

Technical Report 15-004

**Network Models of Entrepreneurial Ecosystems in
Developing Economies**

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U.S. Military Academy, West Point NY

January 2014

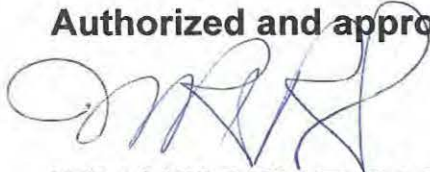


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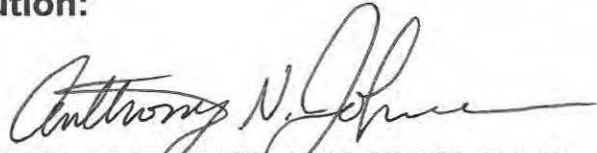
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Network Models of Entrepreneurial Ecosystems in Developing Economies

Daniel Evans & Louis Boguchwal

Introduction

This paper presents a general overview of a project that developed an innovative methodology that depicts local entrepreneurial ecosystems. This method can be modified to represent numerous types of network topologies. Subsequent papers will address in greater detail: the methodology, the data collection efforts, and the initial analysis of the developed network models. Additionally, two technical papers will introduce our network classification methodology and our network influence methodology.

“Youth unemployment is a ticking time bomb,” –Alexander Chikwanda, Finance Minister, Zambia



Protesters in Tahrir Square, Cairo

Motivation

According to the International Monetary Fund's *Perspectives on Youth Employment in the Arab World* report, unemployment in the Middle East/North Africa

(MENA) region is the highest in the world and is largely a youth phenomenon. Overall unemployment is approximately 10%, but the youth rate stands at almost 25% (Ahmed 2012).

The report also states that over the past 50 years, MENA countries and Sub-Saharan Africa have had the highest labor force growth rates in the world due to a combination of large declines in infant mortality rates and high fertility rates. The number of MENA labor force entrants remains daunting – approximately 10.7 million new entrants are expected to join the labor force in the coming decade, compared with 10.2 million in the previous one.

This growing labor force, combined with the recent political and social changes in the region, only contributes to this high unemployment rate. As the Finance Minister of Zambia stated, this combination of a growing young labor force with a lack of employment opportunities is a potential “ticking time bomb” (2012). A recent analysis of the Arab Spring by Filipe Campante of the Harvard Kennedy School and Davin Chor of the Singapore Management University concludes that the lack of employment opportunities was a major factor in the recent civil unrest in North Africa (2012).

In order to address this issue, scholars such as Mongi Boughzala, a professor of Economics at the University of Tunis El-Manar and a Brookings Institute contributor, believes that the long-term solution to this problem is the development of the private sector, especially vibrant Small and Medium Enterprises (SMEs) (2013).

Importance of Small and Medium Enterprises (SMEs), and the Challenges of Creating a Vibrant Local Ecosystem

Major international economic development organizations such as the World Bank, International Monetary Fund, and the United Nations agree that entrepreneurial success and the establishment of Small and Medium Enterprises (SMEs) in the developing world have the potential to alleviate many of the world’s social and economic problems. A recent World Bank report (2015) claims that successful SMEs are:

- Engines of economic growth.
- Essential for a competitive and efficient market.
- Critical for poverty reduction.
- Largest provider of employment in most countries.
- A major source of technological innovation and new products.
- Employers of poor and low-income workers.
- Sometimes the only source of employment in poor regions and rural areas.

Current challenge

Can an environment be established that facilitates the creation and success of SMEs?

This question is critically important because of the inefficiency of economic development work over the past 50 years. According to Dr. William Easterly, a noted economic development expert at New York University, over \$2.5 Trillion of aid and investment has been spent on economic development in emerging economies since the end of World War II with mixed results. In his 2008 paper entitled, "Where Does the Money Go? Best and Worst Practices in Foreign Aid," he suggests that economic development organizations need to:

- Implement better feedback mechanisms
- Develop more specific investment objectives
- More rigorously define "success"

General metrics of success are currently measured in aid and investment fund volumes. Easterly believes that more rigorous metrics can lead to more efficient uses of funds. For example, can specific targeted investments or policy decisions be identified as actions that will more likely result in a measurable Return on Investment?



