PROCEEDINGS

2nd International Conference on Adaptive and Intelligent Agroindustry (ICAIA)

September 16 - 17, 2013

IPB International Convention Center
Bogor - Indonesia

Organized by:

Department of Agroindustrial Technology

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Indonesian Agroindustry Association

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   (Head of Department of Computer Science, IPB)

PROCEEDINGS
2nd International Conference on Adaptive and Intelligent Agroindustry (ICAIA)
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Organized by :

Departement of Agroindustrial Technology, Faculty of Agricultural Engineering and Technology Bogor Agricultural University

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WELCOMING ADDRESS

Prof. Dr. Ir. Nastiti Siswi Indrasti
Head of Agroindustrial Technology Department
Faculty of Agricultural Engineering and Technology
Bogor Agricultural University

On

Second International Conference on Adaptive and Intelligence Agroindustry (2nd ICAIA)

Bogor, September, 16 – 17, 2013

Assalamu'alaikum Warohmatullahi Wabarokatuh
In the name of Allah, the beneficent and the merciful,

Distinguish Guest, Ladies and Gentlemen
Let me first thank you all for accepting the invitation to participate in this 2nd International Conference on Adaptive and Intelligence Agroindustry (ICAIA). In particular I would like to thank Rector of IPB (Institut Pertanian Bogor/Bogor Agricultural University) Prof. Herry Suhardiyanto for supporting this event as part of the series academic event in celebrating the 50th Anniversary of Bogor Agricultural University.

In fact, the idea of organizing this conference was the continuation of the International Workshop on Computational Intelligence and Supercomputing Technology for Adaptive Agroindustry held by the Department of Agroindustrial Technology, Bogor Agricultural University last year.

Professor Kenneth A De Jong from George Mason University, US has successfully conducted joint international research with some staff from the Department of Agroindustrial Technology and Department of Computer Science, Bogor Agricultural University. The research aims to develop an integrated and intelligent system (namely SMART-TIN©) for the design of adaptive agroindustrial system in order to achieve a sustainable agroindustry that can mitigate global climate change and at the same time secure food, water, energy and natural medicine supply.

We are certainly proud to have been able to assemble this event in IPB, Bogor. The range of participants and audience at this conference is precisely something I would like to stress. The main goal of the conference is to provide an effective forum for distinguished speakers, academicians, professional and practitioners coming from universities, research institutions, government agencies and industries to share or exchange their ideas, experience and recent progress in Adaptive and Intelligent Agroindustry.

Distinguish Guest, Ladies and Gentlement,
Global climate change is the most challenging problems for us today and in the near future. This global change in our climate can lead to the shortage of the food, water, bioenergy and natural medicine that will affect the quality of human life. Many studies indicate that the threat of food, water, bioenergy and natural medicine crisis due to global climate change still worries our society. This problem can be solved by the development of agroindustry, i.e. an interrelated value chain entities from farming, to agro-processing industry and then to the end-customers. In fact, the design of agroindustry is complex and involves many factors and large data bases and more importantly, needs a good intelligence to process data and information to good decisions. Therefore, the way to design and manage agroindustry should be improved in order to meet the design objectives.

Agroindustries consume quite significant amount of energy on one side, on the other side they generate sizable amount of industrial wastes and its utilization as a captive energy resource is a kind of potential. Based on our study, a plywood industry with the production capacity of 200.000 m^3/year could generate 32 percentage of solid waste. If this amount of waste used as an energy alternative, it may result on the saving of 131.037.768.597 rupiah per month. Similar to plywood industry, sugarcane industry with the production capacity of 480 ton per hour could generate 154 ton per hour of waste (bagasse) and this amount of waste contribute to the saving of energy consuming by 19.250 Kwh. Recent study we conducted, indicated that cassava starch industry may contribute to a significant amount of waste. It has also potential usage as an energy resource. Based on our study the conversion of its waste into energy will contribute to the saving of energy usage of 4100 liter biogas per ton material.

