Volume 1 No. 1, July 2011
International Journal of Science and Technology

©2010-11 IJST Journal. All rights reserved

http://www.ejournalofsciences.org

A Grid Based Decision Making Model for Agriculture Sector of Bangladesh

[1]Mohammad Saiedur Rahaman, [2]Mohammad Saidur Rahman[1], [3]Md. Zakaria Masud, [4]Arifur Rahman
[1, 2, 4] Department of Computer Science, American International University Bangladesh, Dhaka, Bangladesh
[3] Department of Accounting, American International University Bangladesh, Dhaka, Bangladesh

ABSTRACT

Despite advancement in technology, agriculture is still influenced by hostile weather and climatic conditions. Decision making in agricultural sector and the availability of data based on which the decision will be made is always a turning point for a country like Bangladesh. Agriculture sector of Bangladesh is already under huge pressure resulting from massive and rising demands for food, for natural disasters and for problems raised from reduction of agricultural land and water resources. The effect of global climate change makes the issue particularly vital. The decision making model proposed in this paper aims to provide the agricultural policy-makers and researchers of Bangladesh with the most state-of-the-art information available to forecast and reduce the warning of future food crises in Bangladesh so that timely intervention can be planned successfully.

Keywords: *Grid System, Decision Making Model*

1. INTRODUCTION

Bangladesh is a least developed country with a large number of populations which is becoming a threat to its limited agricultural resources. It seems extreme when natural disasters attack every year. Because after every natural disaster, the crisis for foods, cultivable lands become the prioritize issue for the policy makers and the farmers. But the lack of prior and timely knowledge solving these problems makes things worse.

Any useful agricultural information is always helpful to the policy makers. Usually agricultural information means the information about agricultural resources like land, water, fertilizer, seed, labour, climate, peoples related directly or indirectly to agriculture etc.

Besides, agriculture related information is highly needed in agricultural education, agricultural research & development and these information are also required by different level of users for different purposes like policy-makers, policy-planners, researchers, teachers and students, field workers and the farmers.

Moreover to implement the ideas properly there is also a need for research for further formulation and development of present data and to generate new and efficient policies. Research can be done academically and in a non-academic way as well. But for a large scale output from the data available researchers must require information they needed every now and then from various sources. But to integrate those resources from different source in an efficient and timely manner is a challenge to the respective community. Again it is not possible to make all the agricultural data centralized and as it will not be a successful idea, grid computing can be considered as the solution to virtually integrate all the agricultural resources without changing the original resources [9].

In this regard we can make the best use of technologies. Implementation of Grid in agro-decision making can be a great idea [9]. Generally a grid can be considered as a business strategy for computing infrastructure in which distributed resources can be integrated in to a large virtual computing system to ensure the flexibility in innovation and solve large scale problems [2]. Using different application of Grid computing, it is possible to maximize the current IT infrastructure and minimize the large amount of computing and decision making cost.

In [1] an information system database has been proposed by the Bangladesh Agricultural research Council. But still information gap is there about how this system can be utilized efficiently for agro-decision making in worst cases and sometimes in best cases.

In [3], the impact of climate change especially for flood in Bangladesh perspective is discussed which in an alarming issue for the future. The availability of an efficient decision making system could easily defend the situation in a great way.

In this paper, we propose a large scale grid based decision support system for Bangladesh which is able to make timely and efficient decision in minimizing the loss due to natural disasters, in increasing the crop production while reducing the waste of money replacing the traditional human dependent decision making process.

2. BACKGROUND & CURRENT SITUATION

There are a lot of solutions have been proposed in [4-8] that uses the core of information system concepts for agriculture. But these were situation dependent and area dependent. We know that agricultural sector comprises of

Volume 1 No. 1, July 2011
International Journal of Science and Technology
©2010-11 IJST Journal. All rights reserved
http://www.ejournalofsciences.org

lots of resources and possibilities. The nature of the resources is not fixed. But the proposal exists today cannot be used anywhere based on the demand because of their fixed nature.

Bangladesh was hit by Cyclone Sidr (Category IV) with wind speeds up to 240 kilometres/hour on 15 November 2007 causing major damage to local life, housing, livelihoods and productive infrastructure. A preliminary rapid UN assessment took place from 18 to 20 November 2007 and projected that 4.7 million people were affected and a further 2.6 million people are in need of immediate relief assistance including food, shelter and cash. Of the second category, 2.2 million were estimated to be in need of life saving relief food assistance for a period of approximately 3 months [11].

