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5

Conceptual Frameworks for Intelligence Analysis

If we are to think seriously about the world, and act effectively in it, some sort of simplified map of reality . . . is necessary.

Samuel P. Huntington, *The Clash of Civilizations and the Remaking of World Order*

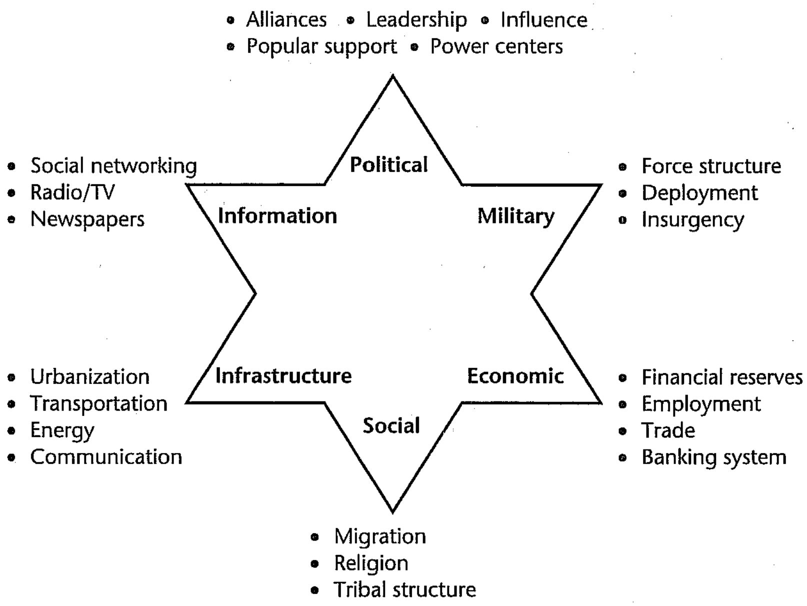
The introduction in chapter 1 stressed that analysis must have a conceptual framework for crafting the analytic product. "Balance of power," for example, was an important conceptual framework used by policymakers during the Cold War. A different conceptual framework has been proposed for assessing the influence that one country can exercise over another.[1] This chapter describes a two-step general conceptual framework for applying the target-centric approach. The first step is to view the target from specific analytic perspectives. The second is to create a model of the target. Let's start with the perspectives.

Analytic Perspectives—PMESII

In chapter 2, we discussed the instruments of national power—an *actions* view that defines the diplomatic, information, military, and economic (DIME) actions that executives, policymakers, and military or law enforcement officers can take to deal with a situation.

The customer of intelligence may have those four "levers" that can be pulled, but intelligence must be concerned with the *effects* of pulling those levers. Viewed from an effects perspective, there are usually six factors to consider: political, military, economic, social, infrastructure, and information, abbreviated *PMESII*. "Social" and "infrastructure" are not considered actions that can be taken but are in the category of *effects* of actions.[2] So which construct you use depends on whether you're thinking about

Figure 5-1 The PMESII Perspective



actions (DIME) or effects (PMESII). Policymakers and military commanders naturally tend to think about actions. Intelligence analysts have to think about both the opponent's actions and the effects of customer actions. So in intelligence, and in this book, we'll take the view of PMESII as factors to address.

Figure 5-1 illustrates the PMESII perspective as a six-pointed star, with some examples of factors that might be of intelligence interest within each point of the star for a given national government. The examples in Figure 5-1 are far from exhaustive for a government, and they would look somewhat different if our focus were on an insurgent group or a transnational criminal organization. Following is a more detailed explanation of what each point encompasses, with some typical questions that might be asked of the analyst:

- *Political.* Describes the distribution of responsibility and power at all levels of governance—formally constituted authorities, as well as informal or covert political powers. (Who are the tribal leaders in the village? Which political leaders have popular support? Who exercises decision-making or veto power in a government, insurgent group, commercial entity, or criminal enterprise?)

- *Military.* Explores the military and/or paramilitary capabilities or other ability to exercise force of all relevant actors (enemy, friendly, and neutral) in a given region or for a given issue. (What is the force structure of the opponent? What weaponry does the insurgent group possess? What is the accuracy of the rockets that Hamas intends to use against Israel? What enforcement mechanisms are drug cartels using to protect their territories?)
- *Economic.* Encompasses individual and group behaviors related to producing, distributing, and consuming resources. (What is the unemployment rate? Which banks are supporting funds laundering? What are Egypt's financial reserves? What are the profit margins in the heroin trade?)
- *Social.* Describes the cultural, religious, and ethnic makeup within an area and the beliefs, values, customs, and behaviors of society members. (What is the ethnic composition of Nigeria? What religious factions exist there? What key issues unite or divide the population?)
- *Infrastructure.* Details the composition of the basic facilities, services, and installations needed for the functioning of a community, business enterprise, or society in an area. (What are the key modes of transportation? Where are the electric power substations? Which roads are critical for food supplies?)[3]
- *Information.* Explains the nature, scope, characteristics, and effects of individuals, organizations, and systems that collect, process, disseminate, or act on information. (How much access does the local population have to news media or the Internet? What are the cyber attack and defense capabilities of the Saudi government? How effective would attack ads be in Japanese elections?)

The typical intelligence problem seldom must deal with only one of these factors or systems. Complex issues are likely to involve them all. The events of the Arab Spring in 2011, the Syrian uprising that began that year, and the Ukrainian crisis of 2014 involved all of the PMESII factors. But PMESII is also relevant in issues that are not necessarily international. Law enforcement must deal with them all (in this case, "military" refers to the use of violence or armed force by criminal elements).

The target-centric model becomes critical here. But issue definition becomes tougher, and you need a systematic approach. The PMESII perspective results in the creation of several distinct models, as the example later in this chapter shows.

Modeling the Intelligence Target

The previous section discussed the PMESII conceptual framework for looking at an intelligence target from different perspectives. Now let's turn to the concept of *modeling* the target.

The target-centric approach and the issue definition process described in chapter 4 naturally lead to the creation of a model of the target, if the model does not already exist. Models are used so extensively in intelligence that analysts seldom give them much thought, even as they use them. Consider the following examples:

- Imagery analysts can recognize a nuclear fuel reprocessing facility because they have a mental model of typical facility details, such as the use of heavy reinforced concrete to shield against intense gamma radiation.
- In SIGINT, a communications or radar signal has standard parameters—it can be recognized because it fits an existing model in its radio frequency, its modulation parameters, and its modes of operation.
- Clandestine or covert radio communications signals can be recognized because they fit a specific model: They are designed to avoid interception, such as by using very short (burst) transmissions or jumping rapidly from one radio frequency to another.
- Economic analysts recognize a deteriorating economy because they have a checklist (a simple form of model) of indicators, such as budget deficit, balance of payments, and inflation. The economic issue decomposition shown in Figure 4-2 provides such a checklist.

The model paradigm is a powerful tool in many disciplines. As political scientist Samuel P. Huntington noted in the quote that begins this chapter, "if we are to think seriously about the world, and act effectively in it, some sort of simplified map of reality, some theory, concept, model, paradigm, is necessary."[4] Former national intelligence officer Paul Pillar described them as "guiding images" that policymakers rely on in making decisions.[5] We've discussed one guiding image—that of the PMESII concept. The second guiding image—that of a map, theory, concept, or paradigm—in this book is merged into a single entity called a *model*.

Or, as the CIA's *Tradecraft Primer* puts it succinctly:

> all individuals assimilate and evaluate information through the medium of "mental models. . . .[6]

Modeling is usually thought of as being quantitative and using computers. However, all models start in the human mind. Modeling does not always require a computer, and many useful models exist only on paper. Models are used widely in fields such as operations research and systems analysis. With modeling, one can analyze, design, and operate complex systems. One can use simulation models to evaluate real-world processes that are too complex to analyze with spreadsheets or flowcharts (which are themselves models, of course) to test hypotheses at a fraction of the cost of undertaking the actual activities. Models are an efficient communication tool for showing how the target functions and stimulating creative thinking about how to deal with an opponent.

Models are essential when dealing with complex targets (Analysis Principle 5-1). Without a device to capture the full range of thinking and creativity that occurs in the target-centric approach to intelligence, an analyst would have to keep in mind far too many details. Furthermore, in the target-centric approach, the customer of intelligence is part of the collaborative process. Presented with a model as an organizing construct for thinking about the target, customers can contribute pieces to the model from their own knowledge—pieces that the analyst might be unaware of. The primary suppliers of information (the collectors) can do likewise.

Analysis Principle 5-1

The Essence of Intelligence

All intelligence involves creating a *model* of the target and extracting knowledge therefrom. (So does all problem solving.)

Because the model concept is fundamental to everything that follows, it is important to define it.

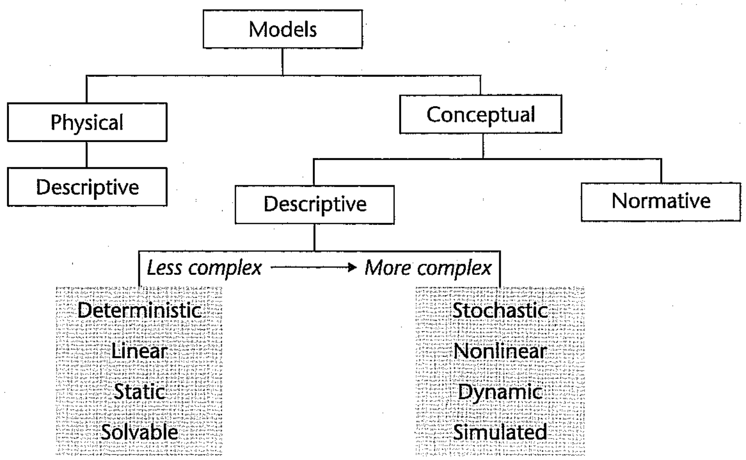
The Concept of a Model

A model, as used in intelligence, is an organizing constraint. It is a combination of facts, hypotheses, and assumptions about a target, developed in a form that is useful for analyzing the target and for customer decision making (producing actionable intelligence). The type of model used in intelligence typically comprises facts, hypotheses, and assumptions, so it's important to distinguish them here:

- *Fact*. Something that is indisputably the case.
- *Hypothesis*. A proposition that is set forth to explain developments or observed phenomena. It can be posed as conjecture to guide research (a *working hypothesis*) or accepted as a highly probable conclusion from established facts.
- *Assumption*. A thing that is accepted as true or as certain to happen, without proof.