The three industries mentioned is only examples of how potential the role of agroindustrial waste as an alternative resource in replacing the conventional energy resource as its presence will be significantly reduced. The new, incremental energy contributions that can be obtained from waste biomass will depend on future government policies, on the rates of fossils fuel depletion, and on extrinsic and intrinsic economic factors, as well as the availability of specific residues in areas where they can be collected and utilized. All of these factors should be in detail examined to evaluate the development of the industrial waste contribution. Hope this conference will also discuss this issue in more detail as it is an important matter for all of us. We should no more think just how to produce high value product but it is also necessarily important how to keep our live in good quality by understanding following old saying…” only when the last tree has been cut, only when the last fish has been angled, and only when the last river has been polluted, then we realized that we could not eat money”.

I do not to take up any more of your time with these opening remarks. Let me simply thank you once again for sharing your thoughts with us. Here’s wishing every success for the conference. May Allah bless all of us.

Thank you for your kind attention,
Wassalamu’alaikum Warohmatullahi Wabarokatuh

AGENDA of
2nd International Conference on Adaptive and Intelligent Agroindustry (ICAIA)

Time	Activities	Room
Day 1 (16 September 2013)		
08.00 – 09.00 (60’)	Registration	
09.00 – 10.00 (60’)	Opening Ceremony • Welcoming Address: Prof. NastitiSiswiIndrasti (Head of Dept TIN, Fateta, IPB) • Conference Opening: Prof. HerrySuhardiyanto(Rector of IPB) o ABET Certification announcement and short ceremony o Launching International Double Degree Master Program in Innovation and Technopreneurship in Cooperation with University of Adelaide, Australia o Soft-launching Master in *Logistik Agroindustri* (Agroindustrial Logistics)	Ballroom
10.00 – 10.45 (45’)	Opening Speeches: Prof. IrawadiJamaran (Agroindustry Guru, IPB: 25’) Prof. Eriyatno (Industrial and System Engineering, IPB: 20’)	Ballroom
Session 1		
10.45 – 11.15 (30’)	Keynote Speech Dr. YandraArkeman (IPB)	Ballroom
11.15 – 12.00 (45’)	Keynote Speech Prof. Kenneth De Jong (George Mason University, USA)	Ballroom
12.00 – 13.30 (90’)	Lunch Break	
Session 2		
13.30 – 15.15 (105’)	Moderator: Prof. EndangGumbiraSa’id (IPB) Invited Speakers (1-4) (4 x 20 minutes) Discussion (25 minutes) Tentative Schedule: Prof. Kim Bryceson (Australia), Prof. SyamsulMa’arif (IPB), Prof. KudangBoro Seminar (IPB), Prof. HaruhiroFujita (Japan)	Ballroom
15.15 – 15.45 (30’)	Break	
15.45 – 17.30 (105’)	Moderator: Prof. Marimin (IPB) Invited Speakers (5-8) (4 x 20 minutes) Discussion (25 minutes) Tentative Schedule: Dr. Gajendran (UK), Prof. Noel Lindsay (University of Adelaide), Dr. KuncoroHartoWidodo (UGM), Prof. UtomoSarjonoPutro (ITB)	Ballroom
Day 2 (17 September 2013)		
08.00 – 08.30 (30’)	Registration	
08.30 – 10.15 (105’)	Moderator: Prof. KudangBoro Seminar (IPB) Invited Speakers (9-12) (4 x 20 minutes) Discussion (25 minutes) Prof. Egum (IPB), Prof. Marimin (IPB), Dr. AgusBuono (IPB), Dr. HeruSukoco (IPB)	
10.15 – 10.30 (15’)	Coffee Break	
10.30 – 12.30 (120’)	Parallel Session 1 Moderator: Prof. Fujita (7 paper @ 15 minutes) Discussion (15 minutes) Parallel Session 2 Moderator: Prof. Ono Suparno (7 paper @ 15 minutes) Discussion (15 minutes) Parallel Session Moderator: Prof. Suprihatin (7 paper @ 15 minutes) Discussion (15 minutes)	

