



Modelling boom and bust of cocoa production systems in Malaysia



Fatimah Mohamed Arshad, B.K. Bala*, E.F. Alias, Ibragimov Abdulla

Institute of Agricultural and Food Policy Studies, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

ARTICLE INFO

Article history:

Received 17 December 2014
Received in revised form 18 March 2015
Accepted 19 March 2015
Available online 15 May 2015

Keywords:

Modelling
System dynamics
Boom and bust
Cocoa
Sustainability
Malaysia

ABSTRACT

Shaded plantation of cocoa is not only a promise for chocolate and cocoa farmers but also shaded cocoa production can significantly support biodiversity. However, boom and bust of cocoa production systems due to pest and diseases have prompted the farmers to abandon the cocoa cultivation. This paper presents system dynamics model to address the boom and bust of cocoa production systems in Malaysia as a case study. The simulated results indicate that the collapse of cocoa production systems can be avoided through biodiversity conservation and insect control resulting sustainable production systems and implementation of such policy demands adequate subsidy to retain high biodiversity, control pest and disease and attain acceptable yields through extension services through farmers field schools.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

The cocoa tree (*Theobroma cacao* L.) is an understory forest species which evolved in the Amazon (Motamayor et al., 2008) and it is currently grown in many countries of the humid tropics. The largest cocoa producing countries are Cote d'Ivoire, Ghana, Indonesia, Nigeria, Cameroon, Brazil, Ecuador and Malaysia and these contribute 90% of world production (Latiff, 2007). Cocoa beans are primarily exported to Europe and North America to be processed to produce cocoa and chocolate. Fig. 1(a) and (b) shows typical cocoa plantation systems in Malaysia, mono cropping (only cocoa trees are planted) and intercropping (cocoa are planted with fruit and rubber trees).

Cocoa was introduced into Malaysia for commercial cultivation in 1950, became the third major commodity products in Malaysia after palm oil and rubber and was considered to be a crop for agricultural diversification in the Second Malaysia Plan, 1971–1975. The availability of superior planting materials, planting technology and the implementation of the government policy to encourage the growing of cocoa as an intercrop with coconuts coupled with the high favourable prices led to the rapid expansion of the cocoa planting industry in Malaysia (Fig. 2). The area planted increased to 123,855 ha in 1980 and 414,236 ha in 1989. The high plantation rate is attributed to the unprecedented high cocoa bean prices in

the 1970s and 1980s (Lee, 2013). But post 1980s marked decrease in cocoa planting area with decline cocoa production due to poor world cocoa prices, labour constraints, competition for land use from oil palm cultivation and the severe spread and infestation of the Cocoa Pod Borer (Lee, 2013). The cultivated area decreased sharply from 393,465 ha in 1990 to 190,127 in 1995 and it continued till 2005 and the area was reduced to 33,398 ha due to severe pest infestation. By 2013, the cocoa planted area was reduced to only 13,728 ha. Fluctuations with small decline in cocoa areas were noted from 2005 (33,398 ha) to 2013 (13,728 ha) and during this period strong government support was provided for cocoa planting especially in the rural and outlying areas to improve livelihood and elevate income with poverty reduction with targeted area of 40,000 ha by 2020 (MPIC, 2011). However, there is an apparent uptrend of cocoa dried bean prices throughout the three regions of Malaysia as that of world cocoa prices. Malaysia has been dropped to 12th position from 4th position in the world cocoa production. However, Malaysia today is the fifth largest cocoa grinder in the world and grinding is expected to continue and expand further in future in between 350,000 to 400,000 t (Lee, 2013).

Questions remain to answer what caused the boom and bust of cocoa plantation in Malaysia in particular? Why cocoa plantation exhibit extremely unstable pattern of development with ecological damages of biodiversity resulting outbreak of severe pest infestation and diseases? What should be the policy for sustainable development of cocoa production systems in Malaysia?

Several studies have reported on boom and bust of agricultural commodities like shrimp aquaculture industry (Arquitt et al., 2005;

* Corresponding author. Tel.: +60 3 8947 1095; fax: +60 3 8943 2611.
E-mail addresses: bkbabalbau@gmail.com, bkbabalbau@yahoo.com (B.K. Bala).



Fig. 1. Cocoa tree with fruits.

