

GIS-Based Smart Crowd Market Analysis for Smart Agriculture: A Conceptual Framework

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Abstract

Agriculture is one of the primitive activities in most countries, but relative to its age and necessity it is very backward, especially in developing countries. To increase the advantage of the people from agriculture modernization of the field is required. GIS-based smart agriculture analysis is used to have high temporal and precise location-based non-spatial information on the overall agricultural process. In the presented conceptual framework, most of the information is assumed to be collected from the customer to the main provider, which helps to eliminate third party role and enhances merit-based relation between supplier and customer. It also used for profitable market and spatial analysis. By integrating GIS-based market analysis and spatial analysis for smart agriculture it is possible to increase agricultural productivity.

Keywords

GIS;
Smart agriculture;
Smart market analysis

1. Introduction

Agriculture is one of the primitive activities in most developing countries. Many people of these countries are dependent on agriculture, but relative to its age and necessity it is very backward. This development limitation on agriculture can hinder the holistic development of the countries [Dagnaw, 2007].

Mostly due to developing countries, by 2030 the world population will become 8.5 billion [Richard, 2018]. This will lead to one of the major environmental impacts, i.e. famine. To this end, to increase the advantage of the people from agriculture, modernization of the field is required.

Making things smart is one of the hottest issues in the present world [Albino *et.al.*, 2015; Zhu et al., 2015; Abdoullaev, 2011; Hernández et al., 2012]. GIS based smart agriculture analysis is used to have high temporal and precise location-based nonspatial information on the overall agricultural process.

In the presented conceptual framework, most of the information is assumed to be collected from the direct customer to the main provider, which helps to eliminate third party role and enhances merit-based relation between supplier and customer. It also used for profitable market and spatial analysis.

2. Conceptual background

I. Geographic Information System (GIS) GIS is a system which is used to collect, analyze, store, manipulate and present spatial and non-spatial data [William, 2003; Gold, 2006]. Integrating these two models of data is the major advantageous aspect of GIS. Spatial data is a data with location information and non-spatial data is used to store descriptive information of the future.

GIS has five basic components;

A. Data: certainly, data is the most crucial component of GIS. GIS data can store spatial and non-spatial data. A spatial data can be represented in raster or vector format.

B. Hardware: is used to operate GIS. Regarding the digital tech-industry development, there are many sophisticated and advanced hardware's for GIS.

C. Software: there are different free and commercial software's, which help to run, analyze, interpret, store and present GIS data.

D. Procedure: a well designed procedure is necessary for successful GIS operations. It may be different based on time, objective, data, expert and other related factors.

E. People: are user of GIS; they run GIS software's, design and implement procedures, operate hardware's, and, collect and analyze the data. People are the main components of GIS.

For smart crowd market analysis, GIS based techniques are used to collect location-based demand and supply information. This makes both the supplier and demander to have a space and time-based information on their interest. On the other side, spatial analysis's can be performed in GIS techniques for more productive agriculture.

II. Smart crowd market analysis

The crowd is the people to interchange information. Analyzing this crowd market interest for agriculture is used to have more valuable agricultural products, so, smart market analysis is the analysis of the market based on the demand of the customer (Fig. 2). It has a great advantage for smart agriculture because it creates full information of the demander and it can also serve

as a platform to connect the supplier and the demander directly [Baker, 1984; Wolf et al., 2005].

The crowd; that provide information, and the platform; for information interchange and spatial analysis are the main aspects for smart market analysis.

III. Smart agriculture

Having smart agriculture can improve the productivity of the field and it can also solve lack of products in the market [McCarthy et al., 2011; Kaczan et al., 2013].

By its nature, agriculture is dependent on natural and manmade factors. Climate is among the major natural factors for agricultural productivity. On the other hand, the market of the product will become a challenging manmade factor, sometimes it is considered as a natural factor. So, analyzing different factors simultaneously for high agricultural productivity is necessary [Dinesh et al., 2015].

As an example, it is not a wise way to evaluate the productivity of agriculture using only the suitability of the climate, the market after production is also should be analyzed.

Figure 1: (a) wastage of the product (b) in uncontrolled poor climate condition there will be wastage of production inputs.

3. A proposed framework for GIS based smart crowd market analysis for smart agriculture Using the crowd as an information provider is used to collect the need of the people.

Having a smart method to analyze this demand and productivity of agriculture enables both the supplier and the demander to have an efficient approach for their target.

The proposed framework has a multidimensional approach to achieve its objective and it uses the phone number as an identifier (Fig. 4). Detail of the framework is discussed as follows.

