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ORCEN AFRICOM Global Power Competition Network Analysis Technical Report

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Abstract

United States Africa Command (AFRICOM) is the global combatant command responsible for countering transnational threats and malign actors, strengthening security forces, and responding to crises on the African continent. The command's goal is to advance U.S. national interests and promote regional security, stability, and prosperity. AFRICOM has developed lines of effort (LOEs) and strategic objectives that provide direction for the organization to achieve its principal goals. Critical to realizing these goals is to observe and measure performance, both by AFRICOM and by its main competitors. AFRICOM subscribes to the Global Power Competition (GPC) paradigm, which focuses on the desire of rival states to project power and exert global influence on developing regions. China and Russia are considered the United States' primary GPC competitors. The purpose of this research is two-fold. First, the study team seeks to determine how GPC actor activities across the African continent positively or negatively align with AFRICOM's stated LOEs and strategic objectives. Second, the study team seeks to develop a network visualization of activities taken by AFRICOM and GPC actors. Using this network visualization tool, the decision maker can then better allocate limited resources using the most appropriate instrument(s) of national power that may yield maximum strategic impact across Africa. The first implication of this work is the development of a clear scoring method for strategic alignment that assesses the ends, ways, and means of activities. This alignment assessment implies the likelihood of success for a given activity. The second implication is that network analysis can help to visualize how activities relate to instruments of national power, LOEs, and strategic objectives. Relationships can be measured using network metrics to determine trends by AFRICOM and GPC competitors. Future research includes fully applying this methodology to make it operational for senior decision makers by integrating it with existing data sources.

Key Words: Strategic alignment; network visualization; network analysis; Global Power Competition; Great Power Competition; AFRICOM



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Acronyms

ACO	AFRICOM Campaign Order
ACP	AFRICOM Campaign Plan
AFRICOM	U.S. Africa Command
C2IE	Command and Control of the Information Environment
CJOA	Combined Joint Operations Area
CJTF-HOA	Combined Joint Task Force-Horn of Africa
COMCAM	Combat Camera
EW	Electronic Warfare
FAQ	Frequently Asked Question
GPC	Global Power Competition
HBR	Harvard Business Review
ISR	Intelligence, Surveillance, and Reconnaissance
JDN	Joint Doctrine Note
JP	Joint Publication
NDS	National Defense Strategy
NSS	National Security Strategy
CCMD	Combatant Command
CCDR	Combatant Commander
GCC	Geographic Combatant Command
OAI	Operations, Activities, Investments
OE	Operational Environment
ILE	Intermediate Level Education
ISE	International Security Environment
LOE	Line of Effort
MILDEC	Military Deception
MISO	Military and Information Operations
OPSEC	Operational Security
PMC	Private Military Company
SOCOM	Special Operations Command
SOE	Strategic Operating Environment
USD	U.S. Dollars
USG	U.S. Government
VEO	Violent Extremist Organization



Section 1 Introduction and Organization

1.1. (U) Introduction

This report summarizes the work done by CPT(P) Raymond Vetter, Mr. Jeffrey Demarest, and MAJ Dereck Kennedy in support of the U.S. Africa Command (AFRICOM) ACJ8 from September 2019 to December 2020.

1.2. (U//FOUO) Project Overview

This study supports AFRICOM ACJ8's efforts to understand how activities performed by the United States and its Global Power Competitors support or detract from achieving AFRICOM's lines of effort (LOEs) and strategic objectives. The first objective is to define alignment with LOEs and strategic objectives and to identify the key metrics and data sources to measure Global Power Competitors' activities. With a definition of alignment and metrics identified, data gaps for Global Power Competitors' activities emerge. The ability to close this gap would improve the ability to measure alignment of U.S. and Global Power Competitors' alignment.

The second objective of this work is to develop a network model that allows for the visualization of activities and how activities align to AFRICOM's lines of effort (LOEs) and strategic objectives. This network visualization may help inform decision makers on how to best invest existing AFRICOM resources to realize AFRICOM's lines of effort (LOEs) and strategic objectives. By identifying activity frequency, activity type, and activity alignment, both by the U.S. and Global Power Competitors, decision makers may better understand the changing dynamics on the African continent.

1.3. (U) Organization

The remainder of this report is organized as follows:

- Section 2 provides background on Global Power Competition and a method to measure organizational alignment.
- Section 3 explains the approach and methodology for defining alignment of LOEs and strategic objectives, identifying key metrics and data sources, and developing a network visualization model.
- Section 4 provides the findings for the research objectives.
- Section 5 provides the impact and recommendations resulting from the study and possible areas of future work.
- Appendix A contains the references used in the conduct of this research.
- Appendix B contains the Table of Nodes representing all possible entities within the network visualization model.
- Appendix C contains the Table of Links between entities within the network visualization model.
- Classified sections are available upon request. Please contact the author at raymond.t.vetter.mil@mail.mil.



Section 2 Background

2.1. (U//FOUO) Introduction

The 2017 National Security Strategy (NSS) and the 2018 National Defense Strategy (NDS) identified strategic competition with “revisionist powers” as an essential focus when protecting and pursuing U.S. national interests. Those interests include protecting the homeland, promoting American prosperity, preserving peace through strength, and advancing American influence [1] [2]. This declaration stands in contrast to U.S. national strategy since the fall of the Soviet Union during the early 1990s when the world shifted from a bi-polar great power dynamic to a unipolar dominated by the U.S. Consequently, U.S. strategy has evolved with less emphasis on responses from other countries.

Since 1978, China’s power and influence regionally and globally have continually increased. Following the opening and reform of its economy, China’s GDP growth has averaged almost 10 percent each year and it currently has the second largest global GDP [3] [4]. China has invested heavily in its military and is currently second only to the United States for annual defense expenditures (\$216 billion as of 2014) [4]. China has also emphasized the need to rapidly advance its technological capabilities, ranking second to the United States for gross domestic expenditures on research and development. The number of Chinese scientific and engineering doctoral degrees granted each year is expected to surpass the United States by 2025 [4]. China uses this economic and military power to influence neighboring countries in the Indo-Pacific region but has expanded these influence operations onto the African continent. Considering China’s authoritarian government and growing power, this expansion represents a threat to the U.S. national interests [2].

Since the fall of the Soviet Union in 1991, Russian aggression toward the West has gradually increased. Vladimir Putin was elected Russian President in 2000, and the rhetoric toward the West and specifically the U.S. has shown a clear lack of respect. He claimed in 2007 that the U.S. “overstepped its national borders in every way” by attempting to impose its [U.S.] cultural, economic, and political policies on other countries. During another 2007 speech, Putin “compared U.S. policies to those of the Third Reich” [5, p. 273]. Russia’s desire to reassert itself onto the international stage became apparent after the 2008 war with Georgia, when it attempted to regain control over the provinces of South Ossetia and Abkhazia [5, p. 274]. The 2014 Russian annexation of Crimea from Ukraine represents another aggressive action to regain its great power status [5, p. 277]. General Townsend, AFRICOM Commander, directly addressed Russian aggression in his 2020 posture statement to the Senate Armed Services Committee. He references Russia and China as “global powers” rather than “great powers.” While both countries pose a legitimate threat to U.S. security and prosperity, he wants to make a clear distinction that Russia does not deserve to be on the same level as the U.S. [6, p. 3].

2.2. (U//FOUO) Global Power Competition in Africa

Through the 2017 NSS and 2018 NDS, the U.S. has identified that China and Russia are primary challengers to U.S. national security. Both countries view themselves as great powers that exert global influence. Additionally, China and Russia seek to have strong networks of allies and partners to increase their prestige and economic prosperity. By increasing alliance networks, China and Russia will weaken U.S. relative influence in the international order. While both countries pose a real threat to the U.S., China and Russia have key differences. China’s economic wealth and influence give it global power. Russia maintains a regional influence and seeks short-term opportunities to increase its power. This distinction between



China and Russia was highlighted in a recent RAND study that stated “[from the U.S. perspective] China is a peer, not a rogue. Russia is a rogue, not a peer” [7, p. viii].

While Chinese and Russian attempts to increase power span the globe, both countries realize the strategic and economic importance of Africa. The African continent has the world’s fastest growing economies and populations and is a key player in international trade. Africa is adjacent to several key sea lines of communication including the Mediterranean Sea, the Red Sea, the Strait of Gibraltar, and the Bab al Mandeb Strait. Africa is home to over half of the world’s farmland and many countries have significant mineral reserves. In short, Africa offers significant opportunity for international investment and growth, both for the U.S. and potential competitors [6, pp. 1-3].

Considering the continued rise of China and Russia along with the potential benefits in Africa, the Department of Defense’s (DoD) paradigm for setting and executing foreign policy priorities has changed. Former Secretary of Defense Mark Esper shifted AFRICOM’s top priority from counterterrorism, including several prominent Violent Extremist Organizations (VEOs) in Africa, to a global competition with the countries of China and Russia [8]. While the 2018 NDS emphasizes great power competition between Russia, China, and the U.S., AFRICOM Commander General Townsend dubs it “global power competition” (GPC). Both Russia and China are “malign actors, unencumbered by international norms and professional military standards” seeking to exploit African countries’ stability [6, pp. 3-4]. The 2018 NDS states that both countries threaten “U.S. prosperity and security” by “gaining veto authority over other countries’ economic, diplomatic, and security decision” [2, p. 2]. Clearly GPC is not constrained to building and posturing military forces. A more complex set of conditions and activities must be considered and deliberately integrated to achieve favorable U.S. outcomes.

GPC does not have a defined end state; rather, it describes the framework in which the U.S. government can direct and justify its readiness efforts. As such, this type of competition is akin to more subjective competitions such as gymnastics as opposed to basketball. In this way, there is not a defined means of outscoring an opponent via an action/counter-action exchange; instead, the competition is based on the perception of performance by judges. In the case of GPC, the judges are the African countries the U.S. desires to partner with and support to further U.S. interests. A key finding from a recent Naval Postgraduate School (NPS) study was that U.S. influence varies in “strength and substance” in different countries, even when similar actions are taken. Some countries are greatly influenced by shared interests and historic relationships whereas other countries are influenced by more direct monetary or material transactions [9, pp. 5-6]. There is also a real possibility that “African governments maintain a variety of relationships with whichever external powers are able and willing to provide them with worthwhile economic, political, or security benefits” [7, p. xi]. African countries require substantial investment for development, so partnering with multiple powerful countries may be in their best interests.

China has taken an active role in Africa to promote its foreign policy objectives. In a 2015 Africa policy white paper, China stated that it intends to be “Africa’s most trustworthy friend and sincere partner” [7, p. ix]. China’s actions on the African continent support this sentiment. Massive Chinese investment in African infrastructure projects, such as the Belt and Road Initiative, seek to connect the Eurasian and African continents. Chinese-built military bases, ports, and helicopter landing plans across Africa provide potential power projection platforms. From 2014 – 2019 Chinese arms sales to African countries total over two billion USD. Diplomatically, China has increased its number of African embassies to fifty-two, three more than the U.S. From 2010 – 2020 China has the most head of state and senior leadership visits to Africa among G20 members [6, p. 4]. These actions illustrate that China views Africa as having great potential for growth and by promoting development early it hopes to have significant influence.

Russia seeks to achieve short-term gains and exert influence in Africa primarily through economic and military action. As the top arms dealer in Africa, Russia sold almost nine billion USD of arms to African countries from 2014 – 2019 [6, p. 4]. Although Russia has a very limited military presence on the continent, their reliance on private military companies (PMCs) represents a unique challenge [7, p. x]. PMCs are ambiguous in their status, sometimes acting on behalf of the Russian government, other times acting as commercial entities [7, p. xiv]. Russia has used PMCs to secure investments, support corrupt regimes, and expand Russia's military footprint. Considering its limited resources and recent actions, it is clear that Russia's focus is on personal gain rather than improving Africa's overall capacity [6, p. 4].

Some Chinese and Russian actions in Africa represent a risk of direct threat to U.S. security; however, other actions by the GPC competitors may promote economic, infrastructure, humanitarian, and security improvements across the continent [6, p. 3]. In many cases Chinese and Russian actions may align with U.S. interests and promote stability and development on the continent. Other actions may not impact U.S. interests at all. In both situations, AFRICOM may be best served to not respond. In the case that China or Russia acts in a way that directly conflicts with U.S. interests, AFRICOM should consider the magnitude of the conflict and its ability to respond effectively [7, pp. xi-xii]. Given AFRICOM's economy of force approach, responding in a selective and measured manner is most appropriate [10].

2.3. (U//FOUO) Instruments of National Power

To advance national interests, the U.S. Government (USG) relies on its instruments of national power: diplomatic, information, military, economic [11, pp. 1-12]. These instruments align with the major executive branches in the USG that apply the power: "the Department of State, Defense, and Commerce, as well as the intelligence community" [12, pp. 11-5]. This section will explain the instruments of national power, which the USG seeks to effectively synchronize and leverage. While each instrument is individually described, it is important to remember that they all interact as part of the strategic operating environment (SOE). The SOE is the "global environment in which the U.S. President employs all the elements of national power (diplomatic, informational, military, and economic)" [13, p. 11].

