"Application of a Network Science Approach to Post-Conflict/Post-Disaster Agricultural System Reconstruction and Development"

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Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's2011 AAEA & NAREA Joint Annual Meeting, Pittsburgh, Pennsylvania, July 24-26, 2011

Introduction

Military units are playing a greater role in the reconstruction of agricultural systems destroyed by conflict and/or natural disaster. This is particularly the case in regions where, due to insecurity, the risks are too great for civilian staff from U.S. and international government agencies or for staff from non-governmental aid organizations.

Generally, these missions focus first on repairing damaged food systems and second on improving agricultural development as a pathway toward community and regional economic development. Providing the local population with access to a secure food supply is a necessary first step toward stabilizing regions ravaged by conflict or natural disaster. Improving the economic lives of families and communities through agricultural development is the next step.

Few think of the military as an agent for economic development. However, U.S. military units, particularly National Guard units, are actively engaged in agricultural development in Afghanistan, Iraq and other under-developed regions. For more than two decades, Guard units have undertaken economic development missions as part of the Guard's State Partnership program. Five years ago, the Guard took this concept to Afghanistan, where Guard Agribusiness Development Teams (ADTs) are involved in multi-year development missions. Guard teams work side-by-side with Afghan farmers to rebuild the nation's agricultural economy and to create a secure food system for the Afghan people.

A joint project consisting of researchers within the Network Science Center at the U.S. Military Academy at West Point (NSC) and members of National Guard ADTs, with support from agricultural economists at land-grant universities, is working to improve the ADT model for use in future post-conflict/post-disaster agricultural development missions. There are currently eight Guard units specifically devoted to agricultural development in Afghanistan with many more U.S. military tactical units engaged in agricultural development projects in that country. Each team serves one year and teams have been operating in Afghanistan since 2007, which means that several dozen teams have now been engaged in agricultural development work in Afghanistan alone.

Researchers involved in the joint NSC/National Guard project are focused on research that will improve the success of military-led agricultural development teams in two key areas – food system security and agricultural development as the path to raise the economic condition of families and communities.

Network Science Analysis Applied to Agricultural Economic Development

Researchers often discover that the more a problem is examined, the more complex it becomes. The problem of under-development is such an example. Despite decades of research into the question of how best to move under-developed nations toward development, the answer is elusive because the answer is complex. One common approach for addressing complexity is the attempt to simplify the complex by breaking it down into its component parts and studying each component. This approach leads to great insight into the pieces that make up the whole, but often not great understanding of the relationships of the parts to the whole.

It is this approach of breaking down the challenges of economic development into component parts that has contributed to the growth of multiple organizations and programs involved in economic development efforts. Military development missions responding to post-disaster/post-conflict situations have provided evidence of this multiplicity of effort.

While many of these organizations are making important contributions to economic development efforts, most all focus on fixing only a part of the economic system with little awareness of the work of other organizations or how their part of the work relates or contributes to the health of the whole system or negatively impacts the system based on timing, capacity or conditions.

The research approach that seeks to understand the role and relationship of the various parts of systems is known as network science. It is an approach that traditionally was applied in more technological fields of study, such as computer science, or in fields such as physics and mathematics. More recently, social scientists have begun to apply this approach to the study of systems, including political systems and economic systems.

NSC has begun applying this network science approach to the study of economics in under-developed nations. Researchers working within NSC and the National Guard are now taking this approach and applying it in research that seeks to build a successful model for military-led agricultural recovery and development efforts. The problem of disconnected development efforts is widespread, found not only in development efforts in Afghanistan but in many other regions.

The NSC/National Guard research team began work with the premise that a deficiency in economic development efforts is the tendency to shy away from the complex. Much effort and much money have been spent on development. But there is often little coordination of effort at the ground level. Each organization believes that its project is the key to economic success. All of these efforts can play key roles in development but it is their successful integration in time, space and cultural norms that results in a well-functioning and sustainable economic system.

Research Findings: Non-coordinated Agricultural Development Effort

A survey of ADTs operating in Afghanistan indicated that one of the greatest challenges to the success of military-led reconstruction/economic development missions is the overlap of effort and lack of coordination resulting from the clash of multiple organizations in the economic development effort. There are many entities undertaking development work in Afghanistan – U.S. government agencies, foreign government agencies, multiple military units, Afghan government agencies and a host of non-governmental organizations (NGOs).

In the summer of 2010, an initial survey was conducted with 10 commanders of National Guard ADTs, both commanders in the field in Afghanistan and those who had returned from deployment. The survey gathered information from commanders on the key challenges they faced in mission success. Based on their responses, follow-up interviews, by email and in person, were made with more than a dozen other soldiers and commanders involved in development missions. In addition, researchers gathered reports and information collected by the military on the actions and results of military agricultural development missions.

A central theme that emerged in the survey, in interviews and in military reports was the complexity of agricultural development efforts on the ground in Afghanistan and the lack of coordination among multiple military units, multiple U.S. Government agencies (USG), Afghan provincial and district agriculture officials, Provincial Reconstruction Teams (PRTs) and a host of NGOs operating in Afghanistan. One ADT, when asked to list the entities found in its area of operations (AO) that were involved in agricultural development work, counted 28 different entities with which it must coordinate efforts. Across the board, ADTs cited lack of coordination as a main roadblock to the development of an integrated and well-functioning food system as well as to the development of a regional agricultural system capable of improving the economic condition of communities.

Aside from common coordination problems such as multiple development agendas and competition for credit and funding, the research highlighted another challenge – lack of information sharing, in particular the absence of any method for tracking all development projects in an area of operations.

