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Redesigning the Senior Leader Engagement Program of the United States Africa Command

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Author Note: Cadets Conger, Cooley, Juhn, Richter, Schreiner, and Tortorice are seniors at the United States Military Academy (USMA) participating in a year-long capstone design course under the direction of Colonel Matthew Dabkowski. In May 2019, they will commission into the United States Army as Second Lieutenants serving their country in the Aviation, Signal, Engineer, and Field Artillery branches. The client for this project is the United States Africa Command (AFRICOM). The team is thankful for AFRICOM's engagement and support throughout the duration of the project. Additionally, the team thanks Captain Christine Krueger for her assistance, as she worked on a broader, related project for AFRICOM.

Abstract: AFRICOM conducts hundreds of senior leader engagements (SLEs) each year throughout the African continent in order to create strategic partnerships and military relationships that preserve American interests abroad. While AFRICOM has been planning and executing these engagements since the inception of the organization in 2008, it lacks a well-defined method to systemize its SLE process. As a result, SLE development is largely ad hoc, potentially decreasing the strategic effectiveness of the engagements and increasing their cost. This paper delineates a decision-making framework to redesign and enhance AFRICOM's SLE program. In particular, it posits a multiple objective decision analysis model that quantifies key stakeholder values and develops several alternatives for future evaluation. Of note, potential solutions imagine a more expansive system where subsets of Senior Leaders (SLs) are assigned to clusters of African countries based on the SLs' similarity to countries within each cluster, providing a basis for relationship ownership and mutual trust.

*Keywords***:** Senior Leader Engagement, AFRICOM, Systems Decision Process, Sparse K-means Clustering

1. Introduction

1.1 Background and Customer Need

Expansive growth opportunities in Africa's natural resources, economic potential, and human capital create a vested strategic interest for the United States (US). In 2008, the US Department of Defense (DOD) established its Africa Command, AFRICOM, to coordinate strategic military operations in Africa, maintain professional military relationships with African partners, uphold security commitments across the continent, and deter threatening entities. Operating in 53 of the 54 African states (excluding Egypt), and with a dynamic, typically non-combat mission set, AFRICOM strives to "[strengthen] security forces, [counter] transnational threats, and [conduct] crisis response in order to advance US national interests and promote security, stability, and prosperity [abroad]" (Waldhauser, 2019).

In support of this mission, AFRICOM partners with a myriad of US and international agencies, including the US Department of State, the US Agency for International Development, the United Nations (UN), the European Union, the African Union, African Regional Economic Communities (RECs), and other non/intergovernmental organizations (NGOs/IGOs). This partner-centric approach not only increases AFRICOM's influence but also maintains its legitimacy as

the command provides military support to diplomacy and development efforts. Given its range of operational tools, AFRICOM walks a fine line between assurance and deterrence, as it applies pressure through kinetic and non-kinetic means. With multi-faceted threats from violent extremist organizations (VEOs) and near-peer adversaries, it is essential for the US to maintain a positive presence on the continent in order to pursue its national interests. AFRICOM conveys this commitment across its various strategic lines of effort (LOEs).

Among AFRICOM's ways and means to pursue its LOEs are Senior Leader Engagements (SLEs) - an essential tool within AFRICOM's repertoire. By definition, SLEs are planned meetings between influential leaders, or senior leaders (SLs), with the intent of fostering relationships that facilitate communication and cooperation across states and institutions (Department of the Army, 2013, pp. 1-8). AFRICOM uses these important engagements as their primary method of developing strategic partnerships with allies. Ensuring SLEs are conducted as effectively as possible is a top priority for the command, as they preserve and enhance essential relationships with key partners across the continent.