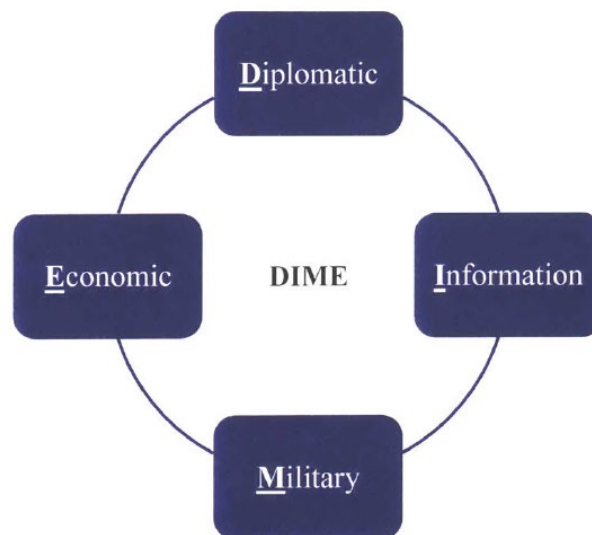


Figure 1: Strategic Operating Environment (SOE) [14, p. 51]



Diplomacy “is the principal instrument for engaging with other states and foreign groups to advance US values, interests, and objectives, and to solicit foreign support for US military operations. Diplomacy is a principal means of organizing coalitions and alliances” [11, pp. I-12]. In a geographic combatant command (GCC), the combatant commander (CCDR) and US ambassadors work to ensure diplomatic efforts are synced with military efforts [11]. Table 1 provides examples of the diplomatic instruments of national power.

The information instrument is a critical component of national security and applies to state and non-state actors. Information includes communications, messaging, intelligence, knowledge management [11, pp. I-13]. The ability to create, exploit, and disrupt knowledge helps provide an actor with an information advantage over his adversary. Information is also used to shape and influence activities of other actors through “coordinated programs, plans, themes, messages, and products” [12, pp. II-6]. Table 1 provides examples of the information instruments of national power.

The military instrument supports national security goals within and without the U.S. While the military is able to provide non-coercive support, such as humanitarian assistance, its primary capability is to “fight and win the Nation’s wars” [11, pp. I-13]. The military can apply force in any domain, land, sea, air, space, and cyberspace. In some situations, the threat of force or supporting international partners with materiel or training can be as effective as kinetic action. Ideally armed conflicts can be prevented using other instruments of national power [12]. Table 1 provides examples of the military instruments of national power.

The economic instrument of national power uses trade, finance, and aid to further or constrain another actor’s prosperity. The economic consequences to an actor can be significant, and economic power is often considered the “heart of national power” [12, pp. II-7]. Jeopardizing a country’s economy to pursue a strategic end is a risk many actors are unwilling to take. Conversely, the opportunity to increase wealth and development through trade, access to capital, and foreign aid can cause an actor to alter its current behaviors [12, pp. II-7]. Table 1 provides examples of the economic instruments of national power.

Table 1: Examples of Instruments of National Power [15]

Diplomatic	Information	Military	Economic
Recognition and non-recognition of states	Radio and TV broadcasts	Peacekeeping Operations	Trade Laws
UN veto power	Leaflets	Counterinsurgency	Tariffs
Demarches	Speeches	Show of Force	Direct Aid (material and financial)
Treaties	Essays	Security Assistance	Economic Sanctions
Participation in regional organizations and forums	Academic, professional, and athletic exchanges	Strikes	Humanitarian assistance
	Web pages	Raids	Competitive contract rules
	(Voice of America)	Blockades	Funding for international organizations
		Humanitarian Assistance	Direct loans
		Noncombatant Evacuation	Debt restructuring
		Mobile Training Teams	
		Multinational Training Exercises	
		Large-scale operations	
	Deterrence		

While the instruments of national power are defined individually, they naturally interact during implementation. As strategists and planners develop coherent strategies, they should identify the main objective to achieve using the instruments of national power. Typically, one instrument has the principal role and other instruments support the effort. This principle and supporting relationship allows for a unity of



effort to be achieved. When considering strategic ends, the goal is to attain that end with minimal cost in lives, resources, property damage, sovereignty, and/or stability for all parties involved. This may require adjusting the combination of instruments of national power employed [12, pp. II-8-9].

2.4. (U//FOUO) AFRICOM and GPC on the African Continent

As one of six GCCs, AFRICOM is directly responsible for employing the U.S. military instrument of power to pursue U.S. national interests within its area of responsibility (AOR) based on the guidance from the NDS and NSS. Its responsibility includes maintaining military relations with African nations, the African Union, and African regional security organizations through operations, exercises, and security cooperation on the African continent, its island nations, and surrounding waters [16]. AFRICOM is headquartered in Stuttgart, Germany and has an AOR that spans 53 nations. The Command's mission statement states that "U.S. Africa Command, with partners, counters transnational threats and malign actors, strengthens security forces, and responds to crises in order to advance U.S. national interests and promote regional security, stability and prosperity" [16]. AFRICOM accomplishes this mission by providing command and control for regional service component commands, including Special Operations, and Combined Joint Task Force-Horn of Africa (CJTF-HOA) while also integrating with a diverse set of U.S. government departments and agencies.

The U.S. national interests are delineated in the 2018 NSS. The interests include protecting the homeland, promoting American prosperity, preserving peace through strength, and advancing American influence. Protecting the homeland focuses on securing national borders, protecting critical infrastructure, engaging malicious cyber actors, and pursuing terrorist threats. Promoting American prosperity emphasizes having fair economic relationships with trade partners and stopping the theft of U.S. intellectual property. Preserving peace through strength directs the rebuilding of the U.S. military and using all tools of national power. Advancing American influence refers to U.S. involvement with partners to increase economic growth and security capabilities [1, p. 4].

U.S. national security interests will not always align with the interests and actions of other nations. A conflict with national interests may cause the U.S. to counter through the use of one or more instrument of national power. Former Secretary of Defense Robert Gates recently highlighted that "...as the great powers today expand and modernize their militaries, if the United States is smart, and lucky, the long competition ahead with China, in particular, will play out in the nonmilitary arena. Those nonmilitary instruments must be revived and updated" [17]. A recent RAND study recommends that the U.S. focus on leveraging its diplomatic and informational soft power advantages over China throughout Africa to promote democracy, human rights, and shared values. The U.S. can also strategically invest where assistance is most needed and will effectively reduce pressure from Russia and China [7, pp. xii-xiii]

The impact of GPC on AFRICOM's focus is evident in the language of its posture statements to the Senate Armed Services Committee since the NDS publication in 2018. The statements extensively reference Chinese and Russian activities on the continent and the effect they have on African nations and U.S. priorities. While the U.S. "encourages constructive partners helping to develop Africa's economic, infrastructure, humanitarian, and security sectors" some "malign actors," such as China and Russia, coerce and exploit many African countries [6, pp. 3-4]. China's attempts to increase military power projection and geo-political influence represents a threat to U.S. security. Russian PMCs have secured Russian investments and likely downed a U.S. unarmed unmanned aircraft in November 2019. General Townsend claims that "they [China and Russia] erode U.S. influence and access over time" [6, p. 4].

AFRICOM's mission seeks to accomplish its stated ends through implementation of its campaign ways and campaign means. Table 2 lists the specific ends AFRICOM is working towards. As defined in Joint Doctrine



Note (JDN) 1-18, Strategy, the *ends* are “the outcomes sought or end states,” which should align with GCC strategic objectives [12, pp. II-1]. The *ways* are how AFRICOM can reach its stated ends. The *means* include available “resources and capabilities” that the ways can use [12, pp. II-1]. Each of AFRICOM’s ends are nested within the NSS and NDS.

Table 2: AFRICOM Strategic Ends, Ways, and Means (courtesy of AFRICOM)

Ends	Campaign Ways	Campaign Means
U.S. Influence is increased	SFA	Funding
African partners contribute to regional security	Exercises	Personnel
VEO threats are reduced	Engagements	Forces
Theater is set	Operations	Authorities
USG and property protected	Maturing Theater	Capabilities
		Footprints
		Agreements
		Senior Leader Time
		International and Interagency Relationships
		State Department Programs

To contribute toward a stated end, a campaign means can support a specific campaign way. However, not all relationships between ways and means will contribute equally toward a specific end. For example, if the desired end is to reduce VEO threats, then operations represent a way to achieve that end. A means to support the “operations” ways could be the employment of forces, and AFRICOM would use forces to execute a specific operation. Forces remains a broad term and deploying an individual battalion to conduct an operation has a far different impact toward reduction of VEO threats than having an Army division conduct that same mission. This difference highlights the need to align means and ways to accomplish stated ends, which will be addressed through the Strategic Alignment Matrix (see Section 3: Approach and Methodology).

2.5. (U//FOUO) Analytical Approaches for Understanding GPC

A key step in this study is understanding how the activities of a nation state are related to the instruments of national power. ATP 5-0.1 briefly highlights two methods for understanding an operational environment, the actors, and the instruments of national power. The first method is a simple categorization of each activity conducted by a nation under one of the DIME instruments. This method is straightforward but has several shortfalls. It can oversimplify an important action by aligning it with one instrument of national power. It does not account for the intent, or goal, and it does not account for the actor that contributed to the action. For example, a cyber-attack may be initiated from one nation state onto another nation state. With no other knowledge of the attack, then we may categorize this action as a Military action. However, a cyber-attack could have Economic and Informational effects which may have been the true purpose of the attack vice destroying some information system. The actor is also important in this case. If the cyber attacker was a citizen with a limited agenda, the relevance of the attack may be less than if the attack was initiated from the military forces of an offensive nation state.

An alternative approach presented in ATP 5-0.1 seeks to address the shortcomings of the previously described method. The second method uses a systems dynamics-based diagramming approach along with design thinking methods to better understand the actors and their relationships within the operational environment. Instruments of national power and elements of DIME that could be applied are identified after the diagram of actors and relationships is understood. An example figure from ATP 5-0.1 is shown below in which the military planners have described an opium network (see Figure 2).

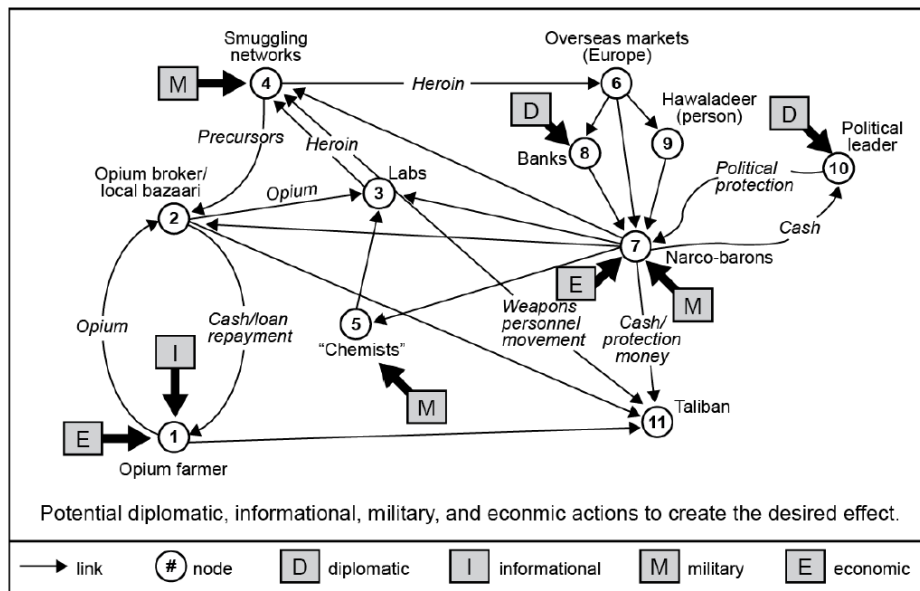


Figure 2: Categorizing Activities using a Systems Dynamics Diagram [18, pp. B-6]

2.6. (U//FOUO) Network Analysis and Visualization

Network analysis is a field that studies a network's structure [19, p. 2]. At a high level, network analysis focuses on the relationships between entities and the patterns that emerge. There has been significant growth and interest in network analysis in recent decades since its applications can extend into many domains. Network analysis techniques have been successfully applied to economic, political, behavioral research fields, among many others [20, p. 3]. The fundamental component of network theory is the existence of relational ties between entities. Entities, also called nodes or vertices, represent actors or actions. These entities are interdependent with other entities as the network structure expands. Entities are connected via links, also called edges. These links represent the flow of information or resources. As the network grows in complexity with added entities and links, patterns and implications emerge about network behaviors [20, p. 4]. Specific metrics, such as degree centrality, closeness centrality, and eigenvector centrality, help quantify how "central" a node is in its network [19, pp. 26-27]. These centrality metrics can potentially imply a level of importance or weight associated with a specific entity and its relationships through a network.

Network analysis and visualization may apply directly to AFRICOM and GPC competitor activities on the African continent. Using network tools and methods can highlight key relationships between activities performed. Section 3: Approach and Methodology explores the application of network analysis to activities within the AFRICOM AOR.