These are the things that go into a model. *But*, it is important to distinguish them when you present the model. Customers should never wonder whether they are hearing facts, hypotheses, or assumptions.

Figure 5-2 The Model Hierarchy



A model is a replica or representation of an idea, an object, or an actual system. It often describes how a system behaves. Instead of interacting with the real system, an analyst can create a model that corresponds to the actual one in certain ways. For example, results of a political poll are a model of how a population feels about a topic; today's weather map is a model of how the weather is expected to behave.

Figure 5-2 shows a hierarchy of models and forms the basis for the discussion that follows. As the figure indicates, models can be classified as physical or conceptual (abstract).

A *physical model* is a tangible representation of something. A map, a globe, a calendar, and a clock are all physical models. The first two represent the Earth or parts of it, and the latter two represent time. Physical models are always descriptive.

Conceptual models—inventions of the mind—are essential to the analytic process. They allow the analyst to describe things or situations in abstract terms both for estimating current situations and for predicting future ones. A conceptual model is not a tangible item, although it may be represented in tangible form. Mathematical models are conceptual; they can be created entirely in the mind. But they can be represented in tangible from by writing the equations on a sheet of paper. A conceptual model may be either descriptive, describing what it represents, or normative. A normative model may contain some descriptive segments, but its purpose is to describe a best, or preferable, course of action. A decision-support model—that is, a model used to choose among competing alternatives—is normative.

In intelligence analysis, the models of most interest are conceptual and descriptive rather than normative. Some common traits of these conceptual models follow.

- *Descriptive models can be deterministic or stochastic.*

  In a deterministic model the relationships are known and specified explicitly. A model that has any uncertainty incorporated into it is a stochastic model (meaning that probabilities are involved), even though it may have deterministic properties.[7] Consider the anecdote about drug kingpin Pablo Escobar described in chapter 3. A model of the home in which Escobar was located, and the surrounding buildings, would have been deterministic—the details were known and specified exactly. A model of the people expected to be in the house at the time of the attack would have been stochastic, because the presence or absence of Escobar and his family could not be known in advance; it could only be estimated as a probability.

- *Descriptive models can be linear or nonlinear.*

  Linear models use only linear equations (for example, $x = Ay + B$) to describe relationships. It is not necessary that the situation itself be linear, only that it be capable of description by linear equations. The number of automobiles produced in an assembly line, for example, is a linear function of time. In contrast, nonlinear models use any type of mathematical function. Because nonlinear models are more difficult to work with and are not always capable of being analyzed, the usual practice is to make some compromises so that a linear model can be used. It is important to be able to justify doing so, because most real-world intelligence targets are complex, or nonlinear. A combat simulation model is nonlinear because the interactions among the elements are complex and do not change in ways that can be described by linear equations. Attrition rates in combat, for example, vary nonlinearly with time and the status of remaining military forces. A model of an economy is inherently nonlinear, but the econometric models used to describe an economy are simplified to a set of linear equations to facilitate a solution.

- *Descriptive models can be static or dynamic.*

  A static model assumes that a specific time period is being analyzed and the state of nature is fixed for that time period. Static models ignore time-based variances. For example, one cannot use them to determine the impact of an event's timing in relation to other events. Returning to the example of a combat model, a snapshot of the combat that shows where opposing forces are located and their directions of movement at that instant is static. Static models do not take into account the synergy of the components of a system, where the actions of separate elements can have a different effect on the system than the sum of their individual effects would indicate. Spreadsheets and most relationship models are static.

A dynamic model, by contrast, considers several time periods and does not ignore the impact of an action in time period 1 on time period 2. A combat simulation model is dynamic; the loss of a combat unit in time period 1 affects all succeeding time periods. Dynamic modeling (also known as simulation) is a software representation of the time-based behavior of a system. Where a static model involves a single computation of an equation, a dynamic model is iterative; it constantly recomputes its equations as time changes. It can predict the outcomes of possible courses of action and can account for the effects of variances or randomness. One cannot control the occurrence of random events. One can, however, use dynamic modeling to predict the likelihood and the consequences of their occurring. Process models usually are dynamic because they envision flows of material, the passage of time, and feedback. Structural and functional models are usually static, though they can be dynamic.

- *Descriptive models can be solvable or simulated.*

  A solvable model is one in which there is an analytic way of finding the answer. The performance model of a radar, a missile, or a warhead is a solvable problem. But other problems require such a complicated set of equations to describe them that there is no way to solve them. Worse still, complex problems typically cannot be described in a manageable set of equations. In complex cases—such as the performance of an economy or a person—one can turn to simulation.

  Simulation involves designing a model of a system and performing experiments on it. The purpose of these "what if" experiments is to determine how the real system performs and to predict the effect of changes to the system as time progresses. For example, an analyst can use simulation to answer questions such as these: What is the expected balance of trade worldwide next year? What are the likely areas of deployment for mobile surface-to-air missiles in country *X*? What is the expected yield of the nuclear warheads on country *Y*'s new medium-range ballistic missiles?

Using Target Models for Analysis

Often, particularly in military combat or law enforcement operations, the creation and analysis of a target model is a quick and intuitive process. Let's begin with a simple example, one that is relevant to military combat operations.

Consider the BMP personnel carrier racing along an Afghan mountain road that was described in chapter 3. The problem definition in that example was very simple: locate Taliban forces in the region so that the Spectre gunship can neutralize them. This time, however, the intelligence officer has an additional problem: He must determine when the BMP will reach a nearby village, where a Doctors Without Borders team is currently providing medical assistance.

The officer has a mental model of the BMP's performance; he knows its maximum speed on typical mountain roads. He has the Predator's information giving the present position of the BMP. And he has a map—a geographic model—that allows him to determine the distance between the BMP's present position and the village. Combining these models and performing a simple computation (analysis), he produces a predictive *scenario* (a combination of several models into a more comprehensive target model), concluding that the BMP will arrive in the village in twenty-five minutes and the Doctors Without Borders team will be toast unless the Spectre gunship arrives first.

Where the intelligence customer is a national leader, policymaker, law enforcement, or business executive, the analysis process is typically more deliberate than in this example. Consider the intelligence problems defined in the issue decompositions of Figures 4-1 and 4-2. The issue decomposition in both cases, when populated with specific intelligence, is also a type of target model that can serve many purposes. It can be used as a basis for requesting intelligence collection on specific topics shown in the boxes at the bottom level of the diagrams—a subject explored in detail in chapter 20. And it can be a framework in which to incorporate incoming intelligence—a subject discussed in chapter 7.

To illustrate, let's use the issue decomposition of a country's economy shown in Figure 4-2 and focus on one part of the overall economy: the country's financial stability, specifically the stability of the banking sector. You have five components that contribute to an assessment of the banking sector: bank failures, bank liquidity, credit growth, loan default rates, and loan terms. Most of these components can be described effectively by a simple type of model that is discussed in chapter 6: a temporal graphic. Using the available raw intelligence information, you draw curves showing the following:

- Bank failures over the past few years (a flat curve)
- Bank liquidity over the same time period (decreasing steadily)
- Credit growth (rising sharply)
- Loan default rates (stable until last year, and then started increasing)

You can also prepare another type of model, a comparative graphic that shows how loan terms compare to those offered by other countries (terms are much more favorable to lenders in the target country).

Combining all of these models into an overall picture of the banking sector, you can observe that although bank failures have been stable so far, the future does not look good. All of the other components of the model are showing unfavorable trends. On the basis of past experience, you can analyze the models to create a predictive model—another scenario—which indicates bank failures will rise dramatically in the near future, and the banking sector of the economy is headed for serious trouble.

This example illustrates how the issue decomposition is closely related to the target model, and can also be used to structure or organize the target model. Part II of this book explores the target model in more detail and illustrates the types of models that are used in analysis. Part III is devoted to analysis methodologies that use models—especially predictive methodologies.

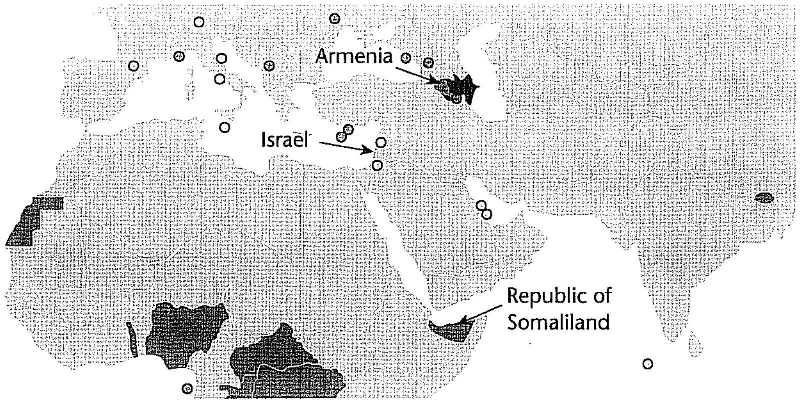
Modeling Using PMESII

The preceding sections introduced the PMESII analytic perspective and the concept of modeling the intelligence target. Before going into how we analyze models, let's examine how these two concepts work together. We can create many models of a typical intelligence target such as a government, depending on the intelligence issue (chapter 3). Let's pick the state of Azerbaijan and look at a few of the possible models that we might need to use to address a specific issue: What are the possible "levers" that could be used to influence actions by the Azerbaijani government? Following the PMESII perspective, some possible models that might be constructed are described in the sections that follow—the set of models is far from complete, of course.