12.30 – 13.30 (60’)	Lunch Break	
13.30 – 15.00 (90’)	Open Discussion (Open Forum) with Prof. Kenneth De Jong Topic: Foundations and Applications of Genetic/Evolutionary Algorithms	Ballroom
15.00 – 15.30 (30’)	Conference Closing	Ballroom
15.30 – 17.00 (90’)	Indonesian Agroindustry Association (AGRIN) National Congress (PIC: Prof. Suprihatin)	Ballroom
17.00 – 17.45 (45’)	Refreshment and Closing of AGRIN National Congress	Ballroom

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SMART-TIN© : An Integrated And Intelligent System For The Design Of Adaptive Agroindustry (A Conceptual Framework)

Yandra Arkeman

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ABSTRACT

Global climate change is one of the most challenging problems for us in today and in the near future. This global change in our climate can lead to the shortage of the food, water,bio-energy and natural medicine that will affect the quality of human life. This problem can be solved by the development of agro-industry. The main cause is that the development of agro-industry in Indonesiais inappropriate due to lack of system design process that takes into considerationthe issue of global climate change. Moreover, agro-industry in Indonesia is designed partially and the design process is not supported by the use of modern computation and information technology. In fact, the design of agro-industry is complex and involves many factors and large data-bases and more importantly, needs a good intelligence to process data and information to good decisions. Therefore, the way to design and manage agro-industryin Indonesia should be improved in order to meet the design objectives. Hence, this research aims to develop an integrated and intelligent system (namely SMART-TIN©) for the design of adaptive agro-industrial system in order to achieve a sustainable agro-industry that can mitigate global climate change and at the same time secure food, water, energy and natural medicine supply. Due to the complexity and scale of the problem, the development of SMART-TIN© in this research will be supported byadvanced computing technology, both in software and in hardware. By developing and then applying SMART-TIN© in real-life the agricultural and agro-industrial system in Indonesia can be designed and then managed well so the threat of global climate change and its negative impact to food, water, natural medicine and bio-energy supply can be reduced to the lowest level.

Keywords:adaptive agroindustry, artificial intelligence, global climate change

1 INTRODUCTION

Global climate change is becoming challenging for us. It has a severe impact in almost every domain of our lives, especially in agro-industry. The impact of global climate change in agro-industry will affect the food, water, medicine and energy supply in the world. Thus, there is a need to study the sustainability of food, water, natural medicine and bio-energy supply with respect to global climate change for today's and tomorrow's agro-industry.It should be noted that agro-industry in this paper can be defined in the broader and narrower context. In the broader context, as used in this research,agro-industry is defined as an inter-related value chain from farming on the up-stream, move to agricultural product processing industry on the middle-stream and then to the endcustomers on the down-stream. On the contrary, in the narrower context, agro-industry is defined as the agricultural product processing industry (in this research isreferred to agro-processing industry) that produce a widerange of products such as food, bio-energy and natural medicine, to mention only a few.

The problem facing by agro-industry today is notadaptive to the global climate change. As consequences, greenhouse gasses emissions from agricultural systems increase, many new and unknown pest and plant diseases attacking paddy fields and crop plantation, clean water supply decreases, to mention only a few negative impacts of global climate change. The root-cause of these problems is that inappropriate design of agro-industry due to lack use of advance computing technology. In fact, in designing agro-industry we need a fast and high-performance computing technology. For examples, for land-use planning we need to consider many objectives and constraints, such as regional or global climate (temperature and rainfall for instance), agricultural systems, agro-processing analysis, demographic factors, greenhouse gasses emissions, carbon sequestration and many more and the computation process can't be done by using conventional computing technology.

This research is aimed to develop anintegrated and intelligent system (namely SMART-TIN©) for the design of an adaptive agro-industrial system in order to mitigate global climate change and at the same time to secure food, water,natural medicine and bio-energy supply for the people. As the problem to be tackled involves large-scale and complex data and models, so the use of advanced computing technology, both in hardware and software, is very essential.

Although, there were many research works on or related to agro-industrial system designusing advanced methods such as agent based model (ABM) and Bayesian Belief Network (BBN) such as reported by Bryceson and Smith (2008), van der Vorst et.al (2007) and Silva and Filho (2007), most of them did not consider global climate change as an important factor in the development of agro-industry.The other researchersused conventional techniques for agro-industrial system design, such as linear programming (Apaiah and Hendrix, 2004), dynamic programming (Gigler, et.al 2002), mixed integer linear programming (Gunnarson et.al, 2004) or standard single/multi objective genetic algorithms (Stewart et.al, 2004; Mardle and Pascoe, 2000; Mayer et.al, 2001; Matthew et.al., 2005)which are inappropriate for complex adaptive systems. Therefore, this research is aimed to alleviating those drawbacks and creating a new innovation for the advancement of agroindustrial and computing technology.