2.7. (U//FOUO) Strategic Alignment

A stated objective of this study is to identify how AFRICOM and GPC competitor activities “positively or negatively align with AFRICOM LOEs and strategic objectives.” JDN 1-18 highlights the importance of continually assessing strategy but fails to give concrete tools or techniques to accomplish this task [12, pp. IV-1-2]. In order to determine organizational alignment requires considering how other successful organizations measure their strategic performance.

Jonathan Trevor and Barry Varcoe propose a method for determining a company’s strategic alignment in Harvard Business Review (HBR). Their technique, published on May 16, 2016, acknowledges that strategic alignment is important but difficult to assess. The authors define key terms to allow for the application of their method. *Strategic alignment* is considered to be the arrangement of all elements within a business. “*Purpose* is what the business is trying to achieve. *Strategy* is how the business will achieve it” [21, p. 3]. “*Organization* ... includes all of the required capabilities, resources (including human), and management systems necessary to implement your strategy” [21, p. 4]. Therefore, a company’s strategic alignment is the arrangement of its strategy and organization to accomplish the stated purpose. A company’s purpose should be considered like the “north star” and have very little deviation even as the strategies and organizational elements shift.

Having a clear definition for strategic alignment, Trevor and Varcoe propose two questions for the organizational decision makers: “*How well does our organization support the achievement of our strategy?*” and “*How well does our strategy support the fulfillment of our purpose?*” [21, pp. 3-4]. Each question should be scored on a 1 to 100 scale, with 1 representing very low support and 100 represent maximum support. The first question captures how well the company resources and capabilities align with strategies being implemented, and the second question captures how well the company strategies are aligned with the overarching purpose.

After answering the two alignment questions, a decision maker can plot his assessment to determine how effective the organization and strategy will be in achieving overall purpose (see Figure 3: Organizational Alignment Tool [21, p. 5][21, p. 5]).



Figure 3: Organizational Alignment Tool [21, p. 5]

Depending on the scores assigned for the two questions, alignment can be classified into four categories. If *organizational capabilities are not aligned* with the strategy and *strategy is not aligned with purpose*, the company is “not long for this world.” Current strategies cannot fulfill the larger company purpose and organizational capabilities are insufficient to accomplish desired strategies. If *organizational capabilities are aligned* with the strategy but *strategy is not aligned with purpose*, the company is “boldly going nowhere.” In this scenario the organizational resources succeed in supporting the desired strategies; however, the strategies remain static and fail to adapt. If *organizational capabilities are not aligned* with the strategy but *strategy is aligned with purpose*, the company has the “best of intentions, but [is] incapable.” For this situation to occur, the company may have good long-term vision but lacks the necessary capacity and resources to realize it. If *organizational capabilities are aligned* with the strategy and *strategy is aligned with purpose*, the company has the “very best chance of winning.” All companies should seek to attain this level of synchronization for purpose, strategy, and resources, as it represents “superior...performance” and “strong commitment to values” [21, pp. 5-7].

An adaptation of this organizational alignment methodology is developed in Section 3: Approach and Methodology. This method seeks to incorporate the ends, ways, and means used by AFRICOM and its GPC competitors as applied to activities on the African continent.

2.8. (U//FOUO) Hypotheses

The primary question this research seeks to answer is how AFRICOM can measure the positive or negative alignment of domain-specific, GPC and AFRICOM, actions with AFRICOM LOEs and strategic objectives. To this end, the problem statement is: Develop an approach for how AFRICOM can measure and visualize the positive or negative alignment of domain-specific, GPC and AFRICOM, actions with AFRICOM LOEs and strategic objectives in order to inform decisions regarding the best investment of AFRICOM resources.



2.8.1.(U//FOUO) Hypothesis 1 (Objective 1)

In support of the research question and problem statement, the study team hypothesizes that because GPC activities in the AFRICOM AOR can be observed, their alignment with AFRICOM LOEs and strategic objectives can be measured to better inform decision on future AFRICOM activities. To illustrate this idea, one can imagine a scenario in which AFRICOM, via some sensor, observes a GPC competitor conducting an activity in an African nation at a specific time. This activity is associated with an instrument of national power and can be categorized as such. The activity is also positively or negatively aligned with AFRICOM efforts, regardless of the actor. The ability to visualize this action in a network of actions will allow AFRICOM to make more informed decisions about their response.

2.8.2.(U//FOUO) Hypothesis 2 (Objective 2)

The second research objective specifies the development of a network visualization model that captures AFRICOM and GPC competitors' actions. The study team hypothesizes that specified AFRICOM and GPC activities have relationships with AFRICOM LOEs and DIME instruments. These relationships can be developed into a network visualization tool that allows for decision makers to identify clear positive and negative alignment to AFRICOM LOEs. Decision makers can allocate limited AFRICOM resources to activities that reinforce specific LOEs as appropriate.

2.9. (U//FOUO) Constraints

A constraint is a restriction imposed upfront in the study's scope and guides the conduct of the study. The only constraint at this time is that this study will only include select intelligence, surveillance, and reconnaissance (ISR) and special operations command (SOCOM) related activities. Only U.S. ISR and SOCOM activities will be included for this study, and classification will be constrained to SECRET classification.

2.10. (U//FOUO) Limitations

Limitations are circumstances limiting the study team's ability to fully meet the study objectives or fully investigate the problem. There are currently two limitations on the study team. First, the current telework environment due to COVID-19 limits the research team's ability to travel to AFRICOM in order to fully engage with problem stakeholders. Second, the data related to GPC actors and their actions in the AOR will be limited, estimations, or purposefully misleading as they have an interest in keeping some of their actions secret from the U.S. government.

2.11. (U//FOUO) Assumptions

Assumptions are statements that are taken as true in absence of facts, often to accommodate a limitation. At this time, the study does not require any assumptions to be made.



Section 3 Approach and Methodology

3.1. (U//FOUO) General Approach

The general approach for this study was divided into two primary efforts in support of the two research objectives.

Objective 1, identifying metrics, available data, data gaps and determining positive or negative alignment to AFRICOM LOEs and strategic objectives, has some implied tasks. The study team needed to establish a definitive list of AFRICOM activities. Additionally, the study team needed to develop a definition of alignment that could apply to AFRICOM and GPC activities. Upon completing those implied tasks, the study team could identify required metrics and data sources. The final task for Objective 1 was to develop a scoring methodology that connecting the alignment definition to the list of activities.

Under Objective 2 the study team relied on the Objective 1 effort to develop a network visualization model that connects AFRICOM and GPC activities to LOEs and strategic objectives. This visualization tool incorporates positive and negative alignment to inform a decision maker how activities on the African continent support or conflict with AFRICOM LOEs. The tool categorizes activities into specific domains. Decision makers can employ this visualization to inform decisions on how to best invest AFRICOM's existing resources.

3.2. (U//FOUO) Objective 1: GPC Competitor Alignment with AFRICOM LOEs

3.2.1.(U//FOUO) Research Procedures

The goal of Objective 1 is to develop a methodology to measure positive or negative alignment of activities conducts by AFRICOM and GPC competitors. To effectively accomplish this, the study team developed the following approach:

1. Research and define activities occurring in the AFRICOM AOR.
2. Define strategic alignment in a way that allows for positively and negatively activities to be quantified.
3. Identify required data and metrics required to apply the strategic alignment tool.
4. Identify data gaps required to improve the effectiveness of the strategic alignment tool.

These discrete steps enabled the study team to decompose Objective 1 and clearly address each component. The following sections (3.2.2 through 3.2.5) explain the methodology and procedures used to that led to the development of the alignment matrix tool. It also addresses data requirements and data gaps that enable the effective implementation of the tool.

3.2.2.(U//FOUO) AFRICOM and GPC Activities

Developing a meaningful list of activities that occur across the AFRICOM AOR requires balancing an appropriate level of abstraction and detail. It is readily apparent in many venues, from the 2020 AFRICOM Posture Statement to the Senate Armed Services Committee to open-source news outlets to social media, that the U.S., China, and Russia are active in Africa. Activities range widely in scope and type. A few



example activities considered for analysis include senior government leadership visits to the continent, construction of military bases and ports, financial contributions to international organizations, sale of arms to African nations, and infrastructure projects to promote economic development [6]. While all of these activities are significant, the study team sought to develop a list of activities that was universal enough to capture all activities that occur on the continent.

One important definition our team established early in the process was that of an activity. Some activities, such as building a military base in a country, has many enabling activities and occur over a prolonged period of time, in some cases several years. Rather than count each individual enabling event as a separate activity, the team defined an activity as such: *an activity is the physical manifestation of ways and means by an actor and includes all enabling events*. Enabling activities are those events that are necessary for the primary activity to occur, such as the agreement between two countries to allow the establishment of a military base. This event must occur prior to a military base being constructed, but it is an enabling activity for the primary activity of establishing a military base. Focusing on primary activities provides an additional benefit. The network visualization will incorporate only primary activities, which have a greater likelihood of having meaningful alignment to LOEs and ends. Going forward, this work will refer to primary activities simply as “activities.”

After establishing a definition for an activity, the study team researched individual activities from a variety of sources. Rather than rely on news outlets and statements from senior military and government leadership, the study team elected to use military doctrine and publications to identify a definitive list of activities. This approach supported the need to have a universal activity list rather than thousands of discrete activities.

The first source for activities incorporated AFRICOM’s list of ways as published in the 2018 AFRICOM Campaign Plan. This listing includes five categories of ways: Security Force Assistance, Exercises, Operations, Engagements, and Enabling Activities (Maturing the Theater). AFRICOM identifies 33 activities that fall into these five categories, ranging from professional military education to infectious disease control to intelligence collection. Since these activities come from AFRICOM’s campaign plan, they rely heavily on the military instrument of national power. However, several activities, such as information operations and key leader engagements, also have some component of diplomatic or informational power. The activities from the 2018 AFRICOM Campaign Plan are:

- Professional Military Education
- Training (Unit Level) / PKO
- Mentoring (Ministry of Defense / Gen Staff Level)
- Military Equipping (not including Arms Sales)
- Defense Institution Building
- Partnered Exercises (African / NATO)
- HQ Exercises (AFRICOM)
- Response Force Exercises (East Africa RF)
- Medical Readiness Exercises (MEDREX)
- Kinetic Operations (sea-based air strikes)
- Advise, Assist, Accompany Operations
- Counter-Threat Finance Operations
- Information Operations
- Cyber Operations
- Intelligence Collection Operations



-
- Non-Lethal Support Operations
 - KLEs / SLEs
 - Military-to-Military Engagements
 - Conferences / Symposiums
 - African Enlisted Development Strategy Engagements (AEDS)
 - Support to Diplomatic Engagements
 - Info / Intel Sharing Engagements
 - Port Calls Engagements
 - Liaison Engagements
 - PAO Engagements
 - Infectious Disease Control Engagements
 - Regional Security Organization Engagements
 - Posturing Enabling Activities
 - Intel Collection Enabling Activities
 - Crisis Response Enabling Activities
 - Force Protection Enabling Activities
 - Logistics Network Enabling Activities
 - Data Management Enabling Activities

The study team sought to manage this complexity by developing multiple linkages between activities and DIME instruments, as will be described shortly.

The second source for AFRICOM and GPC activities on the African continent was Joint Publication (JP) 3-0, Joint Operations. JP 3-0 provides guidance to “plan, execute, and assess joint military operations” [22, p. ix]. There are specific activities listed within JP 3-0 that were not included in the AFRICOM Campaign Plan. The following seven activities are primarily tied to the Information instrument of national power and are identified in JP 3-0:

- Civil Military Operations
- Military Deception (MILDEC)
- Military Information and Support Operations (MISO)
- Operational Security (OPSEC)
- Electronic Warfare (EW)
- Combat Camera (COMCAM)
- Space and Special Technical Operations [22, pp. III-23-26]

These JP 3-0 activities were identified and added to the initial list of activities.

The third source for activities came from the Command and General Staff College’s Intermediate Level Education (ILE) lesson on strategy. This lesson identifies example applications of the instruments of national power. Unlike the first two sources, this source provided specific examples of national power applications. Not all activities identified from this course were added to the composite list of AFRICOM activities. Some activities within the ILE lesson were substantially similar to already identified activities or fell into a broader activity category already identified. The following 28 activities were added from the ILE lesson:

- Conduct Information Operations
- Demarches



-
- Sign Treaty/Agreement
 - UN Veto Power
 - High Intensity Operations
 - Deterrence Operations
 - Naval Blockade
 - Noncombat Evacuation Operations
 - Humanitarian Assistance Operations
 - Sign a Trade Law
 - Establish a Tariff
 - Provide Direct Financial Aid (Foreign Direct Investment (FDI))
 - Provide Direct Material Aid
 - Impose Economic Sanctions
 - Competitive Contract Rules
 - Funding for International Organizations
 - Provide a Direct Loan
 - Debt Relief/Restructuring
 - Establish/Remove Embassy Presence
 - Diplomatic Exchange
 - Head of State Visits
 - Non/Recognition of a State
 - Establish a Military Base
 - Arms Sales
 - Private Military Company (PMC)/Contractor Presence
 - Improve Infrastructure
 - Sponsor African University Students
 - UN Troop Contribution [15]

When paired with the AFRICOM-provided activities and the JP 3-0 activities, the composite list of activities that can occur on the continent has 68 total entries. This list accounts for a wide array of activities and remains broad enough to allow for universal application to Africa. This activity listing deliberately ignores the resources supporting a given activity. As will be explained in Section 3.2.3, the resources are captured within the “means,” which ties into the strategic alignment scoring methodology.