Before seeking solutions to any complex problem, it is imperative that the analysts and the primary stakeholders understand and agree upon what needs to be accomplished. As an academic discipline, Systems Engineering ensures this bilateral accord with the development and validation of the customer needs statement (CNS). The CNS is a brief but highly specific declaration of what the stakeholders need and why they need it. In the context of this project, the capstone team and AFRICOM representatives concurred that: *AFRICOM needs a revised and standardized process to plan and execute SLEs that efficiently and effectively assign general officers (GOs), flag officers (FOs), and their equivalents to specific African states, in order to preserve and enhance relationships with officials and partners across the African continent***.**

1.2 Methodology

To develop a solution to the aforementioned need, the team followed the Systems Decision Process (SDP). As seen in Figure 1, the SDP consists of four integrative phases: problem definition, solution design, decision making, and solution implementation (Parnell, Driscoll, & Henderson, 2011, pp. 281-282). Within each phase are subphases, which include various tasks that must be completed before moving into subsequent phases. Additionally, the SDP acknowledges external environmental factors that impact the process throughout its execution. When followed, the SDP is an iterative process that ensures stakeholder needs are met by the team's solutions or recommendations.

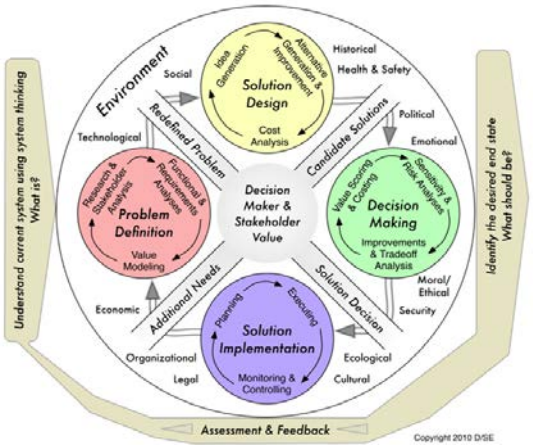

Figure 1. Systems Decision Process (Parnell, Driscoll, & Henderson, 2011, pp. 281-282)

2. Problem Definition

In order to produce the CNS, the capstone team conducted substantial academic research and stakeholder analysis. Academic topics relating to AFRICOM's capabilities, its mission, and the strategic and demographic characteristics of Africa are important to the definition of AFRICOM's need; thus, they had to be well-understood by the team. Stakeholder analysis involved the procurement of information and preferences directly from the stakeholder. The team regularly interviewed and closely corresponded with representatives from AFRICOM's J-8 Directorate, the unit responsible for providing assessments imperative to AFRICOM's strategic performance. The principal effect of the team's stakeholder analysis was the thorough validation of its problem-solving methodologies that led to the final version of the CNS.

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While AFRICOM currently plans and executes a significant number of SLEs each year, its process for doing so is ad hoc and inefficient. Practically, a lack of SLE coordination wastes valuable government resources; theoretically, it compromises the effectiveness of one of AFRICOM's most valuable tools for peacefully influencing the African continent. A more detailed, streamlined, and deliberate method of planning and executing SLEs will allow AFRICOM to better accomplish its mission, thereby promoting stability and peace within Africa.

To address AFRICOM's CNS, the team had to develop an accepted, repeatable method to control the planning of SLEs. To do this, the team worked with AFRICOM to build out a set of stakeholder requirements. Over time, these requirements led to the development of a qualitative value model of the system. This model describes the desired system's qualities in a way that is easily understood by both the capstone team and the client. The fundamental objective and the top-level functions of the qualitative value model are provided in Figure 2, they dictate what the team's solution must accomplish.

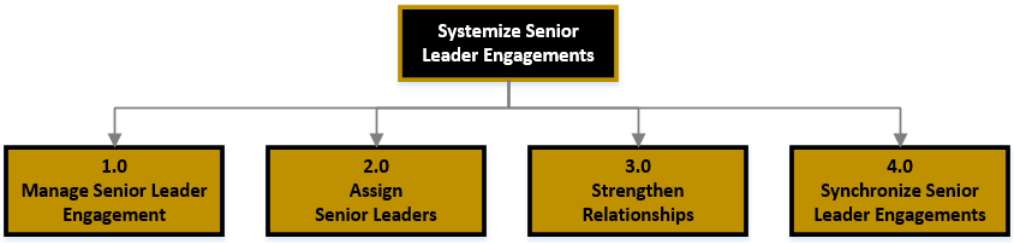

Figure 2. Fundamental Objective and Top-Level Functions of the Qualitative Value Model