Bethlehem Alemu, founder of SoleRebels, a shoe manufacturer in Addis Ababa, Ethiopia employing 90 people. Employees are paid four times the legal minimum wage and receive 100 percent medical coverage for their families. The shoes are exported worldwide and they expect to generate between \$15-20 Million in revenue by 2015.

Additionally, entrepreneurial ecosystems largely depend on their location, as history, culture, and other local factors shape the economic landscape. For example, extended families in West Africa exert great influence on each SME's business decisions. Consequently, policies that do not account for these differences are expected to continue the inefficient spending trends seen in the past.

Our team has developed a methodology that evaluates a local entrepreneurial ecosystem. The quantitative techniques involved incorporate local customs, norms, and differences, potentially resulting in more effective policy recommendations than those seen in the past.

A Network Analysis Approach

The 21st century has ushered in an unprecedented level of complexity in everything from global commerce to human social interaction and data manipulation. What we have learned from such developments is that humans live and work in a world made up of complex adaptive systems, each of which can be represented by various forms of networks.

Behind each complex system there is a network that defines the interaction between the components. During the past decade some of the most important advances towards understanding complexity were provided in context of network theory.

Economic development practitioners, economists and sociologists have also recently embraced network analysis techniques. As far back as 1988, Dr. Bengt Johannisson of Jönköping University in Sweden suggested that the entrepreneur's network, the people and organizations they are connected to, is "the most significant resource of the firm." More recently, projects such as Root Change's Global Impact Investment Map (GIIMAP) have the goal of mapping social networks to better understand local entrepreneurial networks in developing economies. While these types of initiatives produce powerful local insights, our team's techniques have the capability to generate quantitatively backed, macro-level policy recommendations.

Typically, entrepreneurial network models are developed using the Name Generator method (McAllister and Fischer 1978). This approach collects information about each entrepreneur's social contacts to map the network. For example, researchers could interview individuals questioning them about whom they might go to for advice or guidance for different aspects of business development.

This technique is useful but creates several analytical challenges. First, in many environments, the entrepreneur might be hesitant to provide specific names or organizations. Additionally, in many cultures, inconsistent spelling of surnames, and the frequent use of nicknames make it challenging to collect accurate data. Finally, models developed from the Name Generator technique are static, and don't account for dynamic phenomena, such as deaths or job transfers. However, the individual's function would likely be filled by someone else. Consequently, our team believes the Name Generator approach is not ideal to develop effective policy recommendations.



The Name Generator Technique develops models of relationships between people.

Our team has experimented with several other methodologies and has developed an innovative, yet simple, technique that allows us to develop quantifiable entrepreneur networks. The innovation is not to model only the individual entrepreneur's connections, but to model the connections of roles in the local community. In order to develop this model, we have adapted a technique used in sociology to measure social capital called the Position Generator (Lin et al 2001). This technique, while related to the Name Generator, avoids the duplicated efforts associated with mapping each individual's social network. By analyzing the entrepreneur's connections to prominent structural positions in the community or

society, our team is able to develop powerful insights that inform policy recommendations.

Our model is a quantitatively derived network that enables us to accurately assess the local entrepreneurial ecosystem. This methodology identifies the most influential roles in the ecosystem, and allows us to compare and contrast different local communities.