Researchers are now working to address this problem through a project funded by the Defense Advanced Research Projects Agency (DARPA). A challenge for military units on agricultural development missions is that project data is collected and transferred to military network systems, which are closed to civilian entities. A technology tool is being developed that would allow military units to gather agricultural project information and transfer it to open sources before loading it onto military systems. The technology will be on hand-held devices for easy use in the field and will be tested with an ADT in Afghanistan starting in the fall of 2011.

Network Mapping of Agricultural Development Efforts and Food Systems

Researchers in the joint NSC/National Guard project have focused their initial work on improving strategies for the integration of agricultural development projects at the ground level, particularly those efforts related to food system reconstruction and security. In conducting this work, researchers are applying the techniques of network science analysis, focusing first on addressing the questions of how best to integrate efforts to rebuild a food system that has been destroyed and how best to protect food systems should conflict or disaster occur and threaten that system and second on how best to integrate efforts for improved overall agricultural development.

Network science analysis is increasingly used by military units, emergency preparedness teams and disaster response units to identify the critical nodes in systems, such as transportation and power systems, that need protection and to develop plans to reconnect networks should critical nodes or links be damaged. In some regions, those critical nodes and links are destroyed either by conflict or by natural disaster. In other regions, critical nodes and links in the system never existed, thus hampering development. Identifying missing critical nodes and links and developing them is part of the strategy being researched by NSC/National Guard project researchers.

After initial testing of the technology developed through the DARPA project, a longer-term goal of researchers is to expand the use of the DARPA technology such that military units responding to post-disaster/post-conflict situations can quickly gather data on food system networks and use that to identify what in that network must first be prepared to restore the flow of food to the local population and to stabilize the food supply system. A future goal is to expand further the use of the technology tool so that military units can gather information on all other entities operating on the ground, their links to one another, their resources available and their projects in order to create a complete network map showing a full picture of recovery and development efforts in order to create an integrated development effort.

In the interim, project researchers are gathering data from ADTs through more conventional means in order to create network maps of a food system and of entities and development projects in one ADT's area of operations. Data collection is expected to be completed by the fall of 2011 with the network mapping taking place in the fall of 2011.

National Guard teams engaged in development efforts have identified the food system as being the base on which to build economic development. Providing the local population with access to a secure food supply is a necessary first step toward stabilizing regions ravaged by conflict or natural disaster. Once the food supply is secure, development missions can begin to focus on expansion of the agricultural sector as a step toward economic development. For this reason, NSC and National Guard researchers are focused first on understanding the components of food

systems in ADT areas of operation, the roles of those components and their relationships to one another. Researchers are also identifying the efforts of all the governmental and non-governmental organizations on the ground working to repair and strengthen the food system.

Work conducted for the research related to developing food system network maps consists of:

- Gathering information on the food system network in the region of response, including such information as the points of supply, the food transportation system – both inputs and final products – location of processing plants, information on plant/animal diseases and the potential routes for the spread of disease and/or contaminants in the food system. Such information assists in identifying and prioritizing what must be repaired in order to restore the flow of food.
- Analyzing food system networks to identify critical nodes most at risk and researching how best to reduce those risks.
- Analyzing food systems to identify gaps that, if filled, can improve the flow of food through that system. These could be gaps in production inputs, gaps in plant or animal health, or even gaps in policy and laws, such as land ownership policies.

The research being conducted for network mapping of agricultural development efforts in an ADT's area of operations includes the:

- Gathering of information on other organizations in an ADT's area of operations that are engaged in efforts to repair and strengthen the area's food system. This will include data on the projects of those other organizations and an analysis of the integration of these efforts.
- Collection of information on the relationships among development entities and their available resources.
- Examination of strategies for improved information sharing among various organizations on the ground working on food system and agricultural development projects.
- Identification of potential roles for the private sector in contributing to efforts to repair and strengthen food systems.

Conclusion

The research being conducted through the NSC/National Guard project aims to achieve three main objectives over the next 12 months:

1. Increased understanding of agricultural economic systems in the areas of operation of military development teams.

2. Improved understanding of the multiplicity of actors engaged in agricultural development work in the areas of operation of military units with the goal of improved information sharing and coordination of efforts among military and civilian entities.

3. Development of partnerships with private sector businesses and investors for improved integration of the private economic sector into military-led agricultural recovery and development missions.

Initially created to support the Guard's Agribusiness Development Teams operating in Afghanistan, the NSC/National Guard project is expanding to support Guard agricultural development teams currently in operation around the world. The Department of Defense is now looking at expansion of the ADT model into other under-developed regions in Africa. It is a goal of researchers to serve as the center of a network of support for current and future military-led reconstruction and development efforts, particularly for units responding to post-conflict/post-disaster situations.

This research will strengthen the capacity of military units to serve as the spearhead for recovery and economic development in the world's least developed and most unstable regions. The economic development and stability to which these military missions contribute are critical to creating a more secure world, not only for the United States, but for other nations as well. Although the research project supports the concept of military units being the catalyst for agricultural recovery and development, transition of those efforts to the civilian sector is seen as critical for long-term sustainability of agricultural development efforts. The project, therefore, serves as a link between military units in the field and civilian government, non-government and private sector entities working to improve food security and agricultural development around the world.

References

"Agribusiness Development Team," 2008 Army Posture Statement.

Agribusiness Development Teams in Afghanistan Handbook, The Center for Army Lessons Learned, November 2009.

"Expeditionary Economics: Spurring Growth after Conflicts and Disaster," Carl F. Schramm. *Foreign Affairs*, May/June 2010.

FM 3-24: Counterinsurgency, Headquarters, Department of the Army, December 2006.

"Kansas National Guard: Agribusiness Development in Afghanistan," Eric Peck and Lynndee Kemmet. *InterAgency Journal*, Vol. 2, Issue 1, Winter 2011.