Having a defined list of 68 activities, the team needed to classify each activity using the DIME framework of national power. The initial attempt sought to classify each using a binary decision-making rule. For example, each activity would be classified strictly as a diplomatic, informational, military, or economic activity. This resulted in a table similar to Table 3: AFRICOM and GPC Activity Binary Classification, which is an example of how all activities were classified according to DIME instruments.

Table 3: AFRICOM and GPC Activity Binary Classification

Activity	Diplomatic	Informational	Military	Economic
Head of State Visits	1	0	0	0
Conduct Arms sale	0	0	1	0
Improve Infrastructure	0	0	0	1
Competitive contract rules	0	0	0	1
Conduct a conference or symposium	0	0	1	0
Military Information and Support Operations (MISO)	0	0	1	0

This approach to classifying activities into only one DIME category, while simple, has a major flaw; activities often represent more than one instrument of national power. While the binary classification method as shown in Table 3: AFRICOM and GPC Activity Binary Classification provides clear distinctions between DIME elements, it fails to capture the complexities of some activities. In order to better classify activities, a new approach emerged. Figure 4: Network Approach to Activity Classification represents how a specific activity may have clear ties to multiple instruments of national power. For example, conducting a cyber operation may have some elements of military power and some elements of informational power.

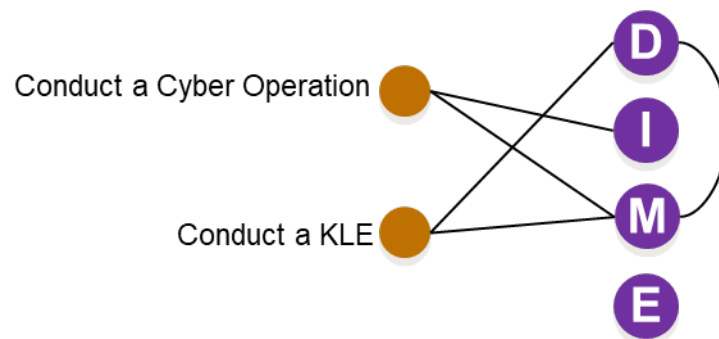


Figure 4: Network Approach to Activity Classification

To capture the multiple ties to DIME elements, the study team developed weighted scores for each activity that would sum to one. These weights represented the proportion of a given activity that was represented by a specific instrument of national power. For example, if the “conduct a cyber operation” activity (depicted in Figure 4) had a 75%/25% split between informational and military elements, then the assigned weights were 0.75 and 0.25 respectively. This method allows for an activity to exhibit multiple ties to DIME elements. When assigning weights to activities, the team established a rule that an activity cannot have more than two links to DIME elements. Although many activities may have some relation with all four DIME elements,



this level of granularity becomes overly specific for this strategic-level analysis. The study team's goal is to develop a method to capture activities (Objective 1) and then develop a network visualization of the alignment (Objective 2). If a preponderance of activities has connections to all four DIME elements, the network visualization risks becoming overly complex and uninterpretable. This rule limiting DIME element connections seeks to resolve that issue but can be amended as desired.

3.2.3.(U//FOUO) Define and Measure Strategic Alignment

Having researched and defined activities occurring on the African continent, the next step was to define strategic alignment in a way that allows for positively and negatively activities to be quantified. As discussed in Section 2.7, JDN 1-18 mentions the importance of assessing progress toward strategic objectives but fails to recommend any specific tools or methods. This gap led the study team to research existing methods and develop a tool to measure strategic alignment that could be applied to AFRICOM's AOR.

The team utilized the strategic alignment method developed by Trevor and Varcoe that seeks to measure how well a business has aligned its purpose, strategy, and organizational capabilities. To use this method effectively, some terminology adjustments were necessary. Section 2.7 identifies the key terms used for Trevor and Varcoe's method. In order for AFRICOM can apply the method, key terms were adjusted as such:

- **Alignment:** the arrangement of Ways and Means to accomplish desired Ends
- Purpose transforms to **Ends:** *what* AFRICOM is working to achieve, outcomes sought or End States
- Strategy transforms to **Ways:** *how* AFRICOM will achieve its Ends using available Means
- Organizational capabilities transform to **Means:** all available *capabilities and resources* [12, pp. II-1]
- **Activity:** the physical manifestation of Ways and Means by an actor and includes all enabling events

Having these definitions incorporate doctrinal terms allows for the broader AFRICOM community to understand the methodology and to implement the alignment method. After defining key terms, the organizational alignment tool was modified to incorporate them (see Figure 5: Strategic Alignment Matrix Part 1).

An analyst can use the Strategic Alignment Matrix to assess a specific activity taken by AFRICOM by answering two questions: "how well does the means support the ways?" and "how well does the ways support the ends?". The answer to each question can be "minimal support" or "strong support" depending on the activity. Upon answering both questions, one can determine which category an activity falls into. In the event than an activity has minimal means supporting the ways and minimal ways supporting the ends, then the activity *will not achieve its ends*. If an activity has strong means supporting ways but minimal ways supporting the ends, then the activity has *misguided ways*. If an activity has minimal means supporting the ways but the ways strongly support the ends, then the activity *lacks proper means to achieve desired ends*. Finally, if an activity has means that strongly support the ways and ways that strongly the ends, then the activity has the *greatest likelihood of achieving its ends*.

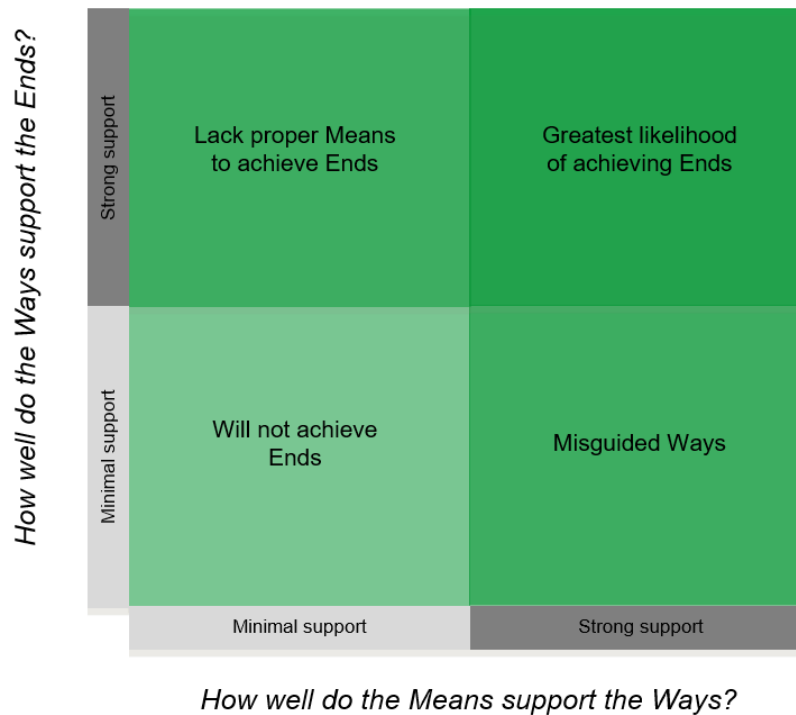


Figure 5: Strategic Alignment Matrix Part 1

While Figure 5 works well to determine the alignment of specific activities that positively align with AFRICOM LOEs and strategic ends, it fails to address negatively aligned activities. In order to address activities that conflict with AFRICOM LOES and strategic ends, the same questions apply: “how well do the means support the ways?” and “how well does the ways support the ends?”. For negatively aligned activities, the means can either have minimal support or strong support for the ways; however, an activity can either be minimally against or strongly against AFRICOM’s LOEs and Ends. Figure 6: Strategic Alignment Matrix incorporates this additional characteristic into the alignment matrix, and negatively aligned activities are clearly depicted on the left-hand side of the matrix in red. When developing this negative alignment characteristic, the study team assumes that only GPC competitor activities will be negatively aligned with AFRICOM LOEs. The team could not envision a situation where AFRICOM would conduct an activity that conflicts with its stated goals on the continent. As such, we expect all AFRICOM activities and some GPC competitor activities to be positively aligned with AFRICOM LOEs and strategic ends, placing them on the right-hand side of the strategic alignment matrix.

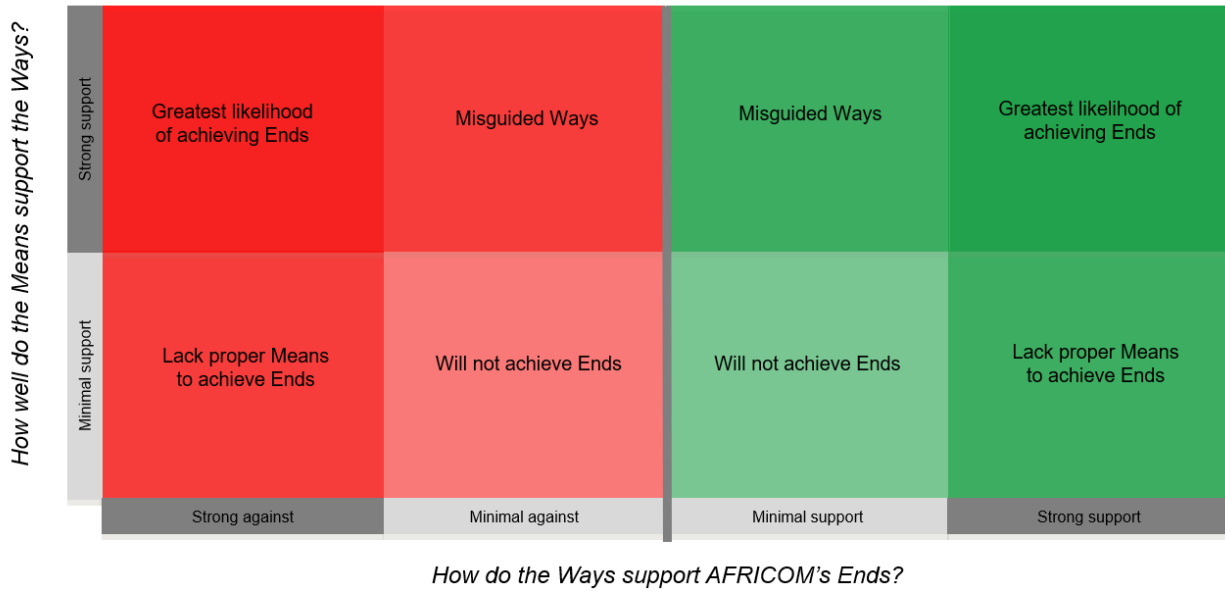


Figure 6: Strategic Alignment Matrix

The Strategic Alignment Matrix shown in Figure 6 classifies activities into eight categories. To further develop this tool, the Strategic Alignment Matrix assigns scores and recommends potential actions to the decision maker. Scoring is from -1.0 to +1.0, with -1.0 indicating strong means and strong ways aligned *against* AFRICOM LOEs and strategic ends and +1.0 indicating strong means and strong ways aligned *with* AFRICOM LOEs and strategic ends. The minimum possible score that an activity can receive is +/- 0.1, which allows for all activities to contribute some type of alignment score. However, activities with minimal means supporting ways and minimal ways supporting/opposing ends will have a relatively low score relative to more significant activities. The potential actions are meant to prompt the decision maker about possible responses for a GPC competitor's activity, not to be a definitive recommendation. Each activity by a GPC competitor has unique circumstances including country priority, type of activity conducted, and broader environmental factors. The Strategic Alignment Matrix helps to quantify the positive and negative alignment of a specific activity.

