Kwamina Ewur Banson

A SYSTEMS THINKING APPROACH TO ADDRESS THE COMPLEXITY OF AGRIBUSINESS FOR SUSTAINABLE DEVELOPMENT IN AFRICA:
A CASE STUDY IN GHANA

Thesis submitted to the University of Adelaide in fulfilment of the requirements for the degree of Doctor of Philosophy

School of Business, Systems Design and Complexity Management

Faculty of the Professions

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Dedicated to Mr Albert Kojo Banson, Sandra Banson and the late Cecilia Tornyedzi
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<td>AAGDS</td>
<td>Accelerated Agricultural Growth and Development Strategy</td>
</tr>
<tr>
<td>AGRA</td>
<td>Alliance for a Green Revolution in Africa</td>
</tr>
<tr>
<td>BBN</td>
<td>Bayesian belief network</td>
</tr>
<tr>
<td>CAADP</td>
<td>Comprehensive African Agricultural Development Plan</td>
</tr>
<tr>
<td>CBBR</td>
<td>Cat Ba Biosphere Reserve</td>
</tr>
<tr>
<td>CLD</td>
<td>causal loop diagrams</td>
</tr>
<tr>
<td>CPT</td>
<td>Conditional Probability Table</td>
</tr>
<tr>
<td>CSA</td>
<td>Community Supported Agriculture</td>
</tr>
<tr>
<td>ECOWAP</td>
<td>Economic Community of West African States Agricultural Policy</td>
</tr>
<tr>
<td>ELLab</td>
<td>Evolutionary Learning Laboratory</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
</tr>
<tr>
<td>FASDEP</td>
<td>Food and Agriculture Sector Development Policy</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
</tr>
<tr>
<td>MESTI</td>
<td>Ministry of Environment, Science, Technology and Innovation</td>
</tr>
<tr>
<td>MOFA</td>
<td>Ministry of Food and Agriculture</td>
</tr>
<tr>
<td>NEPAD</td>
<td>New Partnership for Africa’s Development</td>
</tr>
<tr>
<td>NGO</td>
<td>non-government organisations</td>
</tr>
<tr>
<td>NTFP</td>
<td>non-timber forest products</td>
</tr>
<tr>
<td>PSIA</td>
<td>poverty and social impact analysis</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>research and development</td>
</tr>
<tr>
<td>SCP</td>
<td>structure, conduct and performance</td>
</tr>
<tr>
<td>RQs</td>
<td>research questions</td>
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<td>US</td>
<td>United States</td>
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Abstract

African countries have comparative advantages in the production and export of primary commodities; however, they face many sustainability challenges in the agricultural sector. Since the democratisation of many African countries—notably Ghana—a number of interventions, costing billions of dollars, have been implemented to overcome the challenges facing the agricultural industry, but with little success. The agricultural industry is characterised by complex challenges such as famine, food insecurity, poor soil and quality standards, political instability, inappropriate agricultural practices, and the depletion of natural resources. These challenges have worsened the plight of African farmers. The increasingly complex nature of the agricultural industry in Africa has led to an urgent need for the use of a systemic rather than traditional approach to solve agricultural problems.

Capacity building using a systems thinking approach and the concept of an Evolutionary Learning Laboratory during a series of stakeholder workshops in Ghana, has had a remarkable effect on the ability of the agricultural industry to evolve, improve and increase its efficacy. Causal Loop and Bayesian Belief Network (BBN) modelling were used to develop systems models to determine the components and interactions between the policy and the social, environmental and economic dimensions of the industry. Insights were made into potential system behaviours and leverage points for the systemic interventions required for sustainable agricultural development.

The results reveal that the behaviour over time of agricultural productivity is declining, although new agricultural lands are being exploited, leading to environmental degradation. System archetypes as diagnostic tools have contributed to understanding the cause of a fix ‘now’, which gives rise to a much bigger problem to fix ‘later’. The results illustrate how the structure, conduct and performance elements of the agricultural industry interact together to influence the survival and growth of the sector. The study identifies that stakeholders adopt several strategies to survive and compete, leading to overexploitation of the ecosystem.

Results from the BBN models indicate that the implementation of systemically determined interventions, policies and strategies could result in the chance of raising ‘agricultural productivity’ as high as 92.2% from 57.5%, and it might be plausible to reduce poverty levels from 44.9% to 10.0%. This would also lead to a significant increase in farmers’ yields and profits. These BBNs are used for scenario testing to determine the potential outcomes of different systemic interventions by observing what happens to the system as a whole when a particular intervention/strategy or combination of interventions/strategies is implemented—that is, before any time or money is invested in implementation.
This approach provides clarity on dealing with complex sustainability challenges and should gradually replace the reductionist approach (e.g., short-term quick fixes and treating the symptoms) in dealing with challenges and developing policies. The systems models will help governments to anticipate the long-term consequences of their decisions and actions, as well as help to avoid significant unintended consequences of policies and strategies such as ‘silo mentality’ and ‘organisational myopia’.
Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name for any other degree or diploma in any university or other tertiary institution without prior approval of the University of Adelaide and, where applicable, any partner institution responsible for the joint award of this degree. I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968. The author acknowledges that copyright of published works contained within this thesis resides with the copyright holder(s) of those works. I also give permission for the digital version of my thesis to be made available on the web via the University’s digital research repository, the Library Search and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

I hereby certify that this thesis is submitted in the form of a series of published papers of which I am the main author. I have included as part of the thesis a written statement from each co-author, and endorsed by the Faculty Assistant Dean (Research Training), attesting to my contribution towards the multi-authored publications.

Signed:                                      Date: 9th September 2016

(Kwamina Ewur Banson)
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List of Publications by the Candidate

Published/under review Journal Papers (these papers form the main body of the PhD Thesis)


2. **Banson, KE**, Nguyen, NC & Bosch, OJH 2016, ‘A systems thinking approach to the structure, conduct and performance of the agricultural sector in Africa: a case study—Ghana’, *Systems Research and Behavioral Science*, (under review: 1st round of comments from peer reviewers received; revised manuscript has been submitted)


Peer-Reviewed Conference Publications


**List of Additional Publications**