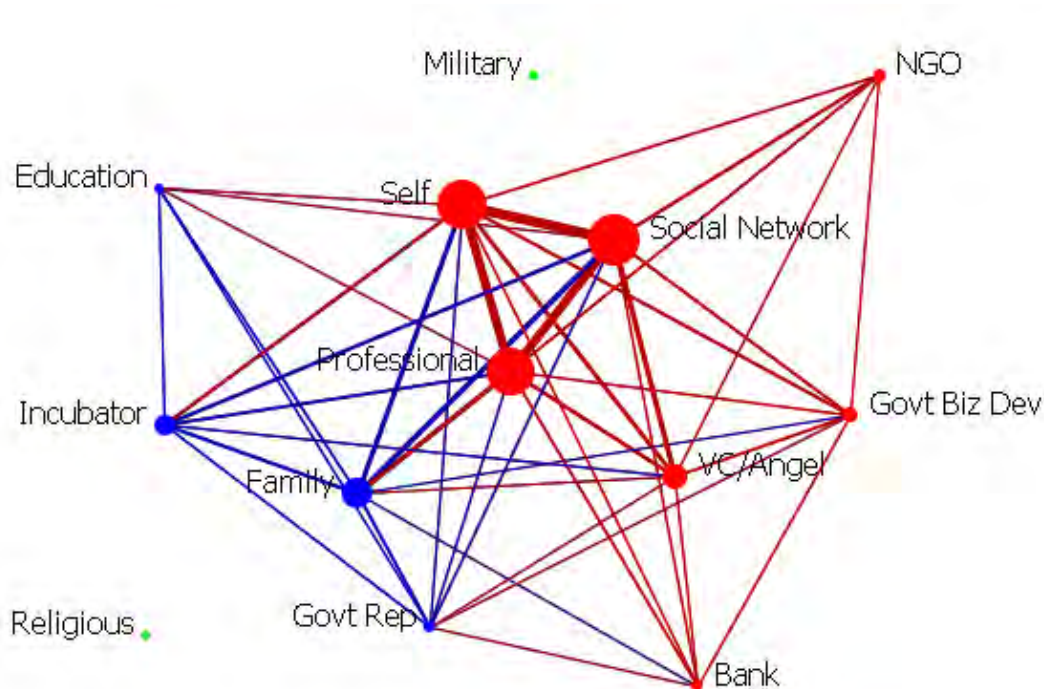


The Position Generator Technique develops models of relationships between people and roles in the local environment.

The model below depicts the entrepreneurial network developed from data our team collected during visits with entrepreneurs operating in the Technology Sector in Kampala, Uganda. Even before a rigorous network analysis, an initial visual inspection yields some interesting insights:

- The Military and Religion Roles have no impact on this ecosystem.
- The Self (an entrepreneur can access the necessary resources themselves), Social Network, and Professional Roles have a close relationship and are influential to the network.

- There are two distinct sub-groups in the network.
- Roles such as Commercial Banks, Government Business Development Programs, and Business Incubators are not as influential as one might expect.



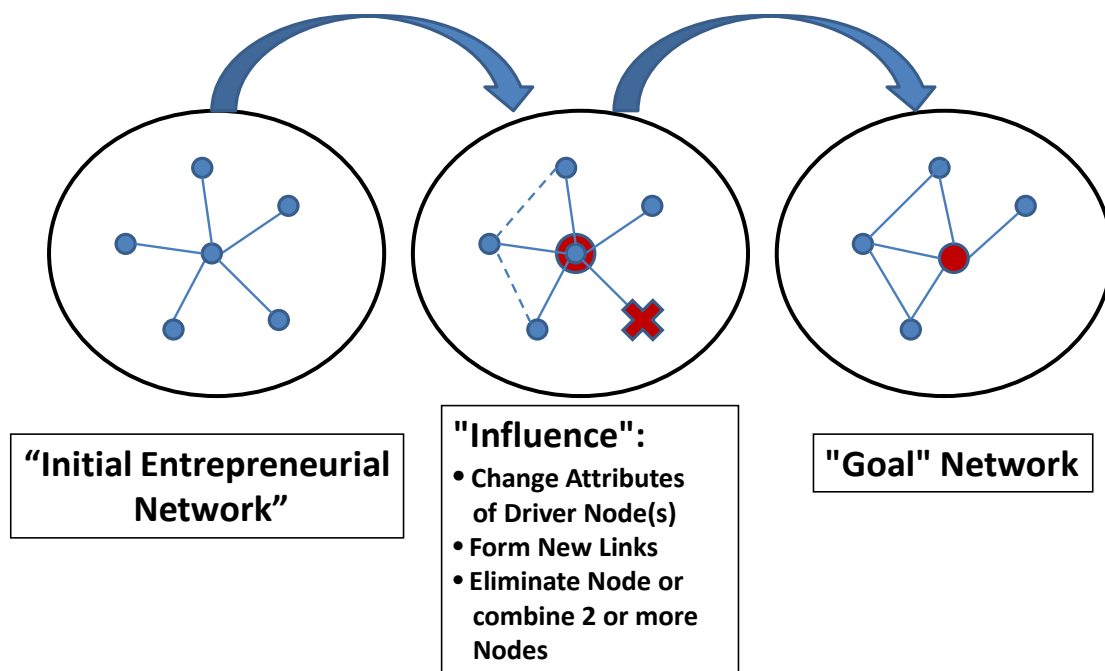
Kampala Entrepreneurial Network Model. Developed after a data collection visit to Uganda. Nodes depicted in the network model are roles, or positions, in the local entrepreneurial ecosystem, and the links illustrate how roles are connected through individuals’ perceptions access to required resources. Each node is sized according to its influence, and is colored by a grouping algorithm. Each group shares specific characteristics.