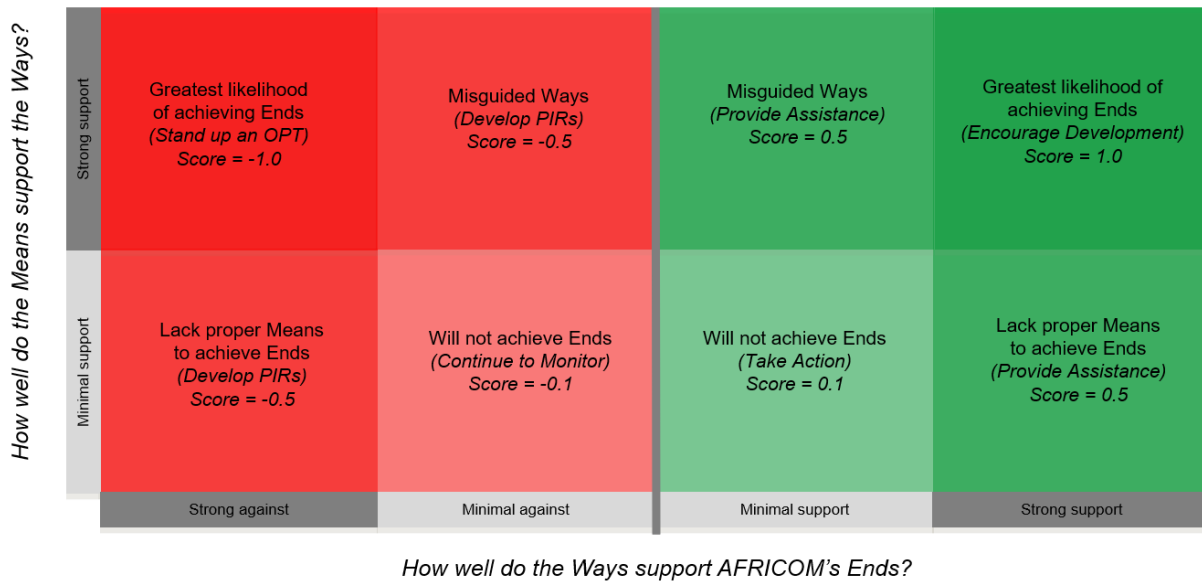


Figure 7: Strategic Alignment Matrix with Scoring

3.2.4.(U) Key Metrics and Data Sources

See SECRET version of Technical Report for Section 3.2.4 - Key Metrics and Data Sources.

3.2.5.(U) Data Gaps

See SECRET version of Technical Report for Section 3.2.5 - Data Gaps.

3.3. (U//FOUO) Objective 2: Network Visualization Model

3.3.1.(U//FOUO) Model Development Procedures

The goal of Objective 2 is to develop a model that assists in the network visualization of activities taken by GPC competitors and AFRICOM throughout the AFRICOM AOR. The intent of this model is to help inform decisions regarding the best allocation of AFRICOM resources. To accomplish this objective, the study team utilized the following approach:

1. Incorporate activities and data identified in Objective 1.
2. Determine relationships between DIME instruments of national power and activities identified in Objective 1.
3. Determine relationships between activities and AFRICOM LOEs.
4. Connect AFRICOM LOEs to AFRICOM Ends using AFRICOM supporting documents.
5. Develop a network model that visualizes the DIME elements, activities, LOEs, ends, and relationships so that a decision maker can understand how activities performed on the continent impact LOEs and Ends over time.

6. Create notional case study data and apply the network model.
7. Interpret the model using a case study example based on a notional data set generated to validate the model.

These discrete steps enabled the study team to decompose Objective 2 and address each component. The following sections (3.3.2 to 3.3.3) explain the methodology used to that led to the development of the network visualization model. It also includes a case study that demonstrates how the model can be applied and interpreted by a decision maker.

3.3.2. (U//FOUO) Network Visualization Model Development

Developing the network visualization model required incorporating activities and data from Objective 1. The study team interviewed COL Matthew Dabkowski, who performed a 2016 study for Combined Joint Task Force-Horn of Africa (CJTF-HOA). His work applied network analysis using DIME to CJTF-HOA's Combined Joint Operations Area (CJOA). COL Dabkowski considered how UN voting records, internet search records, formal military alliances, and exports form networks across the CJOA. He then identified patterns that emerged across the DIME domains. Considering Objective 2 for this study, COL Dabkowski recommended applying a bipartite network to visualize GPC and AFRICOM LOEs and the other side representing GPC LOEs. As activities occurred on the continent, a visualization could emerge. Links between AFRICOM and GPC LOEs could show alignment or conflict, and node sizes could increase as activities linked to each LOE increased in frequency. Figure 8 depicts the concept for this bipartite network approach. Although the study team considered developing this kind of model, significant gaps would make it difficult to properly capture the GPC LOEs and align them against AFRICOM LOEs. Definitely knowing the LOEs of GPC competitors is a challenge outside the scope of this study. Ultimately, the study team elected to develop a network visualization tool that incorporated this concept of LOE alignment and activity frequency in a modified form.

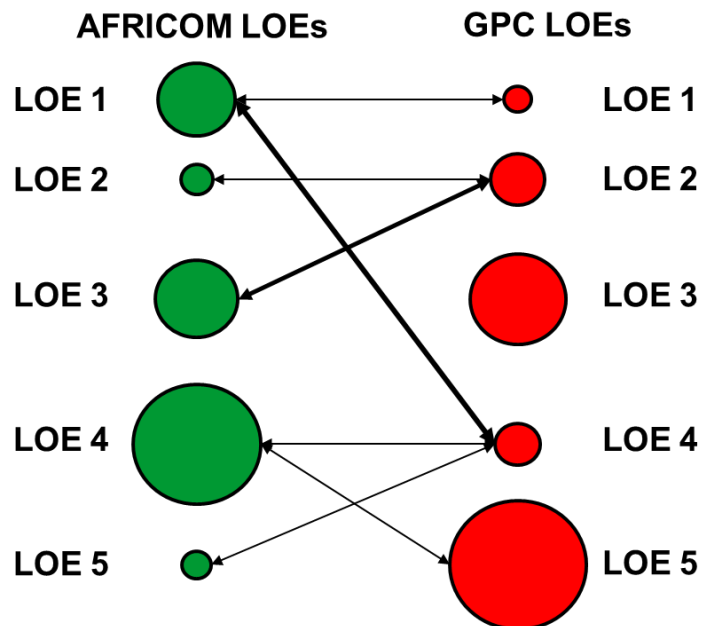


Figure 8: Bipartite Network Concept for Network Visualization

The network visualization model seeks to illustrate the relationships that emerge across domains and ultimately impact LOEs and Ends. To develop these relationships, the study team needed to identify the nodes and links within the network. After building the network structure, notional and real-world data could be applied to the network to build meaningful visualizations. Figure 9 represents the concept sketch the study team used for planning. As shown, the network contains four distinct levels. The first level is the DIME elements available to AFRICOM. The second level is the activities AFRICOM and GPC competitors can perform. The third level is AFRICOM's LOEs. The fourth level is AFRICOM's Ends. Each level has relationships connecting them to the higher level. For example, the Diplomatic element is linked to all activities that have are classified as Diplomatic. The link weight represents the frequency of occurrence. The node size represents the element itself (DIME element, Activity, LOE, or End). Node size captures how connected that node is throughout the network using a network metric, such as eigenvector centrality, betweenness, or degree. The node size then represents how an activity can impact other levels of the network.

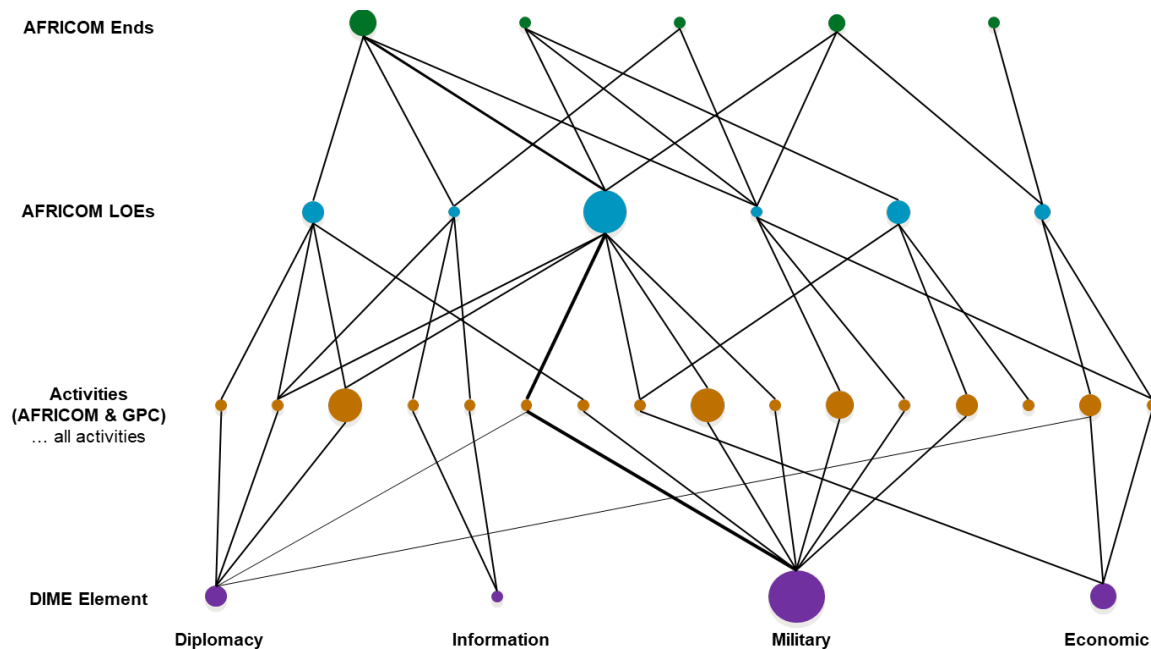


Figure 9: Network Visualization Concept Diagram

The instruments of national power, activities, AFRICOM LOEs, and AFRICOM ends are represented in the network model as nodes. Appendix B lists all possible nodes that could possibly be included in the model, depending on actual activities that occur (see Table 9 through Table 12).

Examples of relationships between entities are highlighted in Table 4 through Table 6. These relationships are the links in the network visualization. Appendix C lists all relationships used to develop the underlying structure of the network model.

Each table includes several important fields needed to develop the network visualization model. Essential to the network model is identifying all possible relationships that exist between nodes. In Table 4 the “from” column is the initiation point in the network and includes the instruments of national power. These DIME instruments represent levers that AFRICOM can use to achieve desired effects and are the inputs to the system. The “to” column represents the activities that are the physical manifestation of the DIME elements



that can occur across the continent. The “type” field captures the aspect of the relationship for plotting, and DIME elements support activities since there is no defined positive or negative relationship. “Weight” represents the proportion divided amongst DIME elements. For example, the “Professional Military Education” activity is linked solely to the Military element; therefore, its weight is 1.0 and it is linked the “M” node. Conversely, the “Mentoring (Ministry of Defense / General Staff Level)” activity is considered both a Diplomatic and Military activity. This activity has links to “D” and “M” and a 0.5 weighting for each DIME element. Weights can range from 0 to 1.0 for each link but for each “to” node, the weights must sum to 1.0. The final field is “plot type,” which is used for plotting different types of network graphs. If the decision maker wants to view all 68 activities, then a Tier A plot is created. If he/she wants to generalize activities into grouping related to DIME elements, then a Tier B plot is appropriate.

Table 4: Example Network Links from DIME Elements to Activities

from	to	type	weight	plot type
M	Professional Military Education	Supporting	1.0	A
D	Mentoring (Ministry of Defense / Gen Staff Level)	Supporting	0.5	A
M	Mentoring (Ministry of Defense / Gen Staff Level)	Supporting	0.5	A
M	M_Kinetic	Supporting	1.0	B
M	M_Nonkinetic	Supporting	1.0	B

Table 5 uses the same approach as Table 4 to capture the links from activity nodes to LOE nodes. Activities are listed in the “from” column, and their respective LOE(s) are listed in the “to” column. Unlike Table 4, activities can have a positive or negative relationship to their LOE(s) based on their alignment score. Since the network structure needs to capture all possible relationships, the “type” field can have a value of “positive” or “negative.” “Weight” represents the proportion amongst LOE(s). For example, the “Professional Military Education” activity is linked solely to the LOE 1; therefore, its weight is 1.0 and it is linked to the LOE 1 node. However, this link can be positive or negative, depending on its alignment score. The “Mentoring (Ministry of Defense / General Staff Level)” activity contributes to LOE 2 and LOE 3. When this activity occurs, it contributes a weight of 0.25 to LOE 2 and 0.75 to LOE 3. These links can be positive or negative, as shown in Table 5.



Table 5: Example Network Links from Activities to LOEs

from	to	type	weight	plot type
Professional Military Education	LOE_1	Positive	1.0	A
Professional Military Education	LOE_1	Negative	1.0	A
Mentoring (Ministry of Defense / Gen Staff Level)	LOE_2	Positive	0.25	A
Mentoring (Ministry of Defense / Gen Staff Level)	LOE_3	Positive	0.75	A
Mentoring (Ministry of Defense / Gen Staff Level)	LOE_2	Negative	0.25	A
Mentoring (Ministry of Defense / Gen Staff Level)	LOE_3	Negative	0.75	A
M_Kinetic	LOE_4	Positive	0.5	B
M_Kinetic	LOE_5	Positive	0.5	B
M_Kinetic	LOE_4	Negative	0.5	B
M_Kinetic	LOE_5	Negative	0.5	B
M_Nonkinetic	LOE_1	Positive	1.0	B
M_Nonkinetic	LOE_1	Negative	1.0	B

Table 6 continues with the same approach, linking the AFRICOM LOEs to their respective Ends. LOEs are listed in the “from” column, and respective end(s) are listed in the “to” column. Similar to Table 4, the links between LOEs and ends are not positive or negative. Accomplishing an LOE supports the stated strategic end, so the “type” field is “supporting.” Like the other links, weights must sum to 1.0, but an LOE can have a singular link to an End or have multiple links (see Table 6). The links between LOEs and Ends are notional.

