

Predicting the Impact of the Value of the Quartz on the Dynamics of Rural Population in Madagascar: A Multi-Agent System Experimental Approach.

Authors: Fenintsoa Andriamasinoro and Jean Michel Angel

Adress: BRGM, 3, avenue Claude Guillemin, BP 6009 Cedex 2, 45000 Orléans, FRANCE

e-Mel: f.andriamasinoro@brgm.fr, jm.angel@brgm.fr

Most populations situated at the Northeast of Madagascar adopt the collection of quartz as an important activity which complements the food crop. These situations have been confirmed by the inquiry on the field leaded by Barthelemy and Bouchut (2002) in Madagascar.

In our present work, we attempt to model and then to simulate this phenomenon. Our aim is at studying, by successive simulation, the (current and future) relations existing between the quartz value and the dynamics of the rural populations. Precisely, we attempt to identify the quartz prices which, according to the population's behavior, fit as close as possible the following criteria: the decreasing of the number of poor families, the increasing of rich families and the evolution of the number of the population itself. To analyze the prediction, our simulations last between 25 to 50 years in order to obtain an intergeneration evolution of the populations.

This work is developed in order to help the decision making related to a strategy of local governance for the reduction of poverty as well as to the design of a sustainable development at the Northeast of Madagascar.

To represent such a complex system, a multi-agent modeling is adopted. Such an approach is appropriate because in the past, this concept has been indeed often used to model similar phenomena (Courdier & al. 2002, Rateb & al. 2004), that is, situations where it is impossible to predict all future evolution of a system by a pure mathematical or statistical approach, and in which the behavior of the actors is non-linear and non-deterministic.

As a preliminary result of 50 years simulations, we can predict the following situations (which are explained according to the village and the family strategies we have introduced): on one hand, a significant valorization of the quartz price at the local scale could result up to a tripling of the population, as well as to a decreasing of the number of families' members. Socio-economically speaking, this favorable scenario should also involve that the ratio of poor populations will be lower than 33% of the whole population. On the other hand, a low valorization of the quartz price should conduct to a sustainable poverty of 80 % of the population and to a general decreasing of the number of families (-50%). This decreasing could be due to the lack of marriages because of the poverty. Besides, our model confirms that higher prices of quartz could conduct to a significant decreasing of the quartz collection activity by families.

References

Barthelemy F., Bouchut J, 2002. Quartz ultra-pur à Madagascar : impact socio-économique au niveau local de la filière à usage industriel. BRGM/RP-52027-FR, 68 p

Courdier R., Guerrin F., Andriamasinoro F.H., Paillat J.M., 2002. Agent-based simulation of complex systems: application to collective management of animal wastes. *In: Journal of Artificial Societies and Social Simulation* vol. 5, no. 3, 30 juin.

Rateb F., Pavard B., Merelo Guervos J.J., Bellamine-BenSaoud N., Garcia Arenas, M.I. 2004. Modelling Malaria with Multi-Agent Systems. *In: Proceedings of 4th International ICSC Symposium on Engineering Of Intelligent Systems (EIS 2004)*, Island of Madeira, Portugal, February 29 – March 2, 2004, in CD-Rom, and Abstract in *International Computing Sciences Conferences Press*, (ISBN 3-906454-35-5), p. 152.

Keywords: Quartz, Madagascar, Populations, Socio-Economy, Agent, Multi-Agent System, Modeling, Simulation