Political Model

The Azeri government, which eliminated presidential term limits in a 2009 referendum, has been accused of authoritarianism. President Ilham Aliyev appears to be firmly in charge. One could develop models of the political support that Aliyev has, his control over the judiciary and legislature, or government links with criminal elements, for example. One example model that is useful for assessing points of influence is a display of Azerbaijan's diplomatic ties with other countries, shown in Figure 5-3. The figure might be used as a starting point for analyzing the nature of Azerbaijan's diplomatic relationships for possible relationships that could be used to exert influence. It shows a few points of analytic interest: Azerbaijan does not have diplomatic relations with Armenia or the Republic of Somaliland, for example. That isn't greatly surprising; Azerbaijan has an unresolved conflict with Armenia, and Somaliland is generally considered to be part of Somalia, not a separate country. More surprising is that Azerbaijan is one of the few majority Muslim countries to have bilateral strategic and economic relations with Israel—a topic we revisit in the military model, next. The map shows that Azerbaijan has diplomatic relations with Tehran, but the relationships are strained because of Iran's support for the Armenians and Azerbaijan's connections to Israel.

Figure 5-3 Countries Having Diplomatic Relations with Azerbaijan



Source: "Azerbaijan Relations," ©Alinor at English Wikipedia, http://commons.wikimedia.org/wiki/File:Azerbaijan_relations.png#/media/File:Azerbaijan_relations.png. Licensed under CC-BY-SA-3.0 via Wikimedia Commons, http://creativecommons.org/licenses/by-sa/3.0/

Credit: © Alinor / Wikimedia Commons / CC-BY-SA-3.0.

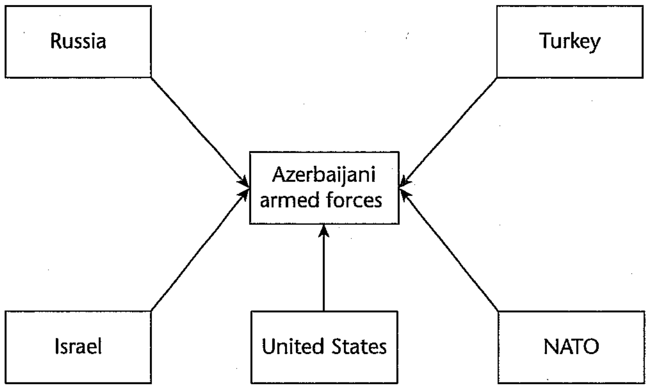
Military Model

Military models could describe deployments, mix of weaponry, or performance of weapons (aircraft, naval vessels, armored vehicles, artillery, air defense systems), for example. In the case of Azerbaijan, its military model is shaped by an unresolved conflict with Armenia over Nagorno-Karabakh, a primarily Armenian-populated region currently controlled by Armenia. Armenia and Azerbaijan began fighting over the area in 1988, and a tenuous cease-fire has existed since 1994. Figure 5-4 shows a model of key cooperative relationships between the Azerbaijani military and other countries that specifically addresses the question of levers of influence. In the figure, the thickness of the connection indicates the strength of the relationship:

- Russia is Azerbaijan's main arms supplier. Military and technical cooperation between the two is estimated to be about $4 billion.
- Turkey has provided Azerbaijan with a mix of light weaponry and other military equipment along with professional training for the Azerbaijani military. Turkey has agreed to provide troops if necessary in the event of a resumption of hostilities between Azerbaijan and Armenia over Nagorno-Karabakh.
- Azerbaijan and Israel cooperate in several areas of the defense industry, with Azerbaijan acquiring Israeli technology such as a capability to produce military UAVs.

- The North Atlantic Treaty Organization (NATO) assists Azerbaijan in defense organizational reforms.
- The United States has agreements providing for military cooperation with Azerbaijan, including special forces assistance.

Figure 5-4 Cooperative Relationships of the Azerbaijani Armed Forces



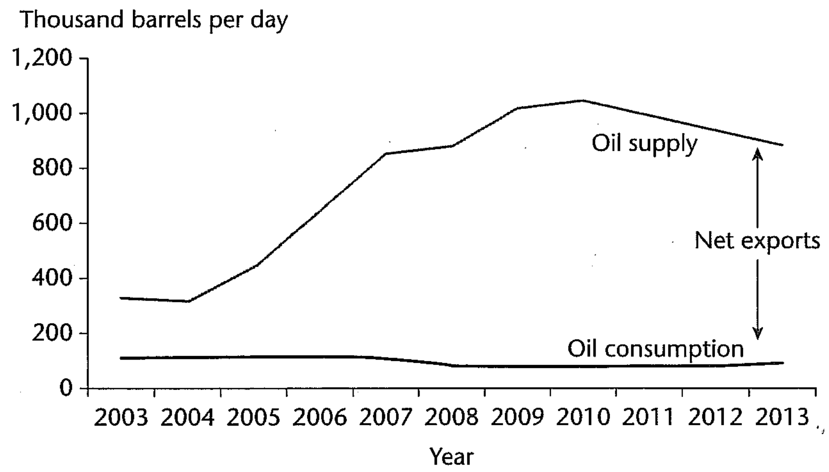
Economic Model

Azerbaijan has experienced high economic growth thanks to large and growing oil and gas exports. The model in Figure 5-5 illustrates this point and, in conjunction with the infrastructure model of Figure 5-7, suggests possible points of economic influence. One could model several of the nonexport sectors that have also experienced double-digit growth, including construction, banking, and real estate. Other economic models might track changes in gross domestic product (GDP), unemployment, inflation rate, or public debt to identify areas in which economic influence might be applied.

Social Model

Azerbaijan is a nation with a majority-Turkic and majority-Shiite Muslim population. Corruption and criminal activity are natural subjects for modeling as both are common throughout the country. Several ethnic groups exist, as illustrated in the ethnic model of Figure 5-6. This particular model could be useful in assessing influence actions involving the Armenians, a persecuted group, or restive groups such as the Talysh and Lezgins. A different model might take into account religious entities that support or oppose the government.

Figure 5-5 Petroleum Production and Consumption in Azerbaijan, 2003–2013



Source: "Azerbaijan International Energy Data and Analysis," U.S. Energy Information Administration, August 2014, https://www.eia.gov/beta/international/analysis_includes/countries_long/Azerbaijan/azerbaijan.pdf.

Note: 2013 data are preliminary estimates.

Infrastructure Model

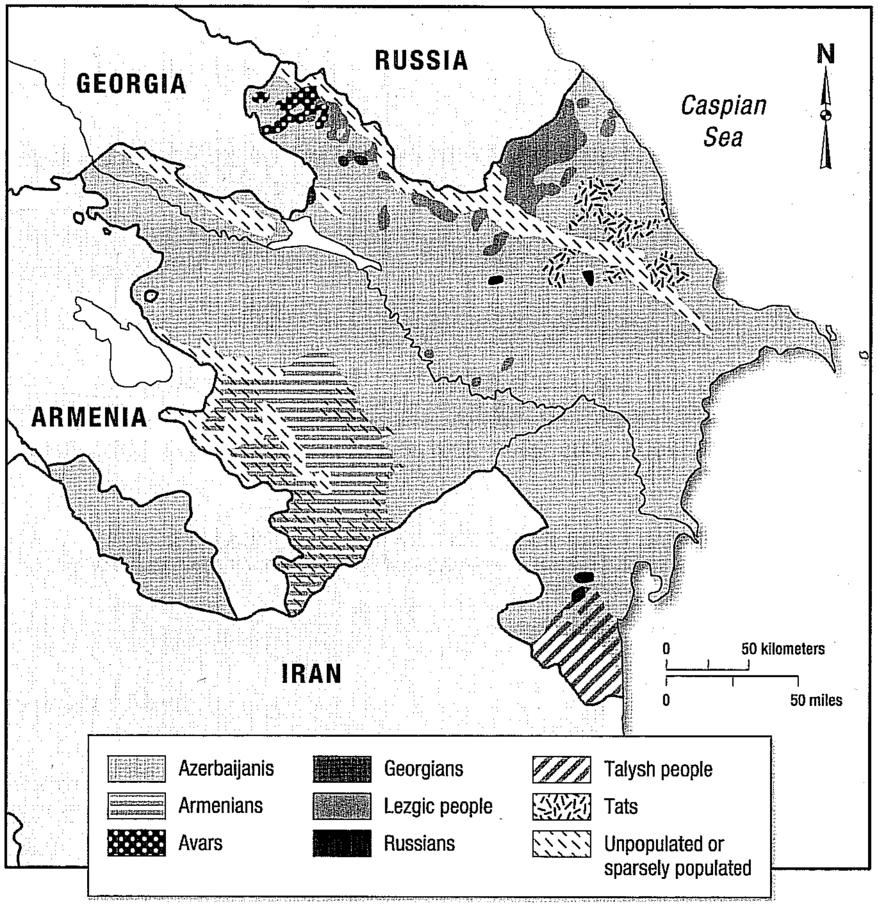
Figure 5-5 illustrated the economic benefits of oil exports to Azerbaijan and their contributions to GDP. Oil exports through the Baku-Tbilisi-Ceyhan, Baku-Novorossiysk, and Baku-Supsa pipelines remain the main economic driver; these networks are illustrated in the infrastructure model of Figure 5-7.

Information Model

Figure 5-8 is an example of an information model. It shows the trend in Internet access for Azerbaijan. As the figure shows, access is growing steadily, partly as a result of the country's national strategy: creating an information and communications technology hub for the Caucasus region. Consequently, the Internet is mostly free from systematic government filtering or blocking. The government does not, however, tolerate political opposition postings online. The graphic is relevant in assessing the possible use of information operations as an information "lever" of influence.