Table 6: Example Network Links from LOEs to Ends

from	to	type	weight	plot type
LOE_1	END_1	Supporting	0.5	D
LOE_1	END_2	Supporting	0.5	D
LOE_2	END_2	Supporting	1.0	D

3.3.3.(U//FOUO) Case Study Example and Interpretation

Having developed the underlying network structure of nodes and links, the study team then created a working model using notional data. The goal was to filter the dataset using different criteria, then produce plots that represented the notional activities. The interpretation of these network visualization plots are examples of how the network visualizations could inform the decision maker of activities in the AFRICOM AOR and show how the activities are aligned to LOEs and ends. The decision maker would then be better informed about how to employ limited resources.

In order to develop a notional dataset, the study team established data fields related to activities that could occur and populated the fields using randomized inputs. 1,500 total activities were generated to populate the notional dataset, with an example highlighted in Table 7. The dataset is structured to replicate how an analyst could input assessments after an activity occurred. The “actor” field was populated to represent



AFRICOM or GPC competitors with a “U,” “R,” or “C.” Activities were assigned using a random number generator and pulling from the 68 activities previously identified. “Country” and “date” were also assigned based on random number assignments, using countries in Africa and dates ranging from January 1, 2015 to January 1, 2020. In practice the “align type” and “alignment score” fields would be assessed by an analyst, but these fields also were randomly generated. Remaining fields auto-populated based on input categories. For example, “Tier B category” was populated based on the specific activity listed, “region” was based on the country input, and “priority” was based on AFRICOM’s notional country priority list. This notional dataset represented a dataset the study team then manipulated to create network visualizations. Tier B categories include: Diplomatic-Soft, Diplomatic-Hard, Informational-Deceptive, Informational-Nondeceptive, Military-Kinetic, Military-Nonkinetic, Economic-Coercive, Economic-Noncoercive. These allow for additional fidelity to be applied the DIME elements without the specificity of the 68 defined activities.

Table 7: Example of Notional Dataset for Network Visualization

Actor	Activity	Tier_B Category	Country	Region	Priority	Date	Align Type	Alignment Score
U	Military Deception	M_Nonkinetic	Mauritania	West Africa	4	5/24/2016	Positive	0.1
R	Improve Infrastructure	E_Noncoercive	Kenya	East Africa	2	12/25/2019	Positive	1
C	Information Operations	I_Deceptive	Senegal	West Africa	4	1/28/2016	Negative	0.1
U	Establish a Tariff	E_Coercive	Gambia	West Africa	3	10/28/2015	Positive	0.5

The complete notional dataset included 1,500 unique events but to generate meaningful network visualizations only a subset of events is required. Table 8 is an example of a filtered notional dataset. The “actor” was set to “C,” the “region” was set to “West Africa,” and the dates were set to be from August 18, 2017 to January 1, 2020. In total, this subset includes 71 events.

Table 8: Example of Filtered Notional Dataset for Network Visualization

Actor	Activity	Tier_B Category	Country	Region	Priority	Date	Align Type	Alignment Score
C	KLEs / SLEs	D_Soft	Guinea	West Africa	4	12/27/2019	Negative	1
C	Provide Direct Material Aid	E_Noncoercive	Benin	West Africa	1	6/25/2019	Positive	0.5
C	Establish a Military Base	M_Nonkinetic	Niger	West Africa	2	10/5/2018	Positive	0.1
C	Naval Blockade	E_Coercive	Ghana	West Africa	3	12/4/2019	Negative	0.5

Incorporating the filtered notional dataset into the established network structure required modifying the R script to generate the network visualization plot. The network visualization should depict only events that met the specified filter criteria, so unused nodes and links needed to be removed from the complete notional dataset. In order to do so, the “nodes” data frame was merged with the filtered notional dataset. If the filtered notional dataset contained an activity node within the original data frame, then the node remained and would be plotted in the network visualization. If the filtered notional dataset did not contain a node from the

complete listing of activity nodes, the node was removed so it would not plot. The same technique was applied to generate links for the network visualization. The next task was to identify the frequency of unique activity types that occurred, which impacted the link weight for the network visualization. The frequency of activities that had positive and negative alignment scores was also determined. Positive and negative alignment is depicted in the links from the activity level to the LOE level of the network visualization.

The network visualization has flexibility to adjust to decision maker preferences. Node colors are set based on the level of the nodes (e.g. activity, LOEs, ends) but can easily be modified. Similarly, the study team has chosen to model the link weights using the frequency of activity occurrence along with polarity of alignment score. Another technique would be to sum alignment scores and have those sums be the link weights. Node sizes are based on the eigenvector centrality network metric, regardless of alignment score. Eigenvector centrality was chosen to represent node size since it measures both how many times an activity occurred and considers the importance of a node's neighbors. This ability to capture a node's "influence in the network" helps to visually depict which nodes are most significant [23, p. 31]. Figure 10 represents an example Tier A network and Figure 11 represents an example Tier B network, followed by how to interpret each visualization.

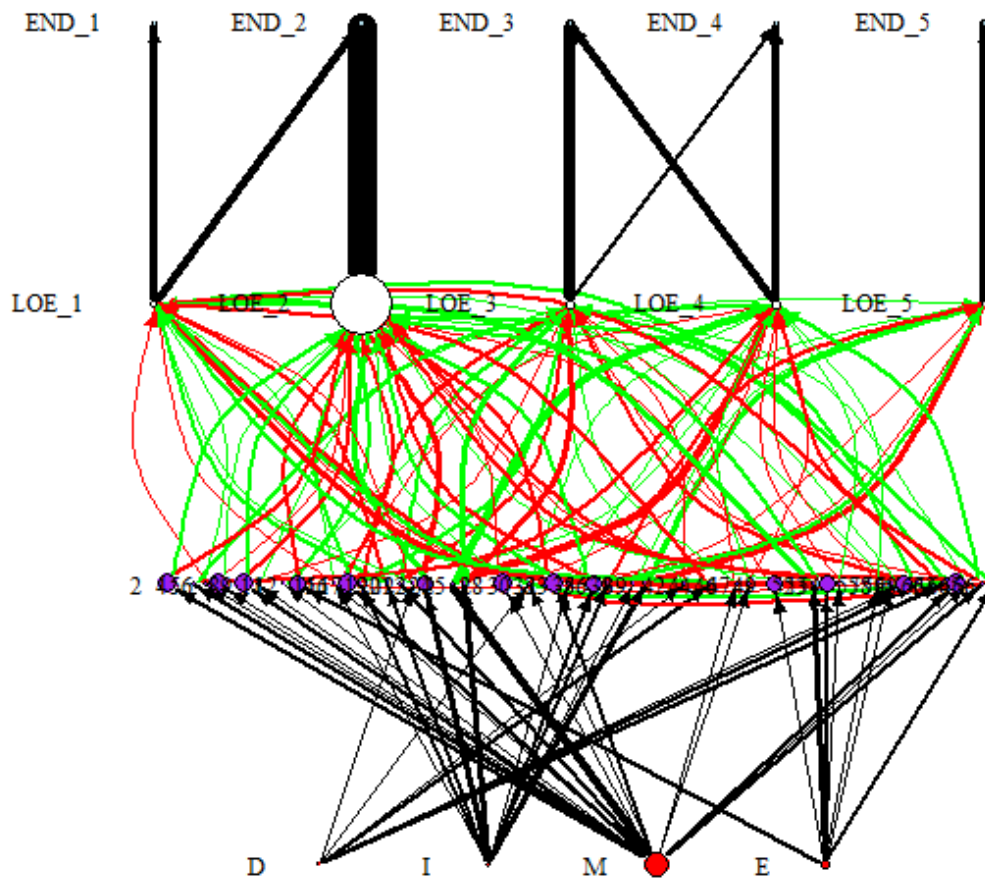


Figure 10: Example Tier A Network Visualization Model using Eigenvector Centrality

Figure 10 contains the notional activities that occurred using the previously described case study example. This Tier A visualization depicts each activity that occurred and removes any activity from the complete list of 68 possible activities that did not occur. It is immediately clear that the interactions of activities across the network are difficult to interpret. The value of the network visualization is not in the details tied to each specific activity that occurred, but rather in the overall insights that can be drawn from the figure. An analyst could have the following potential interpretation. It is clear from assessing the DIME nodes that the Military nodes is largest, meaning it has the most connections and greatest influence throughout the network relative to the other DIME elements. Country C has relied primarily on Military activities in the region, followed by Economic activities. Based on the edge weights from DIME nodes to activity nodes, there has been a high frequency of Foreign Direct Investment (FDI), Private Military Company (PMC) presence, and Arms Sales. It is clear that Country C's activities are focused on LOE 2, as this node is the largest for that level. Country C's activities are both positively and negatively aligned with LOE 2 based on the positive and negative alignment edges entering that node. Finally, End 2 has the highest likelihood of being achieved, as shown from the heavy edge weight connecting LOE 2 and End 2. This is because End 2 has a strong relationship with LOE 2.

The largest issue with this Tier A visualization is that 68 activities makes it difficult to understand, interpret, and use to make decisions. This complexity would dramatically increase if the number of activities within a filtered dataset was greater than the 71 activities from this example. Grouping these activities into broader bins helps improve the visualization.

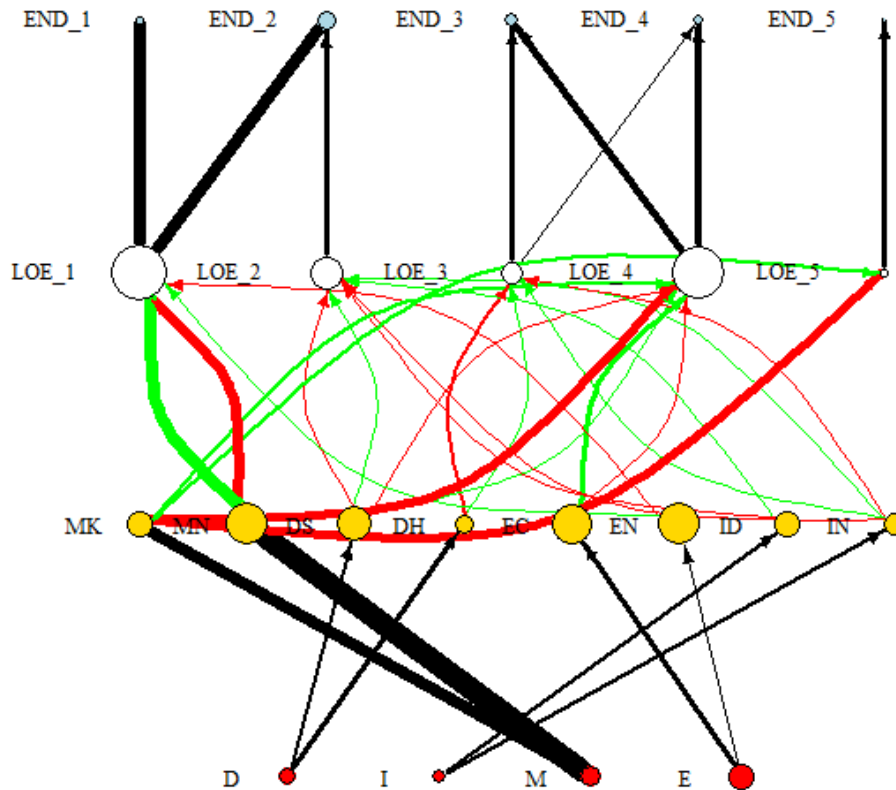


Figure 11: Example Tier B Network Visualization Model using Eigenvector Centrality



Figure 11 depicts a filtered notional dataset in which the “actor” was set to “R,” the “region” was set to “East Africa,” and the dates were set to be from August 18, 2017 to January 1, 2020. In total, this subset includes 62 events. Figure 11 differs from Figure 10 in that the activities are grouped into the “Tier B Categories.” This binning of activities makes the network visualization model easier to interpret and still captures the activities that occurred. An analyst could have the following potential interpretation of Figure 11. It is clear from assessing the DIME nodes that the Economic node is largest, meaning it has the most connections and greatest influence throughout the network relative to the other DIME elements. Country C has relied primarily on Economic activities in the region, followed by Military activities. Based on the edge weights from DIME nodes to activity nodes, there has been a high frequency of Military Nonkinetic (MN), Military Kinetic (MK) and Economic Coercive (EC) activities. It is clear that Country R’s activities are focused on LOE 1 and LOE 4, as these nodes are the largest for that level. Country R’s activities are both positively and negatively aligned with LOE 1 based on the positive and negative alignment edges entering that node. Finally, End 1 and End 2 have the highest likelihood of being achieved, as shown from the heavy edge weight connecting LOE 1 and LOE 2 to End 1 and End 2.