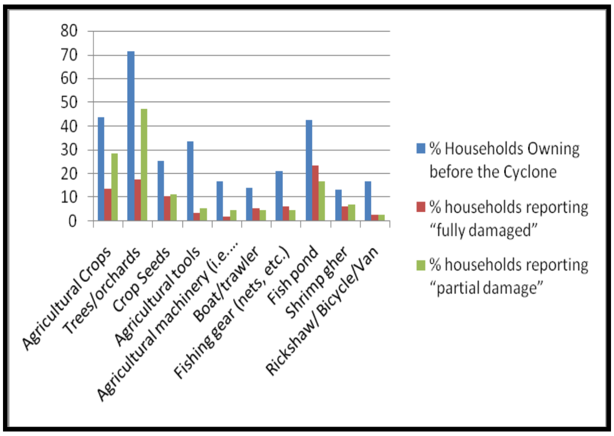

Figure 1: Damages to Agricultural Productive Assets [11]

This huge number of effected population could have been reduced if the authority like the government had any prior preparation to face a situation like this. If we look at the developed countries, it can be identified that those countries have faced worse natural calamity then SIDR, but the total number of effected population was much less. The reason behind this is the understanding and preparation to handle of these situations

3. PROPOSED MODEL

Data need to be accumulated and updated real-time from all related fields and areas. The reasonable field level infrastructure should be implemented starting from Thana level. Each Thana should have its own server accessible by different data loggers and updaters. These Thana based servers will be connected to the corresponding District Grid (DG). When any data is updated on the Thana server, which will also be synchronized to the Central Server and Backup System through the real-time internet connections.

On the National Grid, all the DGs will be connected to the Central Server(s) through the internet connection. Each District will maintain its backup system for all the corresponding Thana level servers. This way the total establishment cost will be reduced by not implementing individual backup system of each Thana.

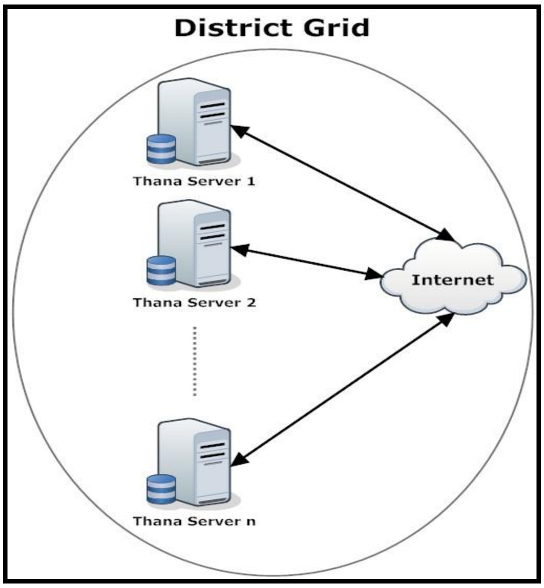

Figure 2: District Grid with Thana Servers

The whole infrastructure and investment will be useless if it cannot be used and utilized by the researchers and different group of people to take efficient decisions on time. So, the DG will be accessible to the Government Analyst(s), Private Analyst(s), Researcher(s), Weather Forecasting Unit, Data Output System(s), and also to the Data Input System(s). Moreover, the field level users like the Farmer(s) and Agro Business Distribution Channel members should be able to access the DGs for planning and optimum production decision(s).

The Architecture of the National Agricultural Grid System is discussed below:

- Data Input System is the infrastructure which will collect and log the data on the system from the field level.
- Researcher(s) will use these field level data to conduct their research and try to produce effective data or information that can be used by the government and private analysts.
- Government and Private Analyst will use the data to understand the current state of agricultural production and market demand to have a positive contribution to the total economy.
- Weather Forecasting Unit will contribute by giving weather information for the near and soft-term future which can be used by the researchers and analysts.
- There are different types of users who will use this system, and they have different demand of data also. Data Output System will be able to provide result generated by any query in a managed way, so that can be easily understood by other users to solve or make any decision.

©2010-11 IJST Journal. All rights reserved

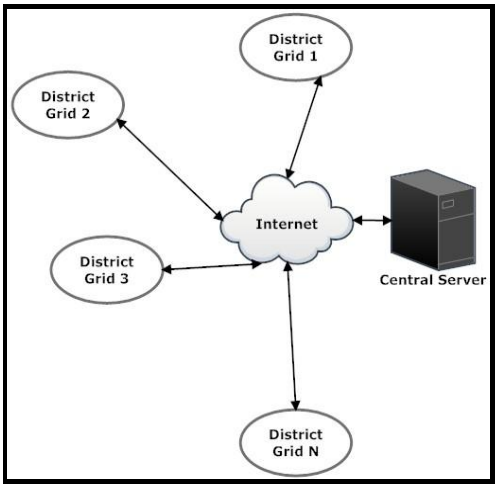

Figure 3: Architecture of the National Agricultural Grid System

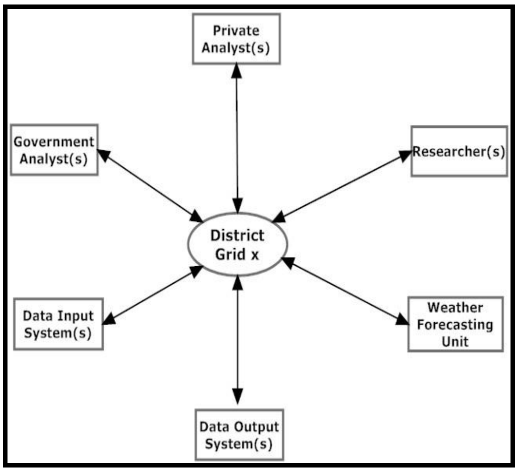

Figure 4: Functional diagram of District Grid(s)

4. COST-BENIFIT ANALYSIS

The following table shows the cost benefit analysis of our proposed model to exhibits its efficiency. Here mainly we are considering two costs: server establishment cost and cost related to its maintenance. We found three most wanted beneficial areas from our model: savings from precautionary measures, savings from post effected measures and benefits to the field level users.