These are fairly straightforward examples of a few models that illustrate the use of modeling across all of the PMESII perspectives. Again, many more such models would be needed to provide a detailed picture that addresses the question of levers of influence.

Figure 5-6 Ethnic Model of Azerbaijan



Source: Adapted from "Ethnographic Map of Azerbaijan, 2003," ©Yerevanci, https://commons.wikimedia.org/wiki/File:Azerbaijan_ethnic_2003.png. Licensed under CC-BY-SA-3.0 via Wikimedia Commons, http://creativecommons.org/licenses/by-sa/3.0/

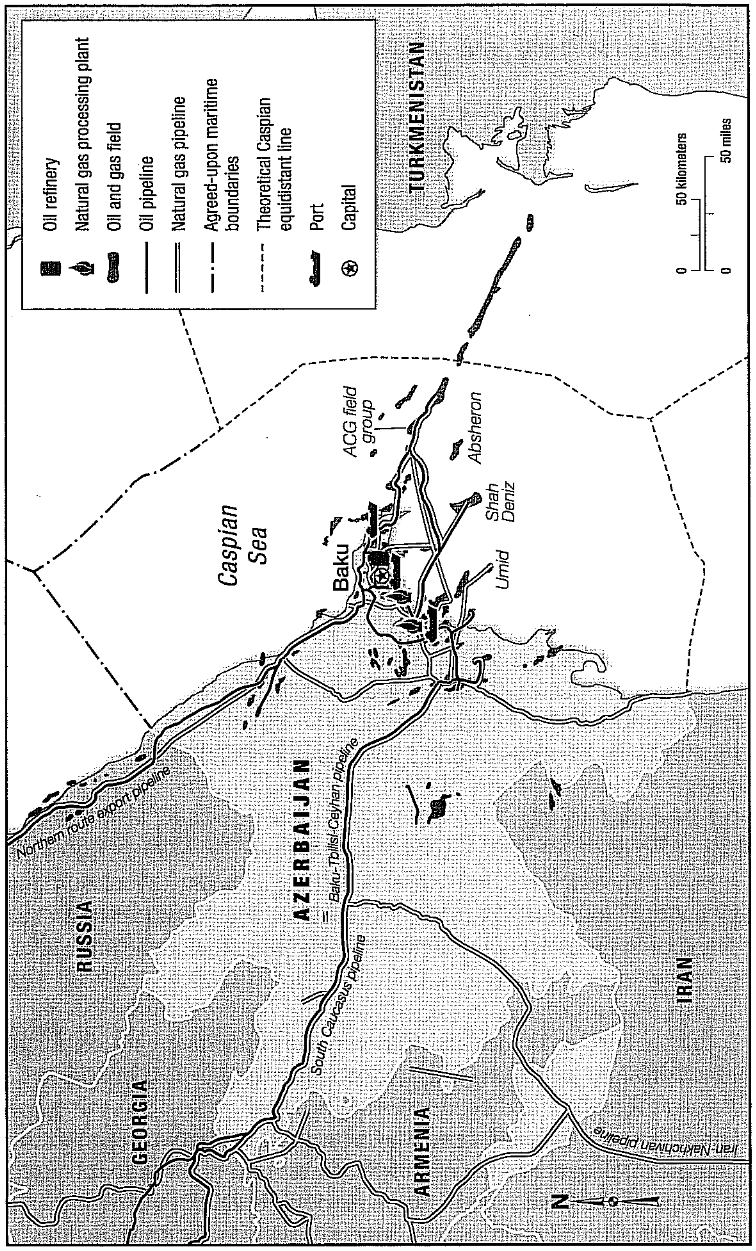
Credit: © Yerevanci / Wikimedia Commons / CC-BY-SA-3.0.

As another example of how a target model can be analyzed and used in policymaking and policy execution, let's revisit the counterintelligence analysis problem.

Using Models in Analysis

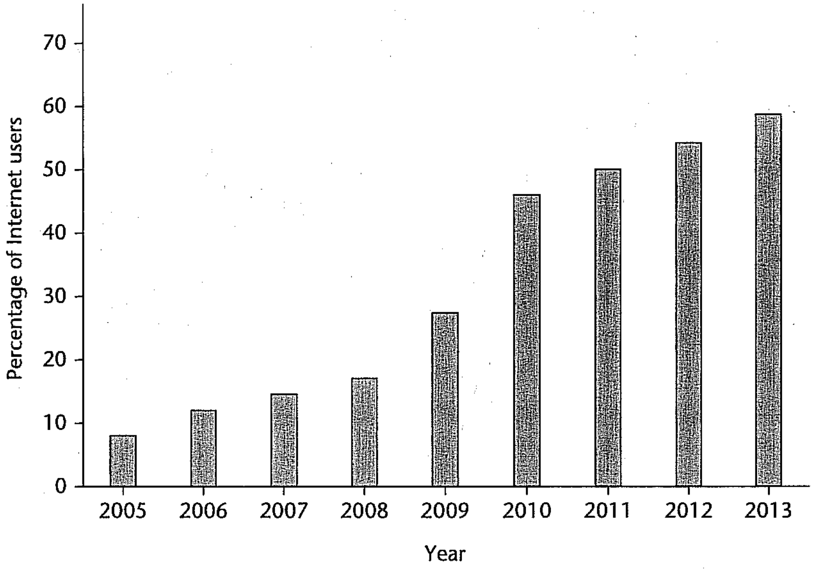
In chapter 4, we examined a simple counterintelligence (CI) issue decomposition model that has as its target a foreign intelligence service. We begin from the block in Figure 4-4 labeled "General strategy" of the organization, which

Figure 5-7 Oil and Natural Gas Structure in Azerbaijan



Source: "Azerbaijan International Energy Data and Analysis," U.S. Energy Information Administration, August 2014, https://www.eia.gov/beta/international/analysis_includes/countries_long/Azerbaijan/azerbaijan.pdf; U.S. Geological Survey, IHS EDIN.

Figure 5-8 Percentage of Internet Users in Azerbaijan by Year



Source: Created by the author from United Nations statistical reporting, http://data.un.org/Data.aspx?d=WDI&f=Indicator_Code%3AIT.NET.USER.P2.

has three subcategories—targets, operations, and linkages (to other intelligence services). The following section illustrates some example analyses of these subcategories taken from the target model, followed by two examples of the possible responses that analysis supports.

Note that this would be classified as an information model; it deals with how some governments obtain intelligence, or information. The model is exemplary and fairly basic; a complete analysis of the CI model would be far more detailed.

Targets

Most intelligence services have preferred strategic targets that closely align with their national interests. As examples, consider four countries with sizeable intelligence services having different targets: Russia, China, France, and Germany.

- Countries such as France and Germany are concerned with combating terrorism and promoting their economies through exports. So they focus on terrorism and economic intelligence.[8]
- China is particularly concerned with regional military threats, causing Chinese intelligence to target Taiwan. China also has a national interest in acquiring technology to develop both military and commercial strength.[9] So a major part of Chinese intelligence efforts focuses on acquiring advanced technology, especially from the United States.[10]

- Russia's priorities center on internal security (particularly against terrorist threats), and political, economic, and military events in neighboring countries, especially former Soviet republics. The Russian intelligence services divide these targets, with the SVU (successor to the KGB) going after political and economic targets, and the Main Intelligence Directorate (Glavnoye Razvedovatel'noye Upravlenie, or GRU) going after military targets.

Operations

Intelligence services prefer specific sources of intelligence, shaped in part by what has worked for them in the past; by their strategic targets; and by the size of their pocketbooks. The poorer intelligence services rely heavily on open source (including the web) and HUMINT, because both are relatively inexpensive. COMINT also can be cheap, unless it is collected by satellites. The wealthier services also make use of satellite-collected imagery intelligence (IMINT) and COMINT, and other types of technical collection.

- France and Germany make use of technical collection, including COMINT and computer intrusion techniques.[11] They are well equipped to do COMINT, because two of the premier COMINT hardware developers are located in France (Thales) and Germany (Rohde & Schwartz).
- China relies heavily on HUMINT, working through commercial organizations, particularly trading firms, students, and university professors far more than most other major intelligence powers do.[12]

In addition to being acquainted with opponents' collection habits, CI also needs to understand a foreign intelligence service's analytic capabilities. Many services have analytic biases, are ethnocentric, or handle anomalies poorly. It is important to understand their intelligence communications channels and how well they share intelligence within the government. In many countries, the senior policymaker or military commander is the analyst. That provides a prime opportunity for "perception management," especially if a narcissistic leader like Hitler, Stalin, or Saddam Hussein is in charge and doing his own analysis. Leaders and policymakers find it difficult to be objective; they are people of action, and they always have an agenda. They have lots of biases and are prone to wishful thinking.

Linkages

Almost all intelligence services have liaison relationships with foreign intelligence or security services. It is important to model these relationships because they can dramatically extend the capabilities of an intelligence service.

- During the Cold War, the Soviet Union had extensive liaison relationships with the intelligence services of its East European satellites. The Soviet intelligence services, however, were always the dominant players in the relationships. Since the breakup of the Soviet Union, Russia has been slowly developing new liaison relationships with some of the former Soviet republics.

- France and Germany share intelligence both directly and through NATO, and they have intelligence liaison arrangements with selected other countries.
- In the area of law enforcement, many countries share intelligence via Interpol, the international organization created to facilitate cross-border police cooperation.

Summary

Two conceptual frameworks are invaluable for doing intelligence analysis. One deals with the instruments of national or organizational power and the effects of their use. The second involves the use of target models to produce analysis.