The unique feature of this research is that it addresses some important issues in adaptive agroindustry. In addition, this research integrates the food, water, bio-energy and natural medicine models so it can tackle the problem more comprehensively and can answer the following research questions: (1) Does climate change really happen? What is climate change prediction for the next 30-50 years? How should we mitigate this climate change? (2) What are the negative (and positive if any) impacts of global climate change for agroindustry? What are its impacts to food, water, bio-energy and natural medicine supply as well as human life? (3) How to design agroindustry that adaptive to and can mitigate global climate change? Can also this adaptive agroindustry secure food, water, bio-energy and natural medicine supply? What computing technology should be applied to design such an adaptive agro-industry and how?

2 OBJECTIVE

The objective of this research is to develop an integrated and intelligent system (namely SMARTTIN©) for the design of an adaptive agro-industrial systems in order to mitigate global climate changand securing food, water, natural medicine supply and bio-energy supply. The unique feature of SMART-TIN© is that it uses some advanced computing technology tools such as computationalintelligence, multi-objective optimization, adaptive systems, agent based modeling, parallel processingand super-computer.

3 METHODOLOGY

3.1 Research Methodology

The methodology used in this research is scientific method to solving complex decision making problems. The steps of scientific approach according to Taylor (2007) and adopted for this research are: (1) Observation: This step is intended to investigate real world problems in agro-industrial systems, (2) Problem definition: In this step, a formal statement of agro-industrial system design problem will be formulized, (3) Model construction: A valid model of agro-industrial system will be constructed at this step, (4) Model solution: This step is for finding the optimum solution(s) for the model developed. New techniques such as Computational Intelligence (CI) and other Advanced Computing Technology will be used for solving the complex and large-scale agro-industrial system design problem, (5) Implementation. If the solution of the model is acceptable for decision maker, the next step is implementing that solution in the real world. An appropriate implementation plan should be presented to the decision maker.

The framework of methodology used in this research is presented in Figure 1. It can be seen in Figure 1 that the solution to the mathematical model (step 4) is to be done by Computational Intelligence techniques i.e. artificial neural networks (NN), genetic algorithms (GA) and fuzzy systems (FS). The logical steps to develop such Computational Intelligence techniques are: (a) Conduct deep literature survey on NN, GA, FS, (b) Develop the most appropriate architectures based on several important criteria such as its suitability, robustness, effectiveness and efficiency, (c) Observe in details the characteristics of developed techniques. Some further improvements and advancement (such as parallelism) will be needed to increase the algorithm performance, (d) Implementation, (e) Test the system performance, and (f) Apply these techniques to solve the previously constructed mathematical models that resulted from step 3.