Following the finalization of the qualitative value model, the capstone team developed numeric value functions and swing weights for each of the identified value measures. The resulting quantitative value model mathematically captures the stakeholders' preferences and provides a basis for designing and selecting solution alternatives that are both feasible and desirable. During the development of the quantitative value model, AFRICOM screened the objectives and tailored them to best fit the organization's needs. For example, the objective "minimize cost of engagements" was removed altogether on the basis that the command valued improving the SLE process significantly more than minimizing its cost. Thus, the final ranking of value measures (from most to least important) is as follows: [1] maximize flexibility of AFRICOM's five primary SLs (i.e., the "Big 5"), [2] minimize the cognitive load placed on SLs, [3] minimize SL travel time, [4] minimize planning time for an SLE, [5] optimize the frequency of SLEs to any given country, [6] optimize the consistency of SLE type conducted by each SL, and [7] maximize the similarities in both position and rank of American and African SLs. Operating with these preferences in mind, the capstone team moved on to the next phase of the SDP: solution design.

3. Solution Design

During the solution design stage of the SDP, the capstone team drafted several potential solution components tailored to the desired system requirements. After much refinement, the ultimate list of components includes clustering methodology, the definition of an SL, primary assignment consideration, and the number of SLs left unassigned to freely travel to any country. As seen in Figure 3, combinations of component options create alternative solutions in a process known as alternative generation. The team deliberately elected three alternative solutions, denoted by color in Figure 3, to analyze in detail. These solutions include the *status quo* (i.e., the method currently used by AFRICOM); the *strategic method*, which highlights the capstone team's creation of a clustering methodology that groups African countries by weighted similarities; and the *DIME (diplomatic, information, military, economic) method*, which incorporates a geopolitical approach to SLE coordination. The following subsections will provide detailed descriptions of each alternative's solution components.

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Clustering Methodology	Definition of Senior Leader	Primary Assignment Consideration	Assigned Leaders
No Clustering	Original AFRICOM Campaign Plan [Big 5]	No Assignment	0%
Existing (AFRICOM)	Updated Theater Campaign Plan [Big 5, J Directors, Component Commanders]	Branch	25%
UN		Rank	50%
RECs	Team Expanded [Big 5, J Directors, Component Commanders, LOE Heads]	Quantification of Previous Knowledge/Experience	75%
Sparse K-means			100%

Legend	
Status Quo	
Strategic Method	
DIME Method	

Figure 3. Alternative Generation (Zwicky's Morphological Box)

3.1 Clustering Methodology

As seen in Figure 3, clustering methodology options include: *no clustering*, *AFRICOM's existing method*, the *UN's method*, clustering by *RECs*, and *sparse K-means*. Among these options, *no clustering* is the simplest and represents the status quo, as SLs are not currently assigned to any particular country or region. The next three options – *AFRICOM's existing method*, the *UN's method*, and clustering by *RECs* – reflect collections of countries currently endorsed by their namesakes. Seen in Figure 4 below, these methods generally cluster countries based on geographic proximity.

Figure 4. Existing Clustering Alternatives (AFRICOM, n.d.; RECS, n.d.; UN, n.d.)

While the methods in Figure 4 provide interesting perspectives, they were derived with different objectives in mind, such as campaign plans or economic interests. As such, the capstone team decided to develop its own clustering methodology based on data deemed relevant for the execution of SLEs, namely diplomatic connectivity, military alliances, and intra-Africa economic trade. Summaries of these sources are given in Table 1 below. Compiling the data resulted in a (53 × 316) matrix representing the countries by row and features by column.