The intelligence customer has four instruments of national or organizational power, as discussed in chapter 2. Intelligence is concerned with how opponents will use those instruments and the effects that result when customers use them. Viewed from both the opponent's actions and the effects perspectives, there are usually six factors to consider: political, military, economic, social, infrastructure, and information, abbreviated PMESII:

- *Political*. The distribution of power and control at all levels of governance.
- *Military*. The ability of all relevant actors (enemy, friendly, and neutral) to exercise force.
- *Economic*. Behavior relating to producing, distributing, and consuming resources.
- *Social*. The cultural, religious, and ethnic composition of a region and the beliefs, values, customs, and behaviors of people.
- *Infrastructure*. The basic facilities, services, and installations needed for the functioning of a community or society.
- *Information*. The nature, scope, characteristics, and effects of individuals, organizations, and systems that collect, process, disseminate, or act on information.

All intelligence involves extracting knowledge from a model of the target. Models in intelligence are typically conceptual and descriptive. The easiest ones to work with are deterministic, linear, static, solvable, or some combination. Unfortunately, in the intelligence business the target models tend to be stochastic, nonlinear, dynamic, and simulated.

From an existing knowledge base, a model of the target is developed. Next, the model is analyzed to extract information for customers or for additional collection. The "model" of complex targets will typically be a collection of associated models that can serve the purposes of intelligence customers and collectors. The models can be created relying on any of the PMESII factors or can be a composite of several factors.

Notes

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2. R. Hillson, "The DIME/PMESII Model Suite Requirements Project," *NRL Review* (2009): 235–239, www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA525056.
3. Expansion of a list contained in the U.S. Army Training and Doctrine Command, "Operation Environments to 2028: The Strategic Environment for Unified Land Operations," August 2012, http://defenseinnovationmarketplace.mil/resources/TRADOC2028_Strategic_Assessment.pdf.
4. Samuel P. Huntington, *The Clash of Civilizations and the Remaking of World Order* (New York: Simon & Schuster, 1996), 29.
5. Paul R. Pillar, *Intelligence and U.S. Foreign Policy: Iraq, 9/11, and Misguided Reform* (New York: Columbia University Press, 2011).
6. CIA, *A Tradecraft Primer: Structured Analytic Techniques for Improving Intelligence Analysis* (Washington, D.C.: Author, March 2009).
7. A stochastic process is one in which the events of the process are determined by chance. Such processes are therefore analyzed using probability theory.
8. "Telecommunications, Satellites Said to Be Targeted for Espionage by France," *Common Carrier Week*, May 17, 1993.
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10. Office of the National Counterintelligence Executive, "Foreign Spies Stealing US Economic Secrets in Cyberspace: Report to Congress on Foreign Economic Collection and Industrial Espionage, 2009–2011" (Washington, D.C.: Author, October 2011), 4–5.
11. Samuel D. Porteous, "Economic Espionage: Issues Arising from Increased Government Involvement with the Private Sector," *Intelligence and National Security*, 9, no. 4 (October 1994): 735–752; Wayne Madsen, "Intelligence Agency Threats to Computer Security," *International Journal of Intelligence and Counterintelligence*, 6, no. 4 (Winter 1993): 413–488.
12. Eftimiades, *Chinese Intelligence Operations*, 22.

6

Overview of Models in Intelligence

One picture is worth more than ten thousand words.

Chinese proverb

The preceding chapters have introduced the concept of models and provided some examples of how analysts use them. The process of populating the appropriate model is known as synthesis, a term borrowed from the engineering disciplines. *Synthesis* is defined as putting together parts or elements to form a whole—in this case, a model of the target. It is what intelligence analysts do, and their skill at it is a primary measure of their professional competence. In this chapter we review the types of models commonly used to describe intelligence targets.

The most important models that find wide use in intelligence are only touched on in this chapter. Later chapters go into more detail, discussing how these models are created and used and some strengths and weaknesses of each type.

Creating a Conceptual Model

The first step in creating a model is to define the *system* that encompasses the intelligence issues of interest, so that the resulting model answers any problem that has been defined by using the issue definition process described in chapter 4. The system could be something as simple as a new fighter aircraft, a data processing center, an opium poppy field, or a new oil pipeline. Many questions in the current or tactical intelligence area can be so narrowly focused. The example given in chapter 3 of the BMP in Afghanistan was narrowly focused on the vehicle, its occupants, and the surrounding terrain. Problems coming into the Symantec war room are usually narrowly focused on an immediate virus, hacker, or Trojan horse of concern, its source, and its victims. However, few questions in strategic intelligence or in-depth research can be answered by using a narrowly defined target.

For the complex targets that are typical of in-depth research, an analyst usually will deal with a complete system, such as an air defense system that

will use the new fighter aircraft; a narcotics growing, harvesting, processing, and distribution network, of which the opium poppy field is but a part; or an energy production system that goes from oil exploration through drilling, pumping, transportation (including the oil pipeline), refining, distribution, and retailing. In law enforcement, analysis of an organized crime syndicate involves consideration of people, funds, communications, operational practices, movement of goods, political relationships, and victims. Many intelligence problems will require consideration of related systems as well. The energy production system, for example, will give rise to intelligence questions about related companies, governments, suppliers and customers, and nongovernmental organizations (such as environmental advocacy groups). The questions that customers pose should be answerable by reference only to the target model, without the need to reach beyond it.

A major challenge in defining the relevant system is to use restraint. The definition must include *essential* subsystems or collateral systems, but nothing more. Part of an analyst's skill lies in being able to include in a definition the relevant components, and only the relevant components, that will address the issue.

A system, as explained in chapter 3, can be examined structurally, functionally, or as a process. The systems model can therefore be structural, functional, process oriented, or any combination thereof. Structural models include actors, objects, and the organization of their relationships to each other. Process models focus on interactions and their dynamics. Functional models concentrate on the results achieved, for example, a model that simulates the financial consequences of a proposed trade agreement.

After an analyst has defined the relevant system, the next step is to select the generic models, or model templates, to be used. These model templates then will be made specific, or "populated," using evidence (discussed in chapter 7). Several types of generic models are used in intelligence. The three most basic types are textual, mathematical, and visual. Many models of intelligence use are combinations of these three basic types.

Textual Models

Almost any model can be described using written text. The CIA's *World Factbook* is an example of a set of textual models—actually a series of models (political, military, economic, social, infrastructure, and information)—of a country. Some common examples of textual models that are used in intelligence analysis are lists, comparative models, profiles, and matrix models.

Lists

Lists and outlines are the simplest examples of a model. Benjamin Franklin favored a "parallel list" as a model for problem solving. He would list the arguments pro and con on a topic side-by-side, crossing off arguments on each side that held equal weight, to arrive at a decision. The list continues to be used by analysts today for much the same purpose—to reach a yes-or-no decision. The parallel list works well on a wide range of topics and remains very effective for conveying information to the customer. It also is often used in intelligence for comparative analysis—for example, comparing the performance of a Russian naval vessel with its U.S. counterpart or contrasting two cultures.

Comparative Models

Comparative techniques, like lists, are a simple but useful form of modeling that typically does not require a computer simulation. Comparative techniques are used in government, mostly for weapons systems and technology analyses. Both governments and businesses use comparative models to evaluate a competitor's operational practices, products, and technologies. This is called *benchmarking*.

A powerful tool for analyzing a competitor's developments is to compare them with your own organization's developments. Your own systems or technologies can provide a benchmark for comparison. One pitfall of comparative modeling is that you may be inclined to rely on models that you are familiar with, such as your country's organizational or industrial process models, instead of those of the target country. Such so-called *mirror imaging* leads to erroneous estimates. This and other pitfalls of comparative techniques are discussed in chapter 9.

Comparative models have to be culture specific to help avoid mirror imaging. A classic example of a culture-specific organizational model is the *keiretsu*, which is unique to Japan, though similar organizational models exist elsewhere in Asia. A keiretsu is a network of businesses, usually in related industries, that own stakes in one another and have board members in common as a means of mutual security. A network of essentially captive (because they are dependent on the keiretsu) suppliers provides the raw material for the keiretsu manufacturers, and the keiretsu trading companies and banks provide marketing services. Keiretsu have their roots in prewar Japan, which was dominated by four large conglomerates called *zaibatsu*: Mitsubishi, Mitsui, Sumitomo, and Yasuda. The zaibatsu were involved in areas such as steel, international trading, and banking and were controlled by a holding company.

Six keiretsu—Sumitomo, Mitsubishi, Mitsui, Dai-Ichi Kangyo, Sanwa, and Fuyo—dominate Japan's economy. Most of the hundred largest Japanese corporations are members of one or another of these "big six" keiretsu.[1]

An intelligence analyst who mirror images Western business practices in assessing the keiretsu would underestimate the close keiretsu cooperation between supplier and manufacturer and the advantages it gives in continual product development, quality improvements, and reductions in cost. But the analyst also would miss the weaknesses inherent in a dependency relationship that shields the partners from competitive pressures, which slows innovation and eventually erodes the market position of all the keiretsu parties.

To avoid the problem of mirror imaging, analysts sometimes create parallel models, side-by-side, for comparative modeling. This exercise helps to highlight the differences between one's own company or country model and that of the target and helps to catch potential areas of mirror imaging.

Profiles

Profiles are models of individuals—in national intelligence, of leaders of foreign governments; in business intelligence, of top executives in a competing organization; in law enforcement, of mob leaders and serial criminals. The purpose of creating profiles usually is to help predict what the profiled person will do in a given set of circumstances[2] or to aid the customer in negotiating with the profiled person. Chapter 15 discusses the use of profiles for predictive simulation.

