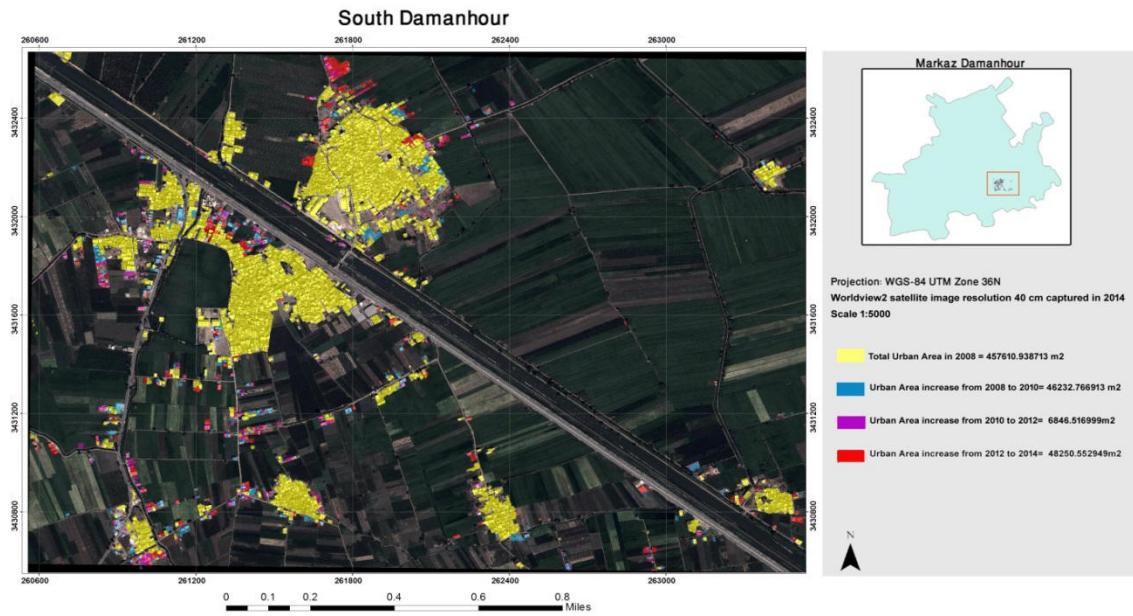
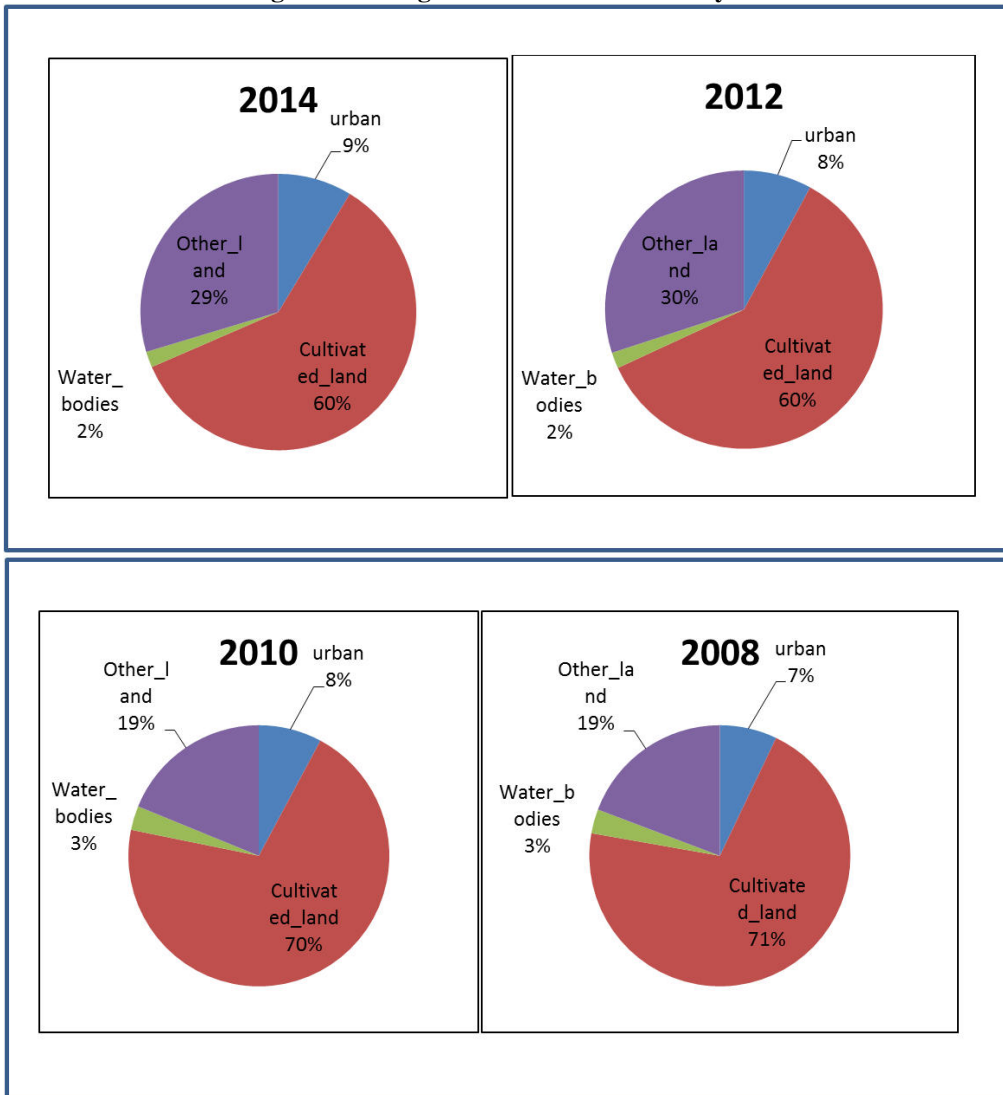**Figure 12 change detection between four years**