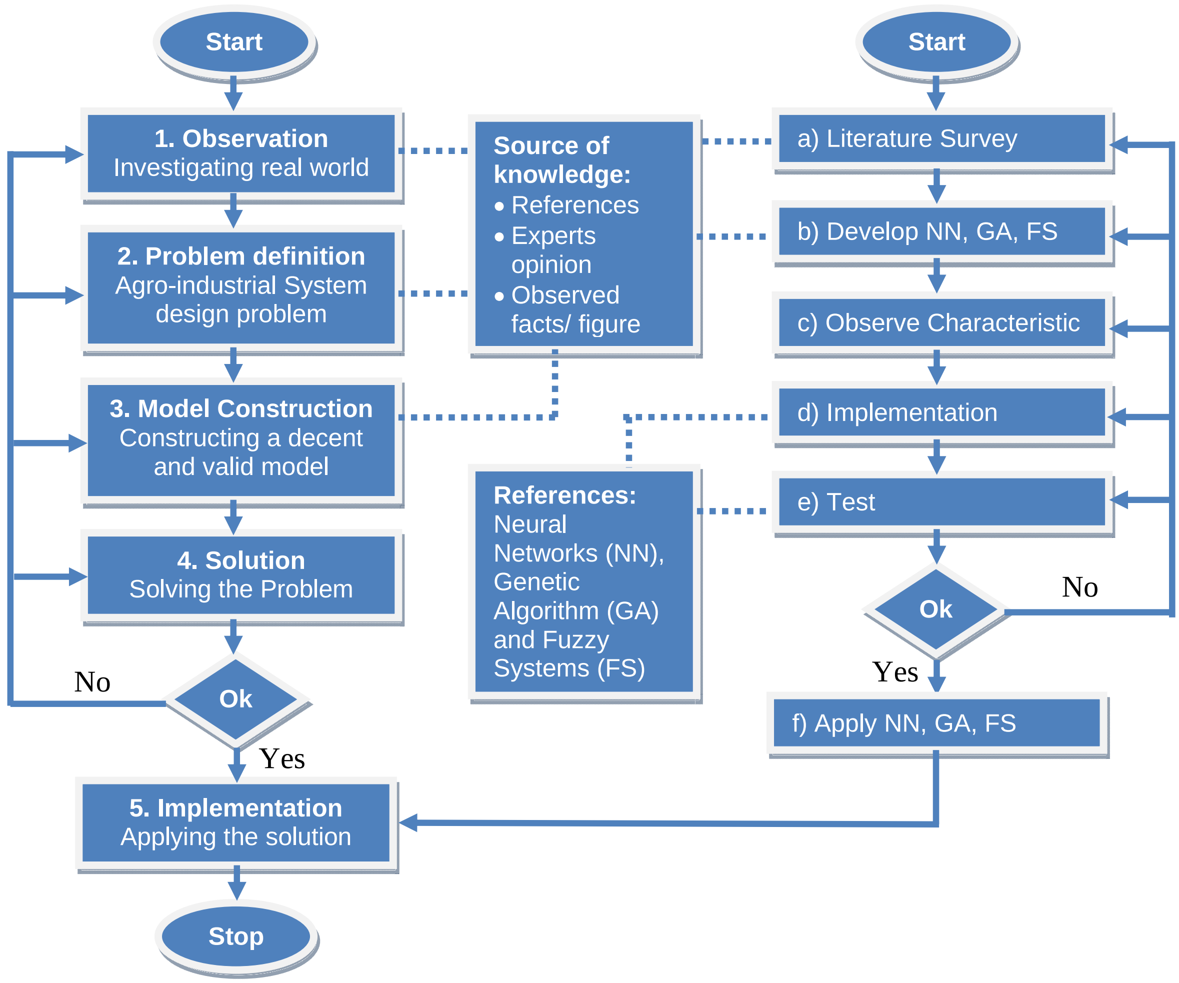

Figure 1: Research Methodology

3.2 Information Flow and Process Design of SMART-TIN©

SMART-TIN© that will be developed in this research consists of a data-base, a knowledge-baseand 7 modules, i.e.: (1) Neural Networks for Climate Prediction, (2) Simulation and Animation, (3)MultiobjectiveGenetic Algorithms for Land Use Planning, (4) Fuzzy Systems for Agro-industrial DevelopmentStrategy, (5) Neural Networks for New Product Development, (6) Geographical Information System, and (7) Fuzzy Systems for Decision Control. Theconfiguration of SMART-TIN is presented in Figure 2.