As our project continues, our team will develop a “goal network” model. The constituent data will be collected from an environment that is considered to be especially conducive for successful SME establishment. We will construct this network using the same methodology, and then determine which nodes in the “initial entrepreneurial network” are the “driver nodes.” By influencing these nodes, or their links to other nodes, we can influence the “initial entrepreneurial network” to evolve towards the “goal network,” possessing similar mathematical characteristics. The resulting analysis will inform the development of specific policy recommendations for specific communities.

For example, the diagram below illustrates two simple networks. Our goal is to influence the initial one on the left to evolve towards the one on the right. In this example, we can make three recommendations:

1. Increase the influence of the center node in the network. This could be enacted through additional funding, resources, or oversight.
2. Develop or establish relationships between the three outermost nodes on the left side of the network model. For instance, this might mean facilitating a relationship between commercial banks and business incubators where none currently exists.
3. Eliminate the node in the lower right corner of the “initial entrepreneurial network” because this node adds no value. In practice, this could be a role that is actually detrimental to the entrepreneurial ecosystem. For example, perhaps a corrupt central government is involved in approving the funding of entrepreneurial efforts.

"Influencing" a Network



Demonstration of network evolution to inform policy recommendations.

Experience & The Way Ahead

Our team has a wealth of experience on the African continent meeting with entrepreneurs, understanding their challenges, and developing quantitatively-backed solutions. Additionally, our team has fostered a relationship with AfriLabs, a community of business and technology incubators located throughout Sub-Saharan Africa. Jon Gosier, founder of AfriLabs, and Tayo Akinyemi, AfriLabs director, have been instrumental in assisting our team with introductions to incubator directors and coordinating our data collection visits.

After several visits with African-based entrepreneurs, a Network Science Center research team conducted a pilot data collection in cooperation with iceaddis, a technology hub located in Addis Ababa, Ethiopia during July of 2012. The lessons learned were incorporated during subsequent visits to Africa in order to make our data collection effort more effective and efficient. Dr. Charles Thomas and Mr. Dan Evans then conducted the Center's first African official data collection trip in Kampala, Uganda during April of 2013. In June of 2013, Dan Evans returned to Addis Ababa for an additional data collection effort. Next, a Network Science Center team was hosted in Lusaka, Zambia by the staff of BongoHive, a technology hub in the AfriLabs network, in August of 2013. Recently, Dan Evans conducted a data collection effort in Monrovia, Liberia operating out of the iLab Liberia hub in November of 2013. The Network Science Center will conduct additional data collection efforts in Ghana, Tanzania, and Rwanda over the next year, and initial analytical results will be published during the summer of 2015.



Dr. Charles Thomas interviews a local entrepreneur at Hive CoLab, a technology/innovation hub in Kampala, Uganda

This work marks just the beginning of the Network Science Center’s frontier market initiatives. In 2015, we aim to expand our technical capabilities to include dynamic models and comparative analytics. Our planned data collection trips will allow us to track changes in the economic landscape and compare communities to one another. Thus, we can build enriched models that account for temporal changes in entrepreneur networks, which will provide deeper insight into how the local economy functions and the role of social capital in entrepreneurial success. Additionally, more powerful comparative methods will drive highly customized country-specific analysis. These detailed metrics can reveal that entrepreneur-economic policies are not “one size fits all.” Specifically, policies must be tailored to the community in question in order to bolster its economy most efficiently. Ultimately, future projects of the Network Science Center will hone in on the notion of “optimal entrepreneurial ecosystem” through advances in temporal and comparative analytics.

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