Profiles depend heavily on understanding the pattern of mental and behavioral traits that are shared by adult members of a society—referred to as the society's *modal personality*. Several modal personality types may exist in a society, and their common elements are often referred to as *national character*. A recurring quip that reflects widely held—though tongue-in-cheek—views of national character goes:

> **Paradise is where:**
>
> the cooks are French
>
> the mechanics are German
>
> the police are British
>
> the lovers are Italian
>
> and it is all organized by the Swiss.
>
> **Hell is where:**
>
> the cooks are British
>
> the mechanics are French
>
> the police are German
>
> the lovers are Swiss
>
> and it is all organized by the Italians.

U.S. readers, after enjoying a laugh at this, might stop to reflect that, in many countries, common stereotypes of U.S. national character include obese people who are gorging on fast food with one hand, carrying a gun in the other, and arrogantly using up as many resources as possible as fast as possible in their materialistic quest for more and newer versions of everything.

Defining the modal personality type is beyond the capabilities of the journeyman intelligence analyst, and one must turn to experts. I offer here only a brief overview of the topic of behavioral profiles to indicate the importance of the concept in the overall decision-modeling problem, which is discussed in chapter 15. The modal personality model usually includes at least the following elements:

- *Concept of self*—the conscious ideas of what a person thinks he or she is, along with the frequently unconscious motives and defenses against ego-threatening experiences such as withdrawal of love, public shaming, guilt, or isolation
- *Relation to authority*—how an individual adapts to authority figures
- *Modes of impulse control and expressing emotion*
- *Processes of forming and manipulating ideas*

Three model types are often used for studying modal personalities and creating behavioral profiles:

- *Cultural pattern models* are relatively straightforward to analyze (see chapter 15) and are useful in assessing group behavior. They have less value in the assessment of an individual. Cultural patterns are derived from political behavior, religious idea systems, art forms, mass media, folklore, and similar collective activities.
- *Child-rearing systems* can be studied to allow the projection of adult personality patterns and behavior. They may allow more accurate assessments of an individual than a simple study of cultural patterns, but they cannot account for the wide range of possible pattern variations occurring after childhood.
- *Individual assessments* are probably the most accurate starting points for creating a behavioral model, but they depend on detailed data about the specific individual. Such data are usually gathered from testing techniques; the Rorschach (or "Inkblot") test—a projective personality assessment based on the subject's reactions to a series of ten inkblot pictures—is an example. However, test data are seldom available on individuals of interest to the intelligence business. In the mid-twentieth century, it was common to rely on the writings and speeches of individuals (*Mein Kampf, The Thoughts of Chairman Mao*) to construct a modal personality picture. More recently, videos of leaders such as Saddam Hussein, Kim Jong-Il, and Osama bin Laden are likely to be used. Sometimes, one is reduced to fragmented bits of information such as anecdotal evidence or handwriting analysis (graphology).

Another model template for individual personality assessments is the Myers-Briggs Type Indicator, which assigns people to one of sixteen different

categories or types. There are four different subscales of Myers-Briggs that purport to measure different personality tendencies. As with other test-based assessments, the trick is to get test results on the target individual.

Interaction Matrices

A textual variant of the spreadsheet (discussed later) is the interaction matrix, a valuable analytic tool for certain types of synthesis. It appears in various disciplines and under different names and is also called a parametric matrix or a traceability matrix.[3] An interaction matrix is shown in Table 6-1. In 2005, four proposals were under consideration to be part of a South Asian gas pipeline project.[4] The interaction matrix summarizes in simple form the costs and risks of each proposal. So it is also a form of comparative model. The matrix is a concise and effective way to present the results of analysis. Table 6-1 permits a view of the four proposals that facilitates comparison.

An interaction matrix can be qualitative or quantitative, as Table 6-1 illustrates. A quantitative interaction matrix naturally fits into many of the commercially available decision-support software packages. It is typically used to ensure that all possible alternatives are considered in problem solving.

In economic intelligence and scientific and technical intelligence, it is often important to assess the impact of an industrial firm's efforts to acquire other companies. One model for assessing the likely outcome of a merger or an acquisition uses the five criteria that Cisco Systems uses to look at possible acquisitions. The criteria are listed in the first column of Table 6-2. In this interaction matrix model, the three candidates for acquisition are ranked on how well they meet each criterion; the darker the shading, the higher the ranking. This merger and acquisition model has potential applications outside the commercial world. In 1958 it would have been a useful tool, for example, to assess the prospects for success of the "merger" that year between Syria and Egypt that created the United Arab Republic. The proposed "merger" would

Table 6-1 Interaction Matrix—Gas Pipeline Proposals

Pipeline Proposals	Cost	Supporters	Risks
From South Pars field, Iran, to Karachi	$3 billion	Iran, Pakistan	Technical
From Iran to northern India	$4–5 billion	Iran, India	Political, security, cost
From Turkmenistan's Dauletabad field to Pakistan	$3.2 billion	Turkmenistan, Pakistan	Security
Underwater pipeline from Qatar to Pakistan	$3 billion	Qatar, Pakistan	Political, technical

Table 6-2 Matrix for Merger and Acquisition Analysis

Merger and acquisition criteria	Company A	Company B	Company C
Shared vision of where the industry is heading and complementary roles each company wants to play in it			
Similar cultures and chemistry			
A winning proposition for acquired employees, at least over the short term			
A winning proposition for shareholders, employees, customers, and business partners over the long term			
Geographic proximity, particularly for large acquisitions			

Source: Michelle Cook and Curtis Cook, "Anticipating Unconventional M&As: The Case of DaimlerChrysler," *Competitive Intelligence Magazine* (January–February 2001).

not have fared well against any of the criteria in Table 6-2, even the one on similar cultures, and in fact, the merger subsequently failed.

Mathematical Models

The most common modeling problem involves solving an equation. Most problems in engineering or technical intelligence are single equations of the form

$$f(x, y, z, t, \ldots, a, b, c, \ldots) = 0$$

or they are systems of equations of this form. Systems of equations are particularly prevalent in econometric synthesis/analysis; single equations are common in radar, communications, and ballistic missile performance analysis.

Most analysis involves fixing all of the variables and constants in such an equation or system of equations, except for two variables. The equation is then solved repetitively to obtain a graphical picture of one variable as a function of another. A number of software packages perform this type of solution very efficiently. For example, as a part of radar performance analysis, the radar range equation is solved for signal-to-noise ratio as a function of range, and a two-dimensional curve is plotted. Then, perhaps, signal-to-noise ratio is fixed and a new curve plotted for radar cross-section as a function of range.

Often the requirement is to solve an equation, get a set of ordered pairs, and plug those into another equation to get a graphical picture rather than solving simultaneous equations.

Spreadsheets

The computer is a powerful tool for handling the equation-solution type of problem. Spreadsheet software has made it easy to create equation-based models. The rich set of mathematical functions that can be incorporated in it, and its flexibility, make the spreadsheet a widely used model in intelligence.

Spreadsheets have many uses in intelligence, most commonly for looking at numerical data. Their value for numerical data is that the software can be used for data visualization, discussed later. Spreadsheets show relationships at a basic level.

Simulation Models

A simulation model is a mathematical model of a real object, a system, or an actual situation. It is useful for estimating the performance of its real-world analogue under different conditions. We often wish to determine how something will behave without actually testing it in real life. So simulation models are useful for helping decision makers choose among alternative actions by determining the likely outcomes of those actions. Simulation models have been used to simulate events such as the detonation of nuclear devices and their effects; to assess the outcome of armed conflicts; and to identify the environmental consequences of human activities. In intelligence, simulation models also are used to assess the performance of opposing weapons systems, the consequences of trade embargoes, and the success of insurgencies.

Simulation models can be challenging to build. The main challenge usually is validation: determining that the model accurately represents what it is supposed to represent, under different input conditions. Simulation models are discussed in detail in chapter 15.

Visual Models

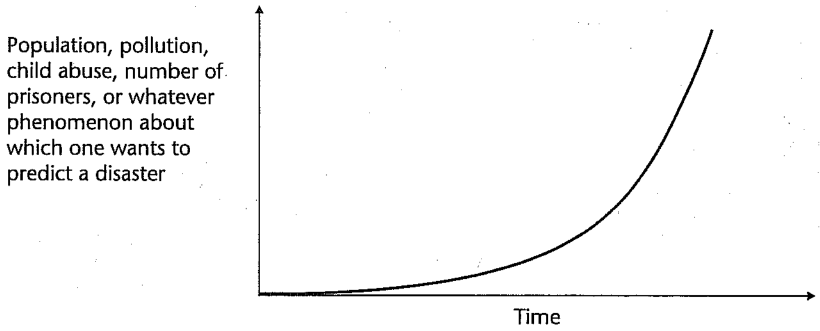
Models can be described in written text, as noted earlier. But the models that have the most impact for both analysts and customers in facilitating understanding take a visual form.

Visualization involves transforming raw intelligence into graphical, pictorial, or multimedia forms so that our brains can process and understand large amounts of data more readily than is possible from simply reading text. Visualization lets us deal with massive quantities of data and identify meaningful patterns and structures that otherwise would be incomprehensible.[5]

Charts and Graphs

Graphical displays, often in the form of curves, are a simple type of model that can be synthesized both for analysis and for presenting the results of

Figure 6-1 The Exponential (or Disaster) Curve



analysis. More curves are introduced and used in later chapters, but here let's look at one of the most common: a type of curve that projects changes over time. When experts extrapolate into the future, they often concentrate on one (or a few) forces that affect an entity, such as the economy or the environment. That can lead them to posit some kind of disaster based on models that use the variables, leading to the *exponential curve* or *disaster curve* shown in Figure 6-1. The creators of the disaster curve tend to ignore or discount the ability of other variables, especially responsive or limiting factors such as human adaptivity and technology, to change at the same rate or faster. A classic example is the exponential extrapolation of growth in telephones, made about 1900, which predicted that by 1920 the entire U.S. population would be working as telephone operators.[6]

Of course, the disaster curve doesn't usually hold up. An opposing reaction, feedback, contamination, or some other countervailing force steps in and retards the exponential growth curve so that an *S curve* results (see Figure 6-2). S curves are fairly common in predictive models.