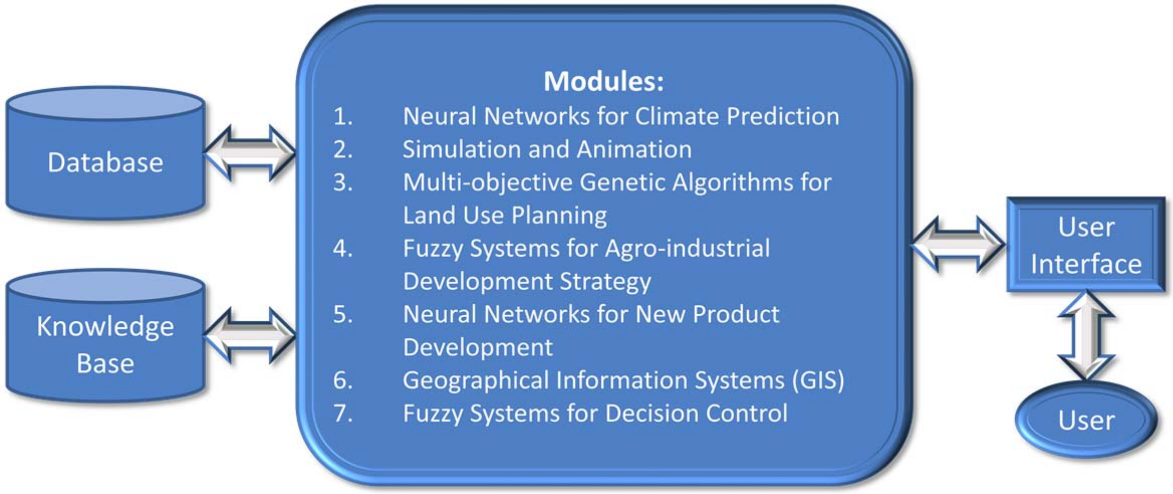

Figure 2: The Configuration of SMART-TIN©

SMART-TIN© will be implemented in web base using computer programming language PHP under any browser.

Information Flow and Process Design of SMART-TIN© is presented below:

- Step 1:
  Climate prediction using artificial neural networks (Module 1). The inputs for prediction are historical time-series data of climate in the region, population growth rate, agriculture land conversion, number of industry, vehicle and industry growth rate, etc. The outputs of prediction are temperature and rainfall for the next 30-50 years in South East Asia and Indonesia
- Step 2:
  The effect of this global climate is then presented in the form of computer simulation and animation, to show the negative impact of global climate change to human life. A simulation and animation program (Module 2) will be developed for this purpose.
- Step 3:
  Based on the information about global climate change and its impact above, we then design an adaptive agro-industrial system using some module 3 to module 5 in SMART-TIN© . This adaptive agro-industrial system is develop to mitigate global climate change and securing food, water, natural medicine and bio-energy at least for the next 30-50 years. The information obtained from these modules are:
  - What crops should be planted and where? What are the roles of those crops in mitigating global climate change reduce greenhouse gas emissions and increase carbon sequestration? What are the roles of those crops in securing food, water, natural medicine and bio-energy? How to plan the land-use optimally in order to prevent conflict of interest (e.g. Food vs. Fuel)? To answer these questions we need to develop genetic algorithms for land use planning (Module 3) with multiple objectives such as economic return, carbon sequestration, land erosion, to mention only a few.
  - What agro-processing industry should be developed to gear economic growth on one hand and to maintain sustainability on the other hand? Where or in what region? What are premium products for each region in Indonesia? What other new products should be launched and how? To answer these questions we need to develop Module 4, i.e. Fuzzy Systems for Agro-industrial Development

Strategy, and Module 5, Neural Networks for New Product Development. These two modules will create a robust knowledge-base for SMART-TIN©
    - The above decisions will be made based on data-base on crops, land-use, consumption level, climate, etc that have been available in commercial Geographical Information Systems (GIS) that is referred to as Module 6 in this research.
- Step 4:
  Simulation and animation to show the significant improvement of our future after the implementation of adaptive agro-industrial system designed by SMART-TIN©. In this scenario, the impact of global climate change will be reduced to the minimum level so as the supply of food, water, natural medicine and bio-energy is sustainable (redo Module 2 with different scenario)
- Step 5:
  SMART-TIN© will also be designed to have capability to response to any possible changes during the interval design or planning horizon by performing WHAT-IF analysis. In addition, SMART-TIN© will also have the capability to revise and fine-tune the decisions for better results. A Fuzzy Systems for Decision Control (Module 7) is developed in this research for that purpose.

4 RESULT

At this second of three-year research, most of the modules have been developed. However each module is still running partially, so the next step of the research is to integrate the modules. The other issue has to be addressed is the parallelization of the modules. As indicated in our preliminary survey that this research will involve large data-base and knowledge-base. So, to speed-up the process as well as to increase the intelligence of the system the software have to be run on the parallel structure. The details of each module of SMART-TIN© is presented in the paragraph below.