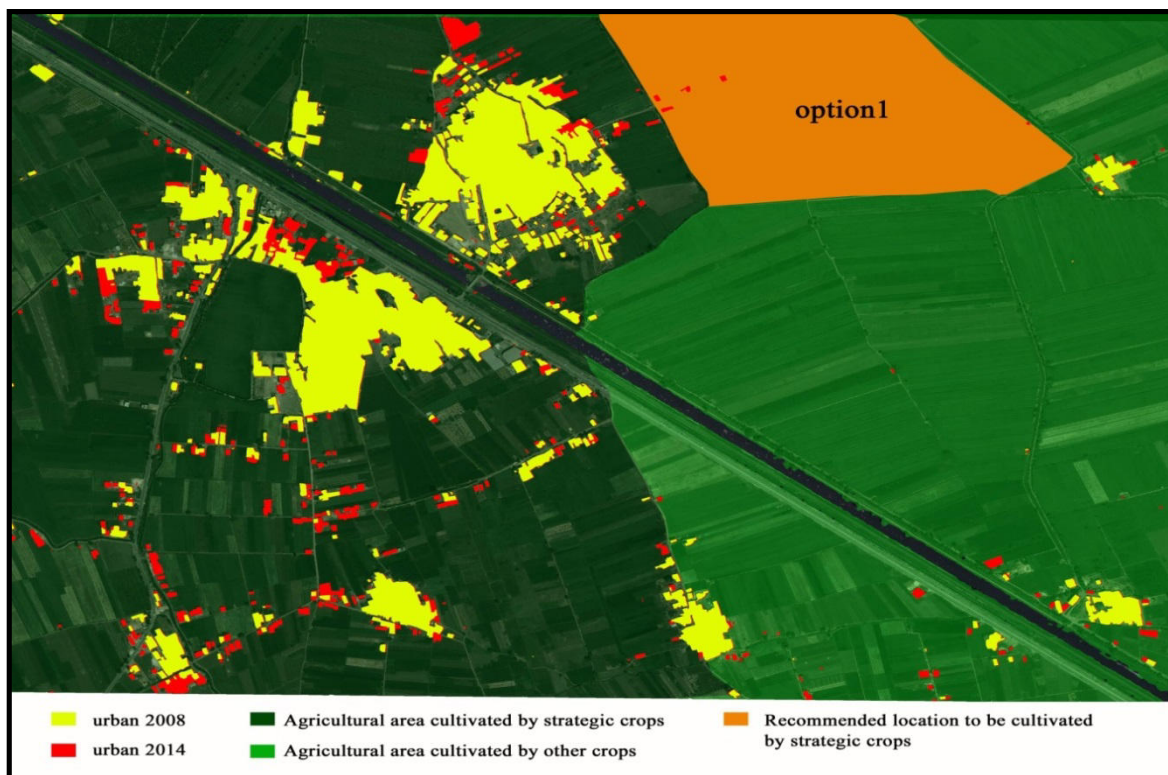

Figure 13 Areas% of land use classes (2008-2014)