Figure 6-2 The S Curve

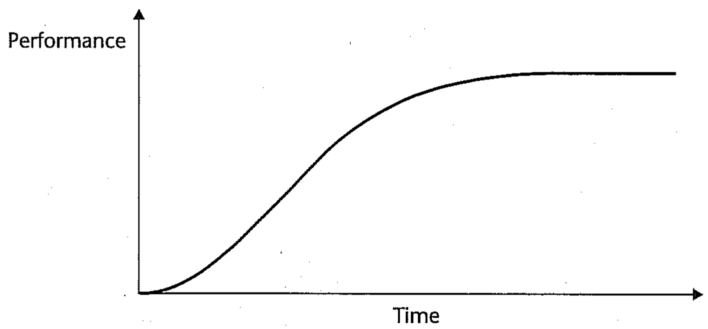
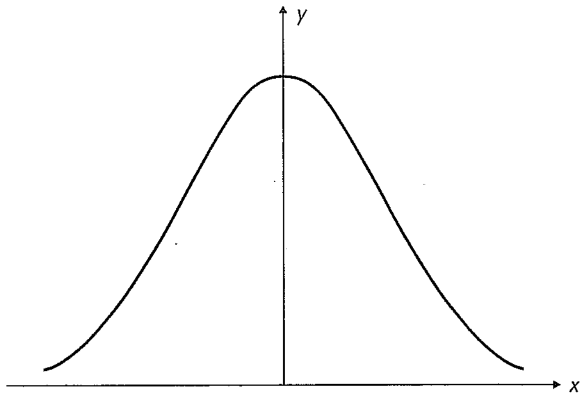


Figure 6-3 The Normal Curve



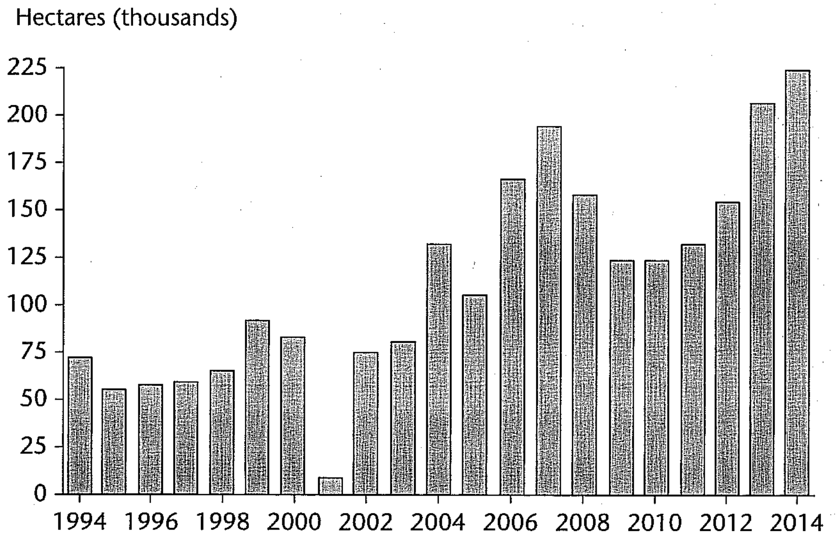
Many phenomena can be modeled by the *Gaussian curve*, or *normal curve*, shown in Figure 6-3. The intelligence of a population, variation in imagery quality, atmospheric dispersion of a chemical release, variation in securities pricing—all these and more can be represented by the normal curve. To illustrate, take the quality of a photograph. The quality of a photograph has an average value, indicated by the point where the curve in Figure 6-3 peaks. But if many (say, two hundred) photographs of a scene are taken with the same camera and their quality plotted, a curve of image quality like that of Figure 6-3 results; a few photographs will be exceptional (falling on the far right side of the curve), and a few will be poor (falling on the far left side of the curve).

Pattern Models

Many types of models fall under the broad category of *pattern models*. Pattern recognition is a critical element of all intelligence.[7] Most criminals and terrorists have a modus operandi, or standard operational pattern. Most governmental and industrial organizations (and intelligence services) also prefer to stick with techniques that have been successful in the past. An important aspect of intelligence synthesis, therefore, is recognizing patterns of activities and then determining in the analysis phase whether (a) the patterns represent a departure from what is known or expected and (b) the changes in patterns are significant enough to merit attention. The computer is a valuable ally here; it can display trends and allow the analyst to identify them. This capability is particularly useful when trends would be difficult or impossible to find by sorting through and mentally processing a large volume of data. Pattern analysis is one way to effectively handle complex issues.

One danger in creating a pattern model is that you may be tempted to find a pattern too quickly. Once a pattern has been settled on, it is easy to emphasize

Figure 6-4 Opium Production in Afghanistan, 1994–2014



Source: United Nations Office on Drugs and Crime, "Afghanistan Opium Survey 2014," November 2014, http://www.unodc.org/documents/crop-monitoring/Afghanistan/Afghan-opium-survey-2014.pdf.

evidence that seems to support the pattern and to overlook, extenuate, or explain away evidence that might undermine it.

One type of pattern model used by intelligence analysts relies on statistics. In fact, a great deal of pattern modeling is statistical. Intelligence deals with a wide variety of statistical modeling techniques. Some of the most useful techniques are easy to learn and require no previous statistical training.

Almost all statistical analysis now depends on computers. The statistical software used should provide both a broad range of statistical routines and a flexible data definition and management capability. The software should have basic graphics capabilities to display such data visually as trend lines.

Histograms, which are bar charts that show a frequency distribution, are one example of a simple statistical pattern. An example that might be used in intelligence analysis is shown in Figure 6-4; it permits an analyst to examine patterns of opium production over time in Afghanistan and to correlate the changes with other events in the region (such as Taliban and government forces activities).

Advanced Target Models

The example models introduced so far are frequently used in intelligence. They're fairly straightforward and relatively easy to create. Intelligence also makes use of four model types that are more difficult to create and to analyze,

but that give more in-depth analysis. We'll briefly introduce them here, and cover them in detail later, in chapters 9, 10, 11, and 14.

Systems Models

Systems models are well known in intelligence for their use in assessing the performance of weapons systems. But we deal with systems in all of the PMESII perspectives described in chapter 5. Systems models have been created for all of the following examples:

- A republic, a dictatorship, or an oligarchy can be modeled as a *political* system.
- Air defense systems, carrier strike groups, special operations teams, and ballistic missile systems all are modeled as *military* systems.
- *Economic* systems models describe the functioning of capitalist or socialist economies, international trade, and informal economies.
- *Social* systems include welfare or antipoverty programs, health care systems, religious networks, urban gangs, and tribal groups.
- *Infrastructure* systems could include electrical power, automobile manufacturing, railroads, and seaports.
- A news gathering, production, and distribution system is an example of an *information* system.

Creating a systems model requires an understanding of the system, developed by examining the linkages and interactions between the elements that compose the system as a whole. As stressed throughout this book,

- A system has *structure*. It is comprised of parts that are related (directly or indirectly). It has a defined boundary physically, temporally, and spatially, though it can overlap with or be a part of a larger system.
- A system has a *function*. It receives inputs from, and sends outputs into, an outside environment. It is autonomous in fulfilling its function. A main battle tank standing alone is *not* a system. A tank with a crew, fuel, ammunition, and a communications subsystem *is* a system.
- A system has a *process* that performs its function by transforming inputs into outputs.

Chapter 9 goes into more detail on systems models.

Relationship Models

Relationships among entities—people, places, things, and events—are perhaps the most common subject of intelligence modeling. There are four levels of such relationship models, each using increasingly sophisticated analytic approaches: hierarchy, matrix, link, and network models. The four are closely related, representing the same fundamental idea at increasing levels of complexity.

Relationship models require a considerable amount of time to create, and maintaining the model (known to those who do it as "feeding the beast") demands much effort. But such models are highly effective in analyzing complex problems, and the associated graphical displays are powerful in persuading customers to accept the results.

Hierarchy Models. The hierarchy model is a simple tree structure. Organizational modeling naturally lends itself to the creation of a hierarchy, as anyone who ever drew an organizational chart is aware. A natural extension of such a hierarchy is to use a weighting scheme to indicate the importance of individuals or suborganizations in it.

Matrix Models. The interaction matrix was introduced earlier. The relationship matrix model is different. It portrays the existence of an association, known or suspected, between individuals. It usually portrays direct connections such as face-to-face meetings and telephone conversations. Analysts can use association matrices to identify those personalities and associations needing a more in-depth analysis to determine the degree of relationships, contacts, or knowledge between individuals.[8]

Link Models. A link model allows the view of relationships in more complex tree structures. Though it physically resembles a hierarchy model (both are trees), a link model differs in that it shows different kinds of relationships but does not indicate subordination.

Network Models. A network model can be thought of as a flexible interrelationship of multiple tree structures at multiple levels. The key limitation of the matrix model discussed earlier is that although it can deal with the interaction of two hierarchies at a given level, because it is a two-dimensional representation, it cannot deal with interactions at multiple levels or with more than two hierarchies. Network synthesis is an extension of the link or matrix synthesis concept that can handle such complex problems. There are several types of network models. Two are widely used in intelligence:

- *Social network models* show patterns of human relationships. The nodes are people, and the links show that some type of relationship exists.
- *Target network models* are most useful in intelligence. The nodes can be any type of entity—people, places, things, concepts—and the links show that some type of relationship exists between entities.

Link and network models are discussed in chapter 10.