The benefit figures are given here considering only one cyclone (SIDR) whereas; in 10 years it will be multiplied with several other natural digesters. Moreover, savings of human life can override any costs associated with the proposed model. However, considering only the quantifiable values of expected benefits are also proving the model a feasible one. It has also been assumed that, by taking proper measures, this model will confirm 60% savings in all aspect. Even if this model can confirm 1% savings in all aspect, the model is feasible as at 1% level cost is still much lower than the expected benefits.

Cost	Amount	Benefits	Amount [20% value addition]	Amount [1% value addition]
Server costs	$0.125*	Savings from precautionary measures	340***	17
Operating costs	10**	Savings from post effected measures	28.70****	1.435
		Benefits to the field level users		

*for 500 thana @ $250 per server per thana
** $2,000 per year per thana
***60% of $1.7 billion [12]
**** 60% of $142 million foreign aid plus 60% of $1.5 million [13]

Table 1: Expected Cost and Expected benefit analysis for 10 years [Amounts are in million]

For further and concrete understanding of the proposed model a summary of natural disasters of last 30 (1980 – 2010) years is given below [14]:

No of events:	234
No of people killed:	191,836
Average killed per year:	6,188
No of people affected:	323,480,264
Average affected per year:	10,434,847
Economic Damage (US$ X 1,000):	17,072,500
Economic Damage per year (US$ X 1,000):	550,726

Table 2: summary of natural disasters of last 30 (1980 – 2010) years

So 10 years average economic damage could be 5,507,260 thousand. A savings of 1% of this figure [USD 55.07 million] can also prove the feasibility of the model. However, benefits to the field level users will also add positive value in favour of the model.

5. CONCLUSION

One of the volatile but sensitive sectors is this agricultural sector. Here a single decision of timely irrigations or proper fertilization has a long term effect on the local market and national economy. So, to make the positively effective decision, and to provide the food to the whole population, we need to implement and use an effective Information Technology infrastructure like the above proposed system, with proper participation of the stakeholders. Without a centrally managed system like this, a over populated country like Bangladesh will face real hardship just to provide food for the population.

©2010-11 IJST Journal. All rights reserved

REFERENCES

[1] http://www.barc.gov.bd/IS_Database.htm

[2] "Grid Computing & Government Sector", Ronald W. Watkins, WW Business Development Executive – Public Sector.www-05.ibm.com/.../Grid-Computing-and GovernmentSector.pdf

[3] "Impact of climate change on riverine flooding in Bangladesh" Ahamadul hasan, Jahir Uddin, Anisul Haque

[4] Tapankumar Basu, Vijaya R. Thool, Ravindra C. Thool, and Anjali C. Birajdar, "Computer Based Drip Irrigation Control System with Remote Data Acquisition System," in Proc. 4th World Congress Conf. Computers in Agriculture and Natural Resources, USA, July 2006.

[5] Y. Kim, R.G. Evans, and W. Iversen, "Remote Sensing and Control of Irrigation System using a Distributed Wireless Sensor Network," IEEE Trans. Instrumentation and Measurement, 2007.

[6] W. Zhang, G. Kantor, and S. Singh, "Integrated Wireless Sensor/Actuator Networks in an Agricultural Application," in Proc. 2nd ACM Int'l Conf. Embedded Networked Sensor Systems (SENSYS 04), ACM Press, 2004, pp. 317.

[7] T. Wark, P. Corke, P. Sikka, L. Klingbeil, Y Guo, C. Crossman, P. Valencia, and D. Swain, "Transforming Agriculture through Pervasive Wireless Sensor Networks," IEEE Pervasive Computing, pp. 50–57, April-June 2007.

[8] A. Baggio, "Wireless Sensor Networks in Precision Agriculture," in Proc. ACM Workshop Real-World Wireless Sensor Networks, 2005.

[9] http://narc.naro.affrc.go.jp/jyoho/GCL/index.html

[10] M. Calin, M. Craus, F. Filipov, C. hiruta;Involving Grid Computing in Agricultural research

[11] Food Security Assessment, SIDR Cyclone – Bangladesh, United Nations World Food Programme and Partners, December 2007.

[12] http://reliefweb.int/node/283121

[13] http://www.asianews.it/news-en/Hunger-looms-over-Bangladesh-after-Sidr-10846.html

[14] EM-DAT: The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Bel. Data version: v11.08, 2010. http://www.emdat.be/