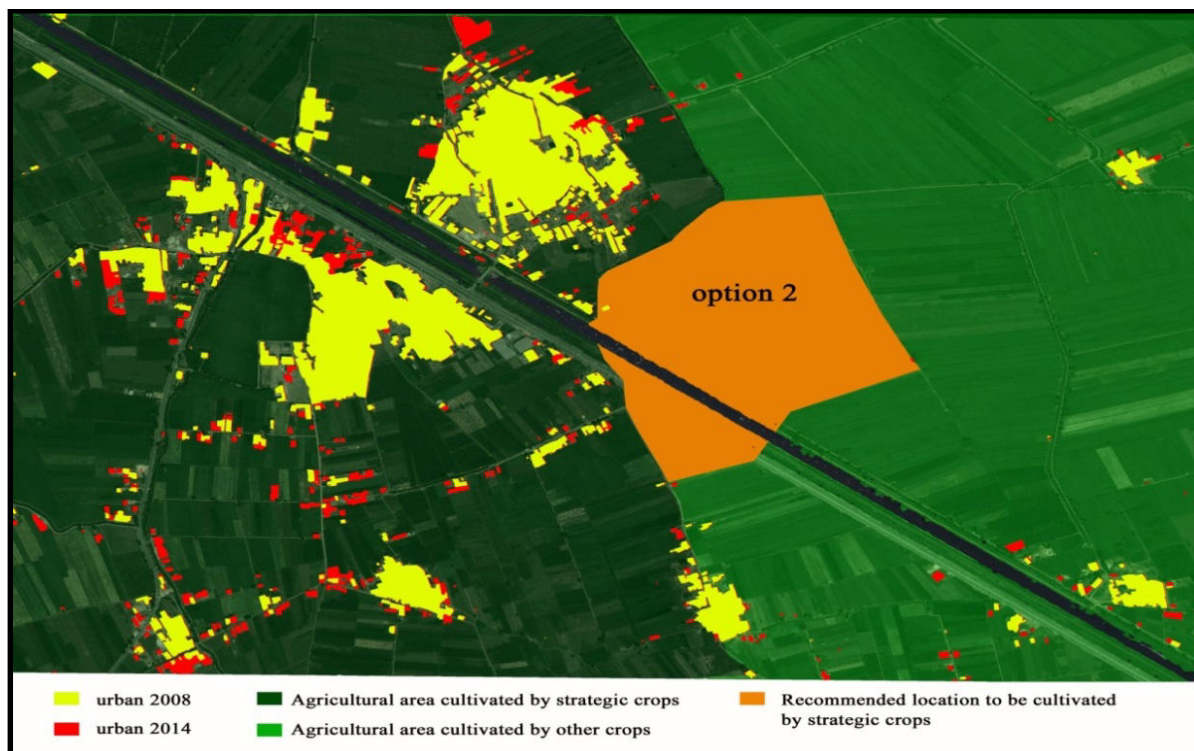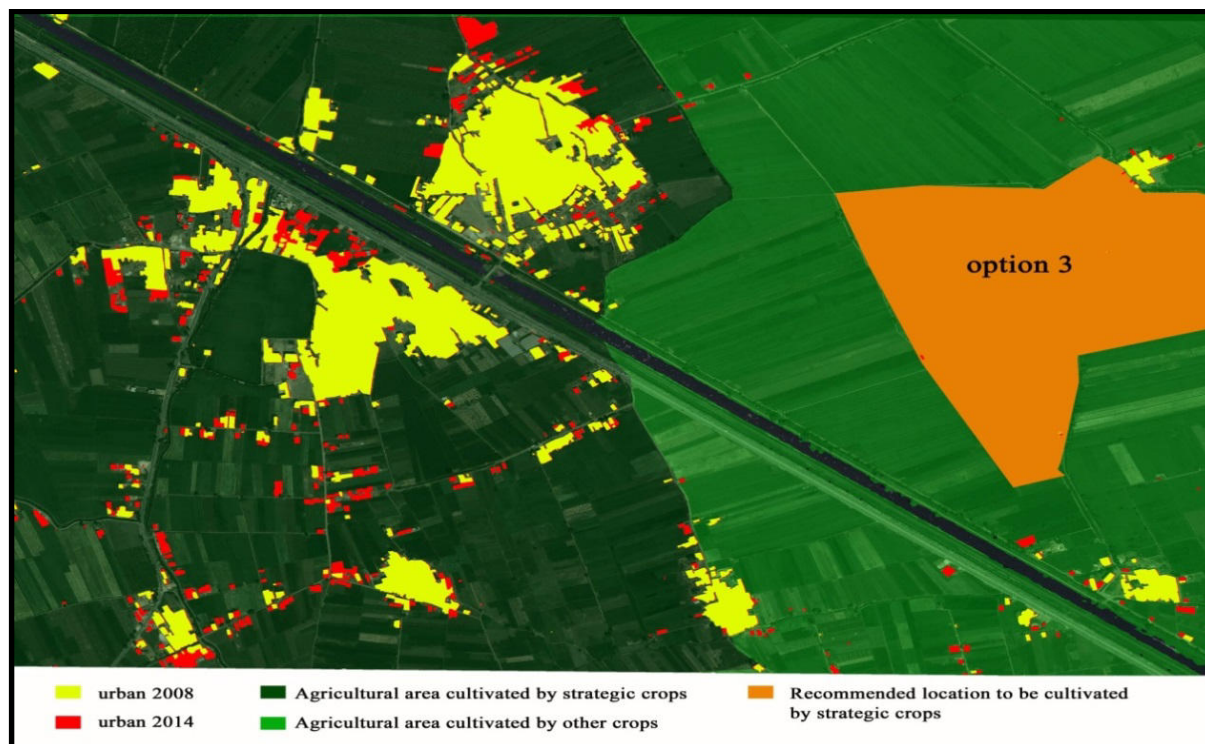**Figure 14 Recommendations solutions for Decision Makers option 2**

Figure 15 Recommendations solutions for Decision Makers option 2

Journal of Information Engineering and Applications
ISSN 2224-5782 (print) ISSN 2225-0506 (online)
Vol.5, No.2, 2015

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Figure 16 Recommendations solutions for Decision Makers option 2

Table 2 Specifications of QuickBird & WorldView2 images

Satellites Data Specifications		
Collection Systems	QuickBird	WorldView-2
Spatial Resolution	Pan 61 cm MS 2.44 m (at 450km)	Pan 46 cm MS 1.84 m (6 ft 0 in)
Swath Width	16.5 km	16.4 km
Average Revisit	2.4 days	1.1 days
Spectral Bands	Pan + 4 MS	Pan + 8 MS