Table 1. Relevant Data Sets Utilized in Sparse K-means Clustering

Data Set Name	Description	Matrix Dimensions	Citation
International Trade, 1870-2014 (v4.0)	This data set shows the number of years that a nation has imported goods from another African nation.	53 countries × 50 countries	(Barbieri and Keshk, 2016)
Diplomatic Exchange (v2006.1)	This data set shows the diplomatic representation between two nations at the level of minister or ambassador.	53 countries × 51 countries	(Reşat, 2006)
Formal Alliances, 1816-2012 (v4.1)	This data set records all active, formal military alliances among states between 1816 and 2012, including mutual defense pacts, non-aggression treaties, and ententes.	53 countries × 42 countries	(Douglas, 2012)
Intergovernmental Organizations, 1815-2005 (v2.3)	This data set tracks the membership of nations in IGOs.	53 countries × 154 IGOs	(Pevehouse, Nordstrom, & Warnke, 2010)
Annual Military Expenditure, 1999-2017 (% of GDP)	This data set shows the percent of GDP that a nation spent on its military each year.	53 countries × 19 years	(SIPRI, 2017)

Although many methods are available for clustering, the large number of features relative to the small number of objects presents challenges. Recent work by Witten and Tibshirani (2010) overcomes these issues by implementing a sparse approach, where an optimal subset of predictors is selected by assigning a limited number of non-zero weights to the full set. Known as *sparse K-means*, the algorithm is implemented in R's *sparcl* package (Witten & Tibshirani, 2018), and it requires the user to specify the number of clusters as an input. To estimate an appropriate value, the capstone team tested two to twelve clusters, calculating the *total weighted between sum of squares* for each number of clusters. Plotted in the left panel of Figure 5, a subtle "elbow" appears between four and six clusters. Subsequent analysis revealed that a six-cluster solution was the most compelling choice, since it established two key countries as their own independent clusters. Moreover, as seen in the center panel of Figure 5, only 32 of the 316 features received non-zeros weights with all 32 coming from the IGO membership and military alliance data sets. The clustering algorithm selects the combination of features and respective weights that maximally separate groups of similar countries. Therefore, the clustering solution is determined entirely from a small number of IGO memberships and military alliances, implying clustered countries have similar interests in a handful of key areas.

After determining the optimal number of clusters, *sparcl* returned the cluster number for each country, which the team used to create the right panel of Figure 5. This is the optimal clustering solution. The clustering appears to be a blend of the other clusters in Figure 4. However, two of the clusters are single countries, namely Eritrea and South Africa. Looking closely at the data, South Africa is a member of many IGOs but belongs to a single alliance, suggesting it shares diplomatic and economic interests with other African nations while maintaining its military distance. Eritrea, on the other hand, is effectively isolated on all fronts.