3.3.4. (U//FOUO) Network Visualization Model Application

Having developed the network visualization model and demonstrating its use with notional data, the next task was to apply the model to real-world data. AFRICOM provided access to its Command and Control of the Information Environment (C2IE) platform, which is where it tracks operations, activities, and investments (OAs) across the continent. As discussed in Section 3.2.4, some key data within C2IE could be used to populate the network visualization model. However, as discussed in Section 3.2.5, there are some significant data gaps. The study team generated relationships between OAs and LOEs since C2IE currently does not contain this information. This enabled a visual depiction of OAs that occurred without removing a significant percentage of records. Although the C2IE data structure was different from the notional dataset used to generate the network visualization model, most of the data exists and, after reformatting and cleaning the data, could be incorporated into the model. The ORCEN team had to randomly generate alignment scores, since that is a new metric developed in this study. This methodology yielded the results that are in Section 4.1 - GPC Alignment Network Visualization Model.



Section 4 Findings

4.1. (U) GPC Alignment Network Visualization Model

See SECRET version of the Technical Report for Section 4.1 - GPC Alignment Network Visualization Model.



Section 5 Conclusions and Implications

5.1. (U) Summary of Findings

See SECRET version of Technical Report for Section 5.1 - Summary of Findings.

5.2. (U) Conclusions Based on Findings

See SECRET version for Section 5.2 - Conclusions Based on Findings.

5.3. (U//FOUO) Impact of the Study

This study supports AFRICOM ACJ8's effort to define, measure, and visualize activity alignment across the African continent. By developing a clear definition of positive and negative alignment, AFRICOM analysts can better categorize events as they occur. The alignment definition can be applied to any event and incorporates widely accepted military doctrine by utilizing ends, ways, and means. The Strategic Alignment Matrix helps quantify activities in terms of significance and expected impact on AFRICOM's LOEs and strategic objectives. The Strategic Alignment Matrix accounts for situations where a GPC competitor activity could still positively contribute to AFRICOM LOEs. This is significant since there is a generally held sentiment that competitor actions always oppose U.S. interests.

The network visualization model provides a tool for decision makers to identify how actors are implementing the instruments of national power in a specific country or region. By visually depicting the relationships between DIME elements, OAs, and LOEs, a decision maker can determine if he/she wants to reallocate limited resources to better achieve a specific LOE. The model can also visually inform senior leaders about how much a specific instrument of national power is utilized, which may cause them to reassess future OAI decisions. There is potential for C2IE data to feed directly into the network visualization model.

5.4. (U//FOUO) Recommended Future Work

While the Strategic Alignment Matrix and network visualization model provide a good foundation to classify the alignment of activities and visually depict relationships, future work can improve both tools. The Strategic Alignment Matrix utilizes a relatively straightforward approach that may be overly simplistic in its scoring and classification methodology. Rather than classify an activity as "strong support" or "minimal support," additional categories may provide more granularity. The additional granularity could provide a greater level of detail and allow analysts to classify activities appropriately. While C2IE has a defined list of characterizations and sub-characterizations to classify activities, the study team separately researched and identified 68 unique activities. There is the potential to improve the C2IE classification groupings by incorporating some of the activities that the study team identified. The network visualization model is built as a fixed model, wherein every activity/OAI that occurs always is linked to the same DIME element and LOE. It is feasible that some activities are classified within the same OAI category but support a different LOE. Having the network visualization model allow for unique relationships between OAs, DIME elements, and LOEs would allow for greater flexibility.

The network visualization model has the potential to incorporate additional levels of detail by incorporating both IMOs and LOEs. By incorporating these levels, analysts and decision makers can potentially draw



more insights. The team recommends adding a data field to collect alignment scores for OAI as they occur. Increased emphasis must be placed on completing all data fields when a new record is generated by an analyst. When logging an OAI into C2IE, an analyst should determine which LOE(s) it support(s) and input that data. Currently, OAIs are only assigned to one DIME element. It is likely that multiple DIME elements apply to an OAI and an analyst should have the ability to capture multiple DIME elements with associated weights when creating a data record. This would further enable the network visualization model to help inform decision makers.

5.5. (U//FOUO) Conclusion

This study has delivered a methodology for AFRICOM ACJ8 to measure activity alignment and visually depict how AFRICOM and GPC activities relation to AFRICOM LOEs. The purpose of this research was to determine how activities on the African continent positively or negatively align with AFRICOM LOEs and strategic objectives. The team incorporated this alignment scoring methodology to develop a network visualization model that uses the DIME elements to classify activities. The Strategic Alignment Matrix allows for an analyst to categorize any activity within AFRICOM's AOR, whether performed by AFRICOM, a GPC competitor, or any other actor. The network visualization model generates a graphical representation for decision makers to see what types of OAIs are occurring across a region. The primary benefit of this tool is that it links DIME elements to OAIs and OAIs to AFRICOM LOEs. As OAIs occur, the network visualization model captures the impact on LOEs. This tool can help inform decisions about which element(s) of national power may be best to implement, especially when considering the effects on AFRICOM LOEs. Assessing C2IE showed that much of the data needed to operationalize the network visualization model exists. Going forward, a data field could also be added to capture the alignment score assessed by an analyst using the Strategic Alignment Matrix. Another area for future work is to consider allowing the network visualization model to dynamically adjust to classification inputs from an end user. OAIs entered into C2IE should be able to be classified under multiple DIME elements if appropriate. Finally, renewed emphasis should be placed on completing data fields for OAIs to allow for meaningful analysis.



Appendix A (U) References

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Appendix B

(U) Tables of Nodes within Network Visualization Model

Table 9: Network DIME Nodes

node ID	node type	node title
D	DIME	D
I	DIME	I
M	DIME	M
E	DIME	E

Table 10: Network Activity Nodes

node ID	node type	node title
Professional Military Education	TierA_Act	1
Training (Unit Level) / PKO	TierA_Act	2
Mentoring (Ministry of Defense / Gen Staff Level)	TierA_Act	3
Military Equipping (not including Arms Sales)	TierA_Act	4
Defense Institution Building	TierA_Act	5
Partnered Exercises (African / NATO)	TierA_Act	6
HQ Exercises (AFRICOM)	TierA_Act	7
Response Force Exercises (East Africa RF)	TierA_Act	8
Medical Readiness Exercises (MEDREX)	TierA_Act	9
Kinetic Operations (sea-based air strikes)	TierA_Act	10
Advise, Assist, Accompany Operations	TierA_Act	11
Counter-Threat Finance Operations	TierA_Act	12
Information Operations	TierA_Act	13
Cyber Operations	TierA_Act	14
Intelligence Collection Operations	TierA_Act	15
Non-Lethal Support Operations	TierA_Act	16
KLEs / SLEs	TierA_Act	17
Military-to-Military Engagements	TierA_Act	18
Conferences / Symposiums	TierA_Act	19
African Enlisted Development Strategy Engagements (AEDS)	TierA_Act	20
Support to Diplomatic Engagements	TierA_Act	21
Info / Intel Sharing Engagements	TierA_Act	22
Port Calls Engagements	TierA_Act	23



Liaison Engagements	TierA_Act	24
PAO Engagements	TierA_Act	25
Infectious Disease Control Engagements	TierA_Act	26
Regional Security Organization Engagements	TierA_Act	27
Posturing Enabling Activities	TierA_Act	28
Intel Collection Enabling Activities	TierA_Act	29
Crisis Response Enabling Activities	TierA_Act	30
Force Protection Enabling Activities	TierA_Act	31
Logistics Network Enabling Activities	TierA_Act	32
Data Management Enabling Activities	TierA_Act	33
Civil Military Operations	TierA_Act	34
Military Deception	TierA_Act	35
Military Information Support Operations	TierA_Act	36
Operational Security	TierA_Act	37
Electronic Warfare	TierA_Act	38
Combat Camera	TierA_Act	39
Space and Technical Operations	TierA_Act	40
Conduct Information Operations	TierA_Act	41
Demarches	TierA_Act	42
Sign Treaty/Agreement	TierA_Act	43
UN Veto Power	TierA_Act	44
High Intensity Operations	TierA_Act	45
Deterrence Operations	TierA_Act	46
Naval Blockade	TierA_Act	47
Noncombat Evacuation Operations	TierA_Act	48
Humanitarian Assistance Operations	TierA_Act	49
Sign a Trade Law	TierA_Act	50
Establish a Tariff	TierA_Act	51
Provide Direct Financial Aid (Foreign Direct Investment (FDI))	TierA_Act	52
Provide Direct Material Aid	TierA_Act	53
Impose Economic Sanctions	TierA_Act	54
Competitive Contract Rules	TierA_Act	55
Funding for International Organizations	TierA_Act	56
Provide a Direct Loan	TierA_Act	57
Debt Relief/Restructuring	TierA_Act	58
Establish/Remove Embassy Presence	TierA_Act	59
Diplomatic Exchange	TierA_Act	60
Head of State Visits	TierA_Act	61



Non/Recognition of a State	TierA_Act	62
Establish a Military Base	TierA_Act	63
Arms Sales	TierA_Act	64
Private Military Company (PMC)/Contractor Presence	TierA_Act	65
Improve Infrastructure	TierA_Act	66
Sponsor African University Students	TierA_Act	67
UN Troop Contribution	TierA_Act	68
M_Kinetic	TierB_Act	MK
M_Nonkinetic	TierB_Act	MN
D_Soft	TierB_Act	DS
D_Hard	TierB_Act	DH
E_Coercive	TierB_Act	EC
E_Noncoercive	TierB_Act	EN
I_Deceptive	TierB_Act	ID
I_Nondeceptive	TierB_Act	IN

Table 11: Network LOE Nodes

node ID	node type	node title
LOE_1	US_LOE	LOE_1
LOE_2	US_LOE	LOE_2
LOE_3	US_LOE	LOE_3
LOE_4	US_LOE	LOE_4
LOE_5	US_LOE	LOE_5

Table 12: Network Ends Nodes

node ID	node type	node title
END_1	US_END	END_1
END_2	US_END	END_2
END_3	US_END	END_3
END_4	US_END	END_4
END_5	US_END	END_5

Appendix C

(U) Tables of Relationships within Network Visualization Model

Table 13: Network Links from DIME Elements to Activities

from	to	type	weight	plot type
M	Professional Military Education	Supporting	1	A
M	Training (Unit Level) / PKO	Supporting	1	A
D	Mentoring (Ministry of Defense / Gen Staff Level)	Supporting	0.5	A
M	Mentoring (Ministry of Defense / Gen Staff Level)	Supporting	0.5	A
M	Military Equipping (not including Arms Sales)	Supporting	1	A
M	Defense Institution Building	Supporting	1	A
M	Partnered Exercises (African / NATO)	Supporting	1	A
D	HQ Exercises (AFRICOM)	Supporting	0.25	A
M	HQ Exercises (AFRICOM)	Supporting	0.75	A
M	Response Force Exercises (East Africa RF)	Supporting	1	A
M	Medical Readiness Exercises (MEDREX)	Supporting	1	A
M	Kinetic Operations (sea-based air strikes)	Supporting	1	A
M	Advise, Assist, Accompany Operations	Supporting	1	A
E	Counter-Threat Finance Operations	Supporting	1	A
I	Information Operations	Supporting	1	A
I	Cyber Operations	Supporting	0.25	A
M	Cyber Operations	Supporting	0.75	A
I	Intelligence Collection Operations	Supporting	0.5	A
M	Intelligence Collection Operations	Supporting	0.5	A
M	Non-Lethal Support Operations	Supporting	1	A
I	KLEs / SLEs	Supporting	1	A
M	Military-to-Military Engagements	Supporting	1	A
I	Conferences / Symposiums	Supporting	1	A
M	African Enlisted Development Strategy Engagements (AEDS)	Supporting	1	A
D	Support to Diplomatic Engagements	Supporting	1	A
I	Info / Intel Sharing Engagements	Supporting	1	A
M	Port Calls Engagements	Supporting	1	A
M	Liaison Engagements	Supporting	1	A
I	PAO Engagements	Supporting	1	A
D	Infectious Disease Control Engagements	Supporting	1	A
D	Regional Security Organization Engagements	Supporting	0.25	A



M	Regional Security Organization Engagements	Supporting	0.75	A
M	Posturing Enabling Activities	Supporting	1	A
I	Intel Collection Enabling Activities	Supporting	1	A
D	Crisis Response Enabling Activities	Supporting	0.25	A
M	Crisis Response Enabling Activities	Supporting	0.75	A
M	Force Protection Enabling Activities	Supporting	1	A
M	Logistics Network Enabling Activities	Supporting	1	A
I	Data Management Enabling Activities	Supporting	1	A
I	Civil Military Operations	Supporting	1	A
I	Military Deception	Supporting	1	A
I	Military Information Support Operations	Supporting	1	A
I	Operational Security	Supporting	1	A
I	Electronic Warfare	Supporting	1	A
I	Combat Camera	Supporting	1	A
I	Space and Technical Operations	Supporting	1	A
I	Conduct Information Operations	Supporting	1	A
D	Demarches	Supporting	1	A
D	Sign Treaty/Agreement	Supporting	1	A
D	UN Veto Power	Supporting	1	A
M	High Intensity Operations	Supporting	1	A
M	Deterrence Operations	Supporting	1	A
M	Naval Blockade	Supporting	1	A
D	Noncombat Evacuation Operations	Supporting	0.5	A
M	Noncombat Evacuation Operations	Supporting	0.5	A
E	Humanitarian Assistance Operations	Supporting	1	A
E	Sign a Trade Law	Supporting	1	A
E	Establish a Tariff	Supporting	1	A
E	Provide Direct Financial Aid (Foreign Direct Investment (FDI))	Supporting	1	A
E	Provide Direct Material Aid	Supporting	1	A
E	Impose Economic Sanctions	Supporting	1	A
E	Competitive Contract Rules	Supporting	1	A
E	Funding for International Organizations	Supporting	1	A
E	Provide a Direct Loan	Supporting	1	A
E	Debt Relief/Restructuring	Supporting	1	A
D	Establish/Remove Embassy Presence	Supporting	1	A
D	Diplomatic Exchange	Supporting	1	A
D	Head of State Visits	Supporting	1	A
D	Non/Recognition of a State	Supporting	1	A