Bala and Hossain, 2010; Prusty et al., 2011). In these cases from systems perspective we can conclude that when the industry is prone to exceed and consume its environmental carrying capacity, boom and bust type of development results in. Clough et al. (2009) reported a qualitative model of the boom and bust of the cocoa production systems as shown in Fig. 3. Franzen and Mulder (2007) highlighted the important ecological, economic and social considerations for sustainable cocoa production. This clearly indicates that there is large research gap to understand the boom and bust and to search for policies for sustainable development of cocoa production and marketing in Malaysia.

Cocoa trees can be planted in the forest or under planted shade, but most cocoa plantations are planted into thinned forests. Shade removal increases the yield in the short run which damages ecosystems and reduces the biodiversity. As the boom busts, the plantation area falls sharply to a very low level due to extremely low productivity. Underlying production busts are failures of the industry participants particularly the policy makers to understand the problem and take effective measures. However, boom and bust of cocoa production in Malaysia has been well documented (Lee, 2013). Current cocoa production systems are not sustainable because of non-eco-friendly production of cocoa beans, although there is demand of cocoa in chocolate industries. Sustainable development of cocoa production and marketing is a major concern for the policy makers and authorities who are searching for a sustainable planning to accomplish the targeted goals. Although boom and bust is the major concern, in addition, the sustainable development aims to achieve social, economic and ecological success in the cocoa production. However, sustainability cannot be achieved unless the

ecological imbalance is rectified. The sustainable production should increase profit within the framework of ecological conservation of biodiversity. This study aims to cover this gap of understanding of boom and bust and designing sustainable production of cocoa beans and proposes a realistic model which can add not only knowledge of boom and bust but also the implementation knowledge of sustainable production of cocoa in Malaysia. The overall objective of this study is to develop a system dynamics model to examine the underlying causes of boom and burst of cocoa production systems in Malaysia and develop policies for sustainable development of production of cocoa in Malaysia.

2. Methodology

We propose to apply system dynamics methodology developed by Forrester (Bala, 1999) starting from problem articulation over the design of a dynamic hypothesis, formulation, and testing to evaluation essentially applying the best practices of system dynamics modelling (Martinez-Moyano and Richardson, 2013). System dynamics (SD) is a computer-aided approach to policy analysis and design. This approach can be applied to complex dynamic problems of agricultural, biological, environmental, social, managerial, economic, or ecological systems—literally any type of dynamic systems characterized by interdependence, mutual interaction, information feedback, and circular causality (Richardson, 1999). The proposed model is intended to provide two deliverables: short term insights of the boom and burst and long term insights of sustainable development.

In system dynamics, a system is represented by feedback loops which simulate the dynamic behaviour of the system. The problem or system (e.g., political system, mechanical system, or cocoa plantation area) is first represented as causal loop diagram as well as a stock and flow diagram. The system dynamics modelling will be conducted in two phase: model building and model testing.

The best way to undertake the system dynamics modelling is considered and consists of six stages: (1) problem identification and definition, (2) system conceptualization, (3) model formulation, (4) model testing and evaluation, (5) model use, implementation, and dissemination and (6) design of learning strategy/infrastructure.

Triangulation and participatory approach has been used to identify and fully understand the challenge of boom and bust of cocoa production systems in Malaysia. Focus group discussions were conducted with the stakeholders and documents related to the project were collected and the information collected were analysed to develop and discuss the dynamic hypotheses and how expected it to replicate the observed behaviour of the boom and burst. The Focus Group Discussion was held with selected stakeholders of the industry particularly the producers, middlemen, and Agricultural Extension Officers in selected cocoa areas of Malaysia peninsular, Sabah and Sarawak. Also the research team visited several estate plantations. The Focus Group Discussion was concentrated on their opinions on the existing production problems, their views on the data collected and suggestions for improvement. Historical data of the boom and bust are crucial to understand the dynamics of the underlying challenge. Data are used to identify and analyse past behaviour of the main variables by establishing the reference mode and to calibrate the model as a part of validation of the model.

Cocoa production is a highly complex system starting from plantation to export of grindings (cocoa beans). Our starting hypothesis about the boom and bust of cocoa plantation should be something to do with the consequences of production of cocoa with intensification and subsequent ecological effect resulting from shade removal and severe infestation of pest and diseases. The low productivity after bust motivates the growers to palm oil or still forest i.e. converted into earlier natural forest. It is necessary to under-

Download English Version:

<https://daneshyari.com/en/article/4375672>

Download Persian Version:

<https://daneshyari.com/article/4375672>

[Daneshyari.com](https://daneshyari.com)