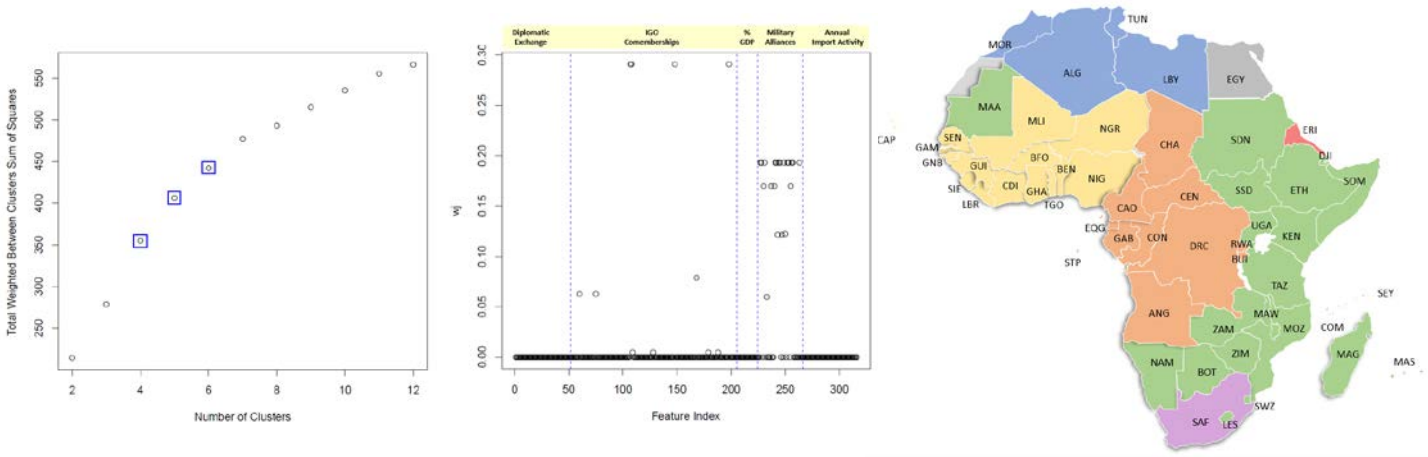

Figure 5. Optimal Number of Clusters, Feature Weights, and Optimal Sparse K-means Clustering

3.2 Definition of Senior Leader

The definition of a SL explicitly designates which individuals within AFRICOM can conduct an SLE. The alternative definitions include: the original Africa Campaign Plan (ACP), which includes the "Big 5" (AFRICOM Commander, Deputy to the Commander for Military Operations, Deputy to the Commander for Civil-Military Engagement, Chief of Staff, and Command Senior Enlisted Leader); the new ACP, which adds the Joint Staff Directors (J-Dirs) and Component Commanders; and the team's expanded definition, which further adds LOE Directors. Expanding the definitive list of who is considered an SL will allow AFRICOM to assign a greater number of leaders to SLEs, but it also may decrease SLE effectiveness as newly defined SLs serve as surrogates for the Big 5.

3.3 Assignment Methodology

Assignment methodology considers personal factors of individual SLs with the goal of matching their background with the areas of expertise of African countries. For example, if a country has a strong navy, a Flag Officer from the Navy would be the best fit for that SLE. The leaders of other countries may only want to meet with an officer of a certain rank or higher, so rank is also a possible consideration. Alternatively, SLs may also be assigned to a cluster based on previous knowledge/experience of a country, language skills, or even interest. The goal of assigning SLs based on one of these factors is to create rapport and build positive relationships with African countries.

3.4 Number of Unassigned Senior Leaders

AFRICOM stakeholders highlighted the importance of flexibility within their planning and coordination framework. Thus, allowing for a reserve of SLs that are not assigned to a cluster of countries in the solution is important. These unassigned SLs would be available for short-notice engagements. In order to allow flexibility in the alternatives, using a percent for assigned leaders would not hold the solution hostage to a specific number of SLs should the total number of SLs change in the future. While having a lower percentage of assigned SLs ready for short-notice engagements is optimal, this may not be realistic. To account for this, there will be a specified percentage of SLs assigned to SLEs.

4. Decision Making and Implementation

In order to recommend a solution, the team will utilize the quantitative value model to assess each of the three alternative solutions. The team will continue to work with the stakeholder to ensure that the quantitative value model accurately reflects AFRICOM's preferences for, and expectations of, their ideal solution. The quantitative value model will then be used to calculate a value score for each alternative solution. The alternative with the highest score will be recommended for implementation within AFRICOM's SLE planning and execution processes. The capstone team will continue to update the quantitative value model as the highly specific and often classified data required becomes more available. By design, the SDP is an iterative process, which will allow future problems regarding implementation to be re-addressed.

5. Conclusion

Each year AFRICOM conducts hundreds of SLEs throughout Africa, yet it currently lacks a well-defined method to systemize its SLE process. This paper partially addresses this shortcoming by delineating a decision-making framework to redesign and enhance AFRICOM's SLE program. It posits a multiple objective decision analysis model that quantifies key stakeholder values and develops several alternatives for future evaluation. In general, potential solutions imagine a more expansive system where subsets of SLs are assigned to clusters of African countries based on the SLs' similarity to countries in the clusters, providing a basis for relationship ownership and mutual trust. Among the most promising findings is a novel, multidimensional clustering of countries that identifies Eritrea and South Africa as nations worthy of special consideration by the command. As the requisite data becomes available, the team will evaluate the proposed alternatives using its approved quantitative value model, which emphasizes the need to maximize the flexibility of the "Big 5" while minimizing the cognitive load placed on SLs and SL travel time.

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