M	Establish a Military Base	Supporting	1	A
M	Arms Sales	Supporting	1	A
M	Private Military Company (PMC)/Contractor Presence	Supporting	1	A
E	Improve Infrastructure	Supporting	1	A
D	Sponsor African University Students	Supporting	1	A
M	UN Troop Contribution	Supporting	1	A
M	M_Kinetic	Supporting	1	B
M	M_Nonkinetic	Supporting	1	B
D	D_Soft	Supporting	1	B
D	D_Hard	Supporting	1	B
E	E_Coercive	Supporting	1	B
E	E_Noncoercive	Supporting	1	B
I	I_Deceptive	Supporting	1	B
I	I_Nondeceptive	Supporting	1	B



Table 14: Network Links from Activities to LOEs

from	to	type	weight	plot type
Professional Military Education	LOE_1	Positive	1	A
Professional Military Education	LOE_1	Negative	1	A
Training (Unit Level) / PKO	LOE_2	Positive	1	A
Training (Unit Level) / PKO	LOE_2	Negative	1	A
Mentoring (Ministry of Defense / Gen Staff Level)	LOE_2	Positive	0.25	A
Mentoring (Ministry of Defense / Gen Staff Level)	LOE_3	Positive	0.75	A
Mentoring (Ministry of Defense / Gen Staff Level)	LOE_2	Negative	0.25	A
Mentoring (Ministry of Defense / Gen Staff Level)	LOE_3	Negative	0.75	A
Military Equipping (not including Arms Sales)	LOE_4	Positive	1	A
Military Equipping (not including Arms Sales)	LOE_4	Negative	1	A
Defense Institution Building	LOE_1	Positive	1	A
Defense Institution Building	LOE_1	Negative	1	A
Partnered Exercises (African / NATO)	LOE_2	Positive	1	A
Partnered Exercises (African / NATO)	LOE_2	Negative	1	A
HQ Exercises (AFRICOM)	LOE_3	Positive	0.5	A
HQ Exercises (AFRICOM)	LOE_3	Negative	0.5	A
HQ Exercises (AFRICOM)	LOE_4	Positive	0.5	A
HQ Exercises (AFRICOM)	LOE_4	Negative	0.5	A
Response Force Exercises (East Africa RF)	LOE_2	Positive	1	A
Response Force Exercises (East Africa RF)	LOE_2	Negative	1	A
Medical Readiness Exercises (MEDREX)	LOE_3	Positive	1	A
Medical Readiness Exercises (MEDREX)	LOE_3	Negative	1	A
Kinetic Operations (sea-based air strikes)	LOE_4	Positive	1	A
Kinetic Operations (sea-based air strikes)	LOE_4	Negative	1	A
Advise, Assist, Accompany Operations	LOE_5	Positive	1	A
Advise, Assist, Accompany Operations	LOE_5	Negative	1	A
Counter-Threat Finance Operations	LOE_2	Positive	1	A
Counter-Threat Finance Operations	LOE_2	Negative	1	A
Information Operations	LOE_1	Positive	1	A
Information Operations	LOE_1	Negative	1	A
Cyber Operations	LOE_2	Positive	0.5	A
Cyber Operations	LOE_2	Negative	0.5	A
Cyber Operations	LOE_4	Positive	0.5	A
Cyber Operations	LOE_4	Negative	0.5	A
Intelligence Collection Operations	LOE_1	Positive	0.5	A
Intelligence Collection Operations	LOE_1	Negative	0.5	A



Intelligence Collection Operations	LOE_4	Positive	0.5	A
Intelligence Collection Operations	LOE_4	Negative	0.5	A
Non-Lethal Support Operations	LOE_2	Positive	1	A
Non-Lethal Support Operations	LOE_2	Negative	1	A
KLEs / SLEs	LOE_3	Positive	1	A
KLEs / SLEs	LOE_3	Negative	1	A
Military-to-Military Engagements	LOE_4	Positive	1	A
Military-to-Military Engagements	LOE_4	Negative	1	A
Conferences / Symposiums	LOE_1	Positive	1	A
Conferences / Symposiums	LOE_1	Negative	1	A
African Enlisted Development Strategy Engagements (AEDS)	LOE_3	Positive	1	A
African Enlisted Development Strategy Engagements (AEDS)	LOE_3	Negative	1	A
Support to Diplomatic Engagements	LOE_1	Positive	1	A
Support to Diplomatic Engagements	LOE_1	Negative	1	A
Info / Intel Sharing Engagements	LOE_2	Positive	1	A
Info / Intel Sharing Engagements	LOE_2	Negative	1	A
Port Calls Engagements	LOE_3	Positive	1	A
Port Calls Engagements	LOE_3	Negative	1	A
Liaison Engagements	LOE_4	Positive	1	A
Liaison Engagements	LOE_4	Negative	1	A
PAO Engagements	LOE_3	Positive	1	A
PAO Engagements	LOE_3	Negative	1	A
Infectious Disease Control Engagements	LOE_5	Positive	1	A
Infectious Disease Control Engagements	LOE_5	Negative	1	A
Regional Security Organization Engagements	LOE_1	Positive	0.75	A
Regional Security Organization Engagements	LOE_1	Negative	0.75	A
Regional Security Organization Engagements	LOE_4	Positive	0.25	A
Regional Security Organization Engagements	LOE_4	Negative	0.25	A
Posturing Enabling Activities	LOE_2	Positive	1	A
Posturing Enabling Activities	LOE_2	Negative	1	A
Intel Collection Enabling Activities	LOE_3	Positive	1	A
Intel Collection Enabling Activities	LOE_3	Negative	1	A
Crisis Response Enabling Activities	LOE_4	Positive	1	A
Crisis Response Enabling Activities	LOE_4	Negative	1	A
Force Protection Enabling Activities	LOE_1	Positive	0.25	A
Force Protection Enabling Activities	LOE_1	Negative	0.25	A
Force Protection Enabling Activities	LOE_3	Positive	0.75	A
Force Protection Enabling Activities	LOE_3	Negative	0.75	A



Logistics Network Enabling Activities	LOE_2	Positive	1	A
Logistics Network Enabling Activities	LOE_2	Negative	1	A
Data Management Enabling Activities	LOE_5	Positive	1	A
Data Management Enabling Activities	LOE_5	Negative	1	A
Civil Military Operations	LOE_5	Positive	1	A
Civil Military Operations	LOE_5	Negative	1	A
Military Deception	LOE_2	Positive	1	A
Military Deception	LOE_2	Negative	1	A
Military Information Support Operations	LOE_5	Positive	1	A
Military Information Support Operations	LOE_5	Negative	1	A
Operational Security	LOE_2	Positive	1	A
Operational Security	LOE_2	Negative	1	A
Electronic Warfare	LOE_5	Positive	1	A
Electronic Warfare	LOE_5	Negative	1	A
Combat Camera	LOE_5	Positive	1	A
Combat Camera	LOE_5	Negative	1	A
Space and Technical Operations	LOE_5	Positive	1	A
Space and Technical Operations	LOE_5	Negative	1	A
Conduct Information Operations	LOE_5	Positive	1	A
Conduct Information Operations	LOE_5	Negative	1	A
Demarches	LOE_3	Positive	1	A
Demarches	LOE_3	Negative	1	A
Sign Treaty/Agreement	LOE_4	Positive	1	A
Sign Treaty/Agreement	LOE_4	Negative	1	A
UN Veto Power	LOE_1	Positive	1	A
UN Veto Power	LOE_1	Negative	1	A
High Intensity Operations	LOE_2	Positive	1	A
High Intensity Operations	LOE_2	Negative	1	A
Deterrence Operations	LOE_3	Positive	1	A
Deterrence Operations	LOE_3	Negative	1	A
Naval Blockade	LOE_4	Positive	1	A
Naval Blockade	LOE_4	Negative	1	A
Noncombat Evacuation Operations	LOE_1	Positive	0.5	A
Noncombat Evacuation Operations	LOE_1	Negative	0.5	A
Noncombat Evacuation Operations	LOE_2	Positive	0.5	A
Noncombat Evacuation Operations	LOE_2	Negative	0.5	A
Humanitarian Assistance Operations	LOE_2	Positive	1	A
Humanitarian Assistance Operations	LOE_2	Negative	1	A



Sign a Trade Law	LOE_3	Positive	1	A
Sign a Trade Law	LOE_3	Negative	1	A
Establish a Tariff	LOE_4	Positive	1	A
Establish a Tariff	LOE_4	Negative	1	A
Provide Direct Financial Aid (Foreign Direct Investment (FDI))	LOE_1	Positive	1	A
Provide Direct Financial Aid (Foreign Direct Investment (FDI))	LOE_1	Negative	1	A
Provide Direct Material Aid	LOE_2	Positive	1	A
Provide Direct Material Aid	LOE_2	Negative	1	A
Impose Economic Sanctions	LOE_4	Positive	1	A
Impose Economic Sanctions	LOE_4	Negative	1	A
Competitive Contract Rules	LOE_1	Positive	1	A
Competitive Contract Rules	LOE_1	Negative	1	A
Funding for International Organizations	LOE_2	Positive	1	A
Funding for International Organizations	LOE_2	Negative	1	A
Provide a Direct Loan	LOE_4	Positive	1	A
Provide a Direct Loan	LOE_4	Negative	1	A
Debt Relief/Restructuring	LOE_1	Positive	1	A
Debt Relief/Restructuring	LOE_1	Negative	1	A
Establish/Remove Embassy Presence	LOE_2	Positive	1	A
Establish/Remove Embassy Presence	LOE_2	Negative	1	A
Diplomatic Exchange	LOE_3	Positive	1	A
Diplomatic Exchange	LOE_3	Negative	1	A
Head of State Visits	LOE_5	Positive	1	A
Head of State Visits	LOE_5	Negative	1	A
Non/Recognition of a State	LOE_1	Positive	1	A
Non/Recognition of a State	LOE_1	Negative	1	A
Establish a Military Base	LOE_2	Positive	1	A
Establish a Military Base	LOE_2	Negative	1	A
Arms Sales	LOE_3	Positive	1	A
Arms Sales	LOE_3	Negative	1	A
Private Military Company (PMC)/Contractor Presence	LOE_4	Positive	1	A
Private Military Company (PMC)/Contractor Presence	LOE_4	Negative	1	A
Improve Infrastructure	LOE_1	Positive	1	A
Improve Infrastructure	LOE_1	Negative	1	A
Sponsor African University Students	LOE_2	Positive	1	A
Sponsor African University Students	LOE_2	Negative	1	A
UN Troop Contribution	LOE_3	Positive	1	A
UN Troop Contribution	LOE_3	Negative	1	A



M_Kinetic	LOE_4	Positive	0.5	B
M_Kinetic	LOE_5	Positive	0.5	B
M_Kinetic	LOE_4	Negative	0.5	B
M_Kinetic	LOE_5	Negative	0.5	B
M_Nonkinetic	LOE_1	Positive	1	B
M_Nonkinetic	LOE_1	Negative	1	B
D_Soft	LOE_2	Positive	0.25	B
D_Soft	LOE_4	Positive	0.75	B
D_Soft	LOE_2	Negative	0.25	B
D_Soft	LOE_4	Negative	0.75	B
D_Hard	LOE_3	Positive	1	B
D_Hard	LOE_3	Negative	1	B
E_Coercive	LOE_4	Positive	1	B
E_Coercive	LOE_4	Negative	1	B
E_Noncoercive	LOE_1	Positive	1	B
E_Noncoercive	LOE_1	Negative	1	B
I_Deceptive	LOE_2	Positive	1	B
I_Deceptive	LOE_2	Negative	1	B
I_Nondeceptive	LOE_2	Positive	0.5	B
I_Nondeceptive	LOE_3	Positive	0.5	B
I_Nondeceptive	LOE_2	Negative	0.5	B
I_Nondeceptive	LOE_3	Negative	0.5	B

Table 15: Network Links from LOEs to Ends

from	to	type	weight	plot type
LOE_1	END_1	Supporting	0.5	D
LOE_1	END_2	Supporting	0.5	D
LOE_2	END_2	Supporting	1	D
LOE_3	END_3	Supporting	0.75	D
LOE_3	END_4	Supporting	0.25	D
LOE_4	END_3	Supporting	0.5	D
LOE_4	END_4	Supporting	0.5	D
LOE_5	END_5	Supporting	1	D



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