SMART-TIN© is implemented in web base using computer programming language PHP under any browser. The user-interface of SMART-TIN©can be seen on Figure 3.

Figure 3: SMART-TIN© on web base

To access any modules, the user just go on to tab Modules. The tab modules can be seen on Figure 4.

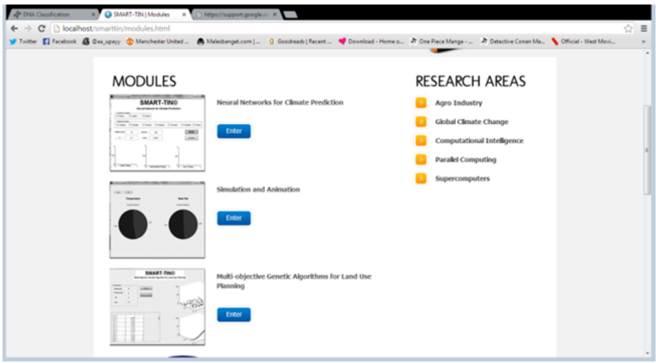

Figure 4: Tab modules on SMART-TIN©

On the first module there is Neural Network for Climate Prediction. When user input the data, the result will be seen like in the Figure 5.

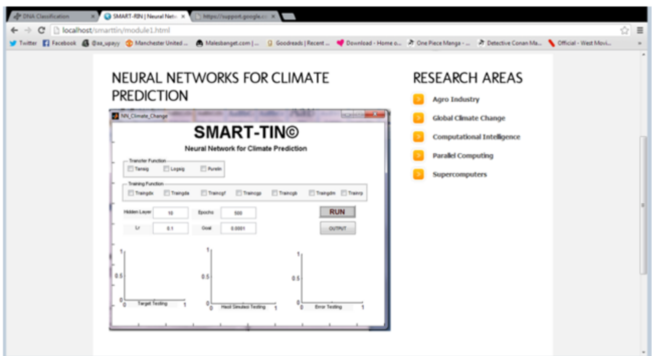

Figure 5: Neural Networks for Climate Prediction

Visualization and animation of the result from the first module is using dashboard system technique. Dashboard system is a modelinformation system interface that is analogous to the dashboard of a car that is easy to learn. In this case the information is presented in the form of animated graphics. Each data generating graphs in the dashboard. Figure 6 is one of the visualizations that display the data that is generated by precipitation and temperature predictions.

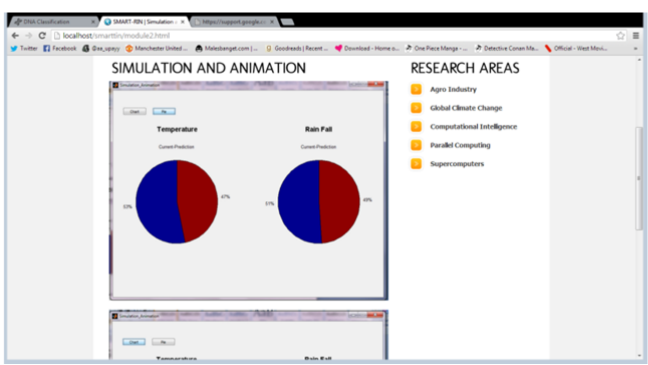

Figure 6: Simulation and Animation

Meanwhile, the result of module 3 can be seen on Figure 7.

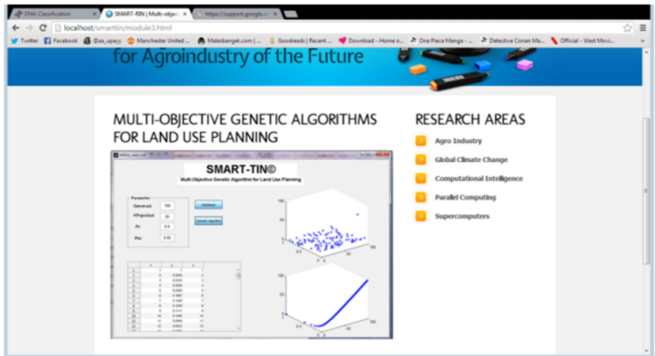

Figure 7: Multi-Objective Genetic Algorithms for Land Use Planning

All of the modules can have information in geographic. Geographical information system can be seen on Figure 8.