Spatial and Temporal Models

Another way to examine data and to search for patterns is to use spatial modeling—depicting locations of objects in space. Spatial modeling can be used effectively on a small scale. For example, within a building, computer-aided design/computer-aided modeling, known as CAD/CAM, can be a powerful tool for intelligence synthesis. Layouts of buildings and floor plans are valuable in physical security analysis and in assessing production capacity, for example. CAD/CAM models are useful both in collection and in counterintelligence analysis of a facility. CAD/CAM can be used to create a physical security profile of a facility, allowing an analyst to identify vulnerabilities by examining floor plans, construction details, and electronic and electrical connections.

Spatial models of local areas, such as city blocks, facilitate a number of analytic inferences. For example, two buildings located within a common security fence can be presumed to have related functions, whereas no such presumption would follow if the two buildings were protected by separate security fences. Spatial modeling on larger scales is usually called *geospatial modeling* and is discussed in more detail in chapter 11.

Patterns of activity over time are important for showing trends. Pattern changes are often used to compare how things are going now with how they went last year (or last decade). Estimative analysis (chapter 12) often relies on chronological models.

Scenarios

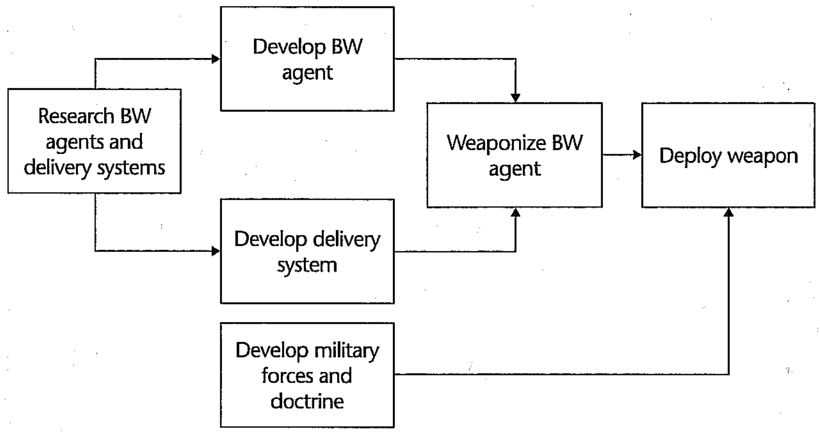
Arguably the most important model for estimative intelligence purposes is the scenario, a very sophisticated model, which is discussed in chapter 14. Alternative scenarios are used to model future situations. These scenarios increasingly are produced as virtual reality models because they are powerful ways to convey intelligence and are very persuasive. (Here, think of virtual worlds such as Second Life or massive multiplayer online roleplaying games such as World of Warcraft.) As a real-world example, virtual reality video tours of North Korea's Yongbyon Nuclear Research Center have been produced and posted online.

Target Model Combinations

Almost all target models are actually combinations of many models. In fact, most of the models described in the previous sections can be merged into combination models. One simple example is a relationship-time display. This is a dynamic model where link or network nodes and links (relationships) change, appear, and disappear over time. Another dynamic model is a space-time model such as used in activity-based intelligence (explained in chapter 11).

We also typically want to have several distinct but interrelated models of the target in order to be able to answer different customer questions. Let's illustrate with an example of organizing available intelligence about a biological weapons threat. Our issue is to assess the ability of country *X* to produce, deploy, and use biological weapons as a terror or combat weapon. You might start by synthesizing a generic model, or model template, based

Figure 6-5 Generic Biological Weapons (BW) System Process Model



on nothing more than general knowledge of what it takes to build and use biological weaponry. Such a generic process model would probably look like Figure 6-5.[9]

But this generic model is only a starting point. From here, the model has to be expanded and made specific to the target, the program in country *X*, in an iterative modeling process that involves the creation of more detailed models called *submodels* or *collateral models*.

Submodels

One type of component model is a submodel, a more detailed breakout of the top-level model. It is typical, for complex targets, to have many such submodels of a target that provide different levels of detail. Participants in the target-centric process then can reach into the model set to pull out the information they need. The collectors of information can drill down into more detail to refine collection targeting and to fill specific gaps. The intelligence customer can drill down to answer questions, gain confidence in the analyst's picture of the target, and understand the limits of the analyst's work. The target model is a powerful collaborative tool.

Figure 6-6 illustrates a submodel of one part of the process shown in Figure 6-5.[10] In this scenario, as part of the development of the biological weapons agent and delivery system, a test area has to be established and the agent must be tested on animals.

Collateral Models

In contrast to the submodel, a collateral model may show particular aspects of the overall target model, but it is not simply a detailed breakout of

Figure 6-6 Biological Weapons (BW) System Test Process Submodel

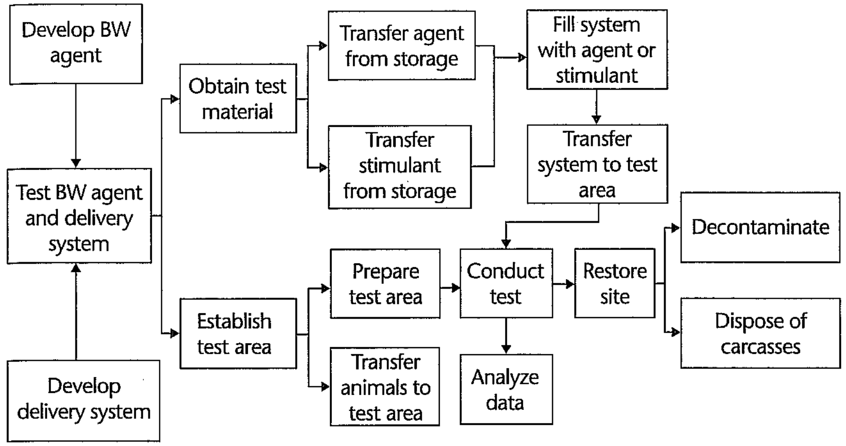
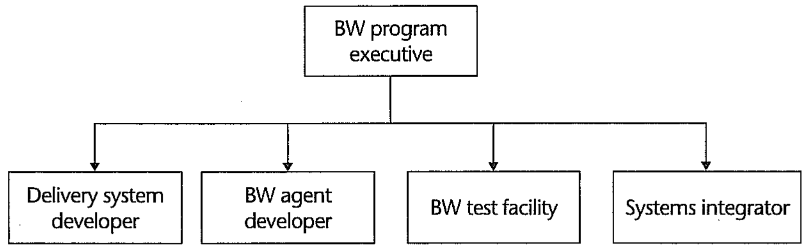


Figure 6-7 Biological Weapons (BW) Development Organizational Model



a top-level model. A collateral model typically presents a different way of thinking about the target for a specific intelligence purpose. For example, suppose that the customer needs to know how the biological weapons organization is managed, where the operations are located, and when the country might deploy biological weapons.

Figure 6-7 is a collateral model intended to answer the first question: How is the organization managed? The figure is a model of the biological weapons development organization and, like most organizational models, it is structural.

Figure 6-8 illustrates a spatial, or geographic, collateral model of the biological weapons target, answering the second question of where the biological weapons operations are located. This type of model is useful in intelligence collection planning, as discussed in chapter 20.

Another type of collateral model of the biological weapons target is shown in Figure 6-9—a temporal (chronological) model of biological weapons development designed to answer the question of when the country will deploy

Figure 6-8 A Collateral Model of Biological Weapons (BW) Facilities

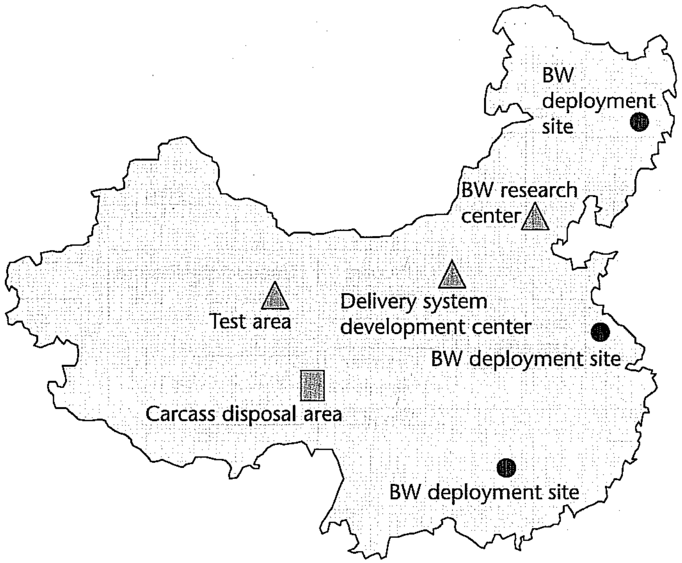
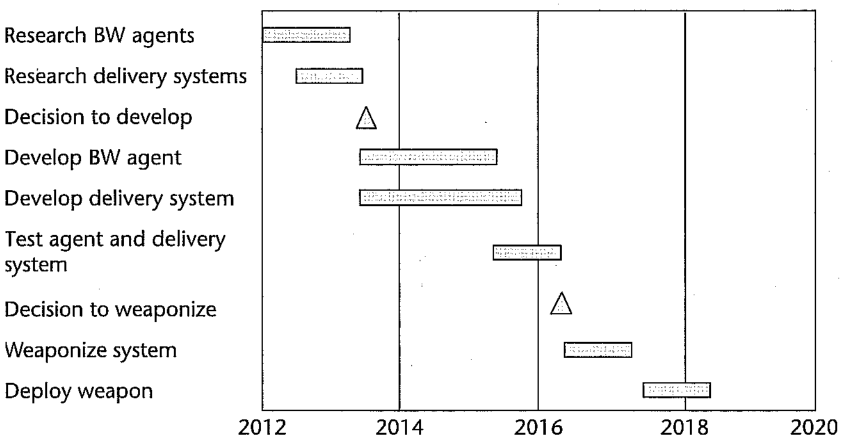


Figure 6-9 Chronological Model of Biological Weapons (BW) Development



biological weapons. This model also is of value to an intelligence collector for timing collection