A. Agricultural product supplier The agricultural product supplier could be an individual, organization or group of people who need to provide its products to the demander.

In different countries, nowadays there are small enterprises and other organizations that need to create a link between the supplier and the demander. This framework creates a direct link between the two ends.

Figure 2: A framework for GIS based smart crowd market analysis for smart agriculture.

B. Information

The supplier is expected to provide its product location information and the available products to the database.

The location information submitted from the agricultural product supplier can be dependent on the device that is supposed to provide the information. If the supplier can use smart devices, it is possible to submit the location information using the device GPS (Global Positioning System) otherwise, it is possible to send the location information via SMS (Short Multimedia Message).

In the case of smart devices the location information will be more precise, but if the supplier is using devices without location information, the best way is providing standard local names.

C. Spatial database

The spatial database is used to store both spatial and non-spatial data. The major spatial data for analysis is the location information. Product types and user addresses are among the non-spatial data.

D. Automated spatial analysis

Based on the provided location information the automated spatial analyst is used to execute different spatial analysis which increase the productivity.

a. Climate analysis: it is one of the major factors for productivity of agriculture. There will be built in data for this automated spatial analysis. This analysis can help to select the crop type for suitable climate condition, to arrange cultivation time and, for preparation of harvesting.

b. Fertilizer type: different soil

Types in different climate condition will need different fertilizer types. Analyzing fertilizer type based on specific location information increases the productivity of the fertilizer.

E. Agricultural product demander The demander is the crowd. Individuals, group of people or organizations can send their request using the prepared platform.

This information is stored in the spatial database for further analysis and it sends back the request result to the demander. The result contains information about the availability of the product, its location and address of the provider.

F. Result-I

The database returns Result-I to the supplier based on the demander request, thej supplier will be identified by its information provided to the database. The result will contain the contact address and location information of the demander, this enables the supplier to directly contact with the demander.

G. Result-II

Based on the location information collected from the supplier the result of the automated spatial analysis is returned to the supplier.

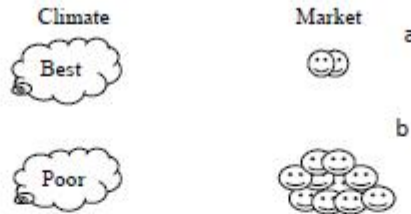
This result will contain climate analysis result and suitable fertilizer type for the specified location.

H. Request

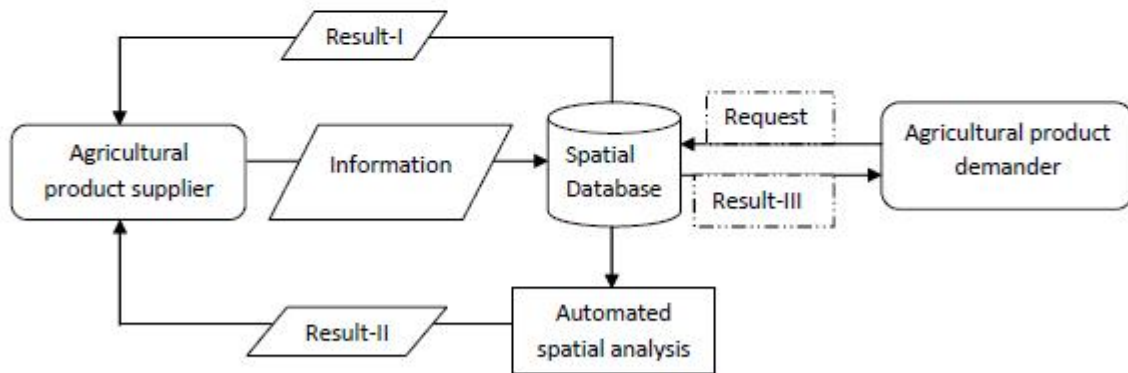
The supplier sends its request with detail contact information, including the location.

I. Result-III

This result helps the demander to know the availability of its need in the market and if it is available detail contact information of the supplier will be provided.



(a) Wastage of the product (b) in uncontrolled poor climate condition there will be wastage of production inputs.



A framework for GIS based smart crowd market analysis for smart agriculture.

Conclusion

This paper has developed a conceptual framework of GIS based smart crowd market analysis for smart agriculture. By integrating GIS based market analysis and spatial analysis for smart agriculture it is possible to increase agricultural productivity. The crowd is the main information source for market analysis and the automated spatial analyst provides scientific recommendations for agriculture.

Beside the demand of the market the suitability of spatio-temporal conditions have high impact on agriculture. The main components of this frame work are; a crowd sourcing platform, spatial database, automated spatial analyst and information disseminator.

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