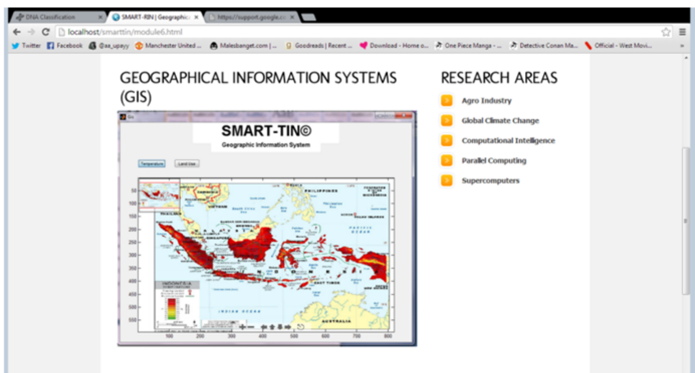

Figure 8: Geographical Information System

The mathematical model of each module is not discussed in details here as they involve many equations and use many techniques for solving the problems. The focus of this paper is to discuss about the conceptual frame-work of SMART-TIN© and the progress of implementation of its modules.

5 CONCLUSION

This paper has presented the development of SMART-TIN©, an integrated and intelligent system for agroindustrial system design for securing food,water, bioenergy and natural supply. At this stage most of the modules have been developed, however those modules have to be integrated in one compact software so it can be used in user-friendly manner. The other issue is the parallelization of the modules in the computer cluster. These issues will be addressed in the next implementation year of this research.

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REFERENCES

[1] Apaiah, R.K. & Hendrix, E.M.T. 2004. Design of a supply chain network for pea-based novel protein foods, Journal of Food Engineering (available online at http://www.sciencedirect.com)

[2] Bryceson, K.P. & Smith, C.S. 2008. Abstraction and Modelling of Agri-food Chains as Complex Decision Making Systems, paper prepared for presentation at the 110th EAAE Seminar on ‘System Dynamics and Innovation in Food Networks’ Innsbruck-Igls, Austria

[3] Gigler, J.K. Hendrix, E.M.T., Heesen, R.A., Van den Hazelkamp, V.G.W. &Meerdink, G. 2002. An optimisation of agri chains by dynamic programming. European Journal of Operational Research, volume 139, pages 613-625

[4] Gunnarsson, H., Rönnqvist, M. & Lundgren, J.T. 2004. Supply chain modelling of forest fuel, European Journal of Operational Research, volume 158, pages 103-123 (available online at http://www.sciencedirect.com)

[5] Mardle, S. & Pascoe, S. 2000. Use of evolutionary methods for bioeconomic optimization models: an application to fisheries, Journal Agricultural Systems, volume 66, page 33-49

[6] Matthews, K.B., Buchan, K., Sibbald, A.R. & Craw, S. 2005. Combining deliberative and computer-based methods for multi-objective land-use planning, Journal of Agricultural Systems (available online at http://www.sciencedirect.com)

[7] Mayer, D.G., Belward, J.A. &Burrage, K. 2001. Robust parameter settings of evolutionary algorithms for the optimisation of agricultural systems models, Journal of Agricultural Systems, volume 69, pages 199-213

[8] Silva, C.A. & Souza Filho. 2007. Guidelines for rapid appraisals of agrifood chain performance in developing countries, AMMF Occasional Paper 20, FAO, Rome

[9] Stewart, T.J., Janssen, R. & van Herwijnen, M. 2004. A genetic algorithm approach to multiobjective land use planning, Journal of Computers & Operations Research, volume 31, pages 2293-2313

[10] Vorst, van der, J.G.A.J., Silva, C.A. &Trienekens, J.H. 2007. Agro-industrial supply chain management: concepts and applications, AMMF Occasional Paper 17, FAO, Rome