Complexity of Military Operations in Megacities

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Abstract: Megacities are excellent locations for enemy headquarters and transportation hubs for revenue generating goods as well as weapons and supplies. Influencing these operations at a strategic level by targeting the systems upon which they rely will allow military forces to avoid direct engagement in particularly dangerous environments while still inhibiting the enemy. The high degree of interdependency between enterprises within megacities introduces unique challenges to decision makers who desire to engage the enemy without detrimental effects to noncombatants. The Department of Defense is currently uncertain on how to handle the challenges of a megacity, specifically the unintended consequences of warfighter actions. This paper develops a common taxonomy for megacities to classify better the vague definitions associated with megacities and examine the unique challenges that exist in each. Using system thinking to frame the network of systems in these cities, we formulate a methodology using decision hierarchies and fuzzy cognitive maps to examine the second and third order effects that may arise from disruptions in one branch of the network caused by decision makers.

Keywords: Megacities, Fuzzy Cognitive Maps, Dense Urban Environments, Ungoverned Spaces, Systems Thinking

1. Taxonomy

This study analyzes the basic characteristics of megacities and dense urban environments and develops a taxonomy or scheme of classification based on behavior characteristics rather than solely population including gross domestic product (GDP), the rate of GDP growth, rate of growth, population increases, and other factors. A good taxonomy separates all elements of a group (taxon) into subgroups (taxa) that are mutually exclusive and unambiguous (Rowes, 2016).

Currently, the term megacity is used to describe any dense urban center with over 10 million inhabitants (Baxter, 2003). This is an incomplete definition because the characteristics of a megacity such as New York City are very different from that of Jakarta, Indonesia. Using characteristics of current megacities to include population, GDP, and development status, we have established a megacity definition, which categorizes all megacities into three tiers. The categorization of each city allows decision makers to more accurately assess and understand the technology and systems architecture associated with each city.

1.1 Definitions

There are currently no commonly accepted definitions differentiating megacities, dense urban environments and ungoverned spaces. The derivation of these definitions is important to this report for further classification, understanding, and methodology for analyzing 2nd and 3rd order causal effects.

This study defines a megacity as an interconnected, densely populated urban city with over 10 million residents that contains both dense urban environments and ungoverned spaces. Ungoverned spaces are areas within a megacity that lack the reach of state institutions, infrastructure, control, and all other external interference that allow criminal networks to flourish. Finally, a dense urban environment is an urban, densely populated area with a population of at least 500,000 with similarly complex systems architecture as that of a megacity.

1.2 Megacity Classification

Figure 1 contains a plot of population versus GDP per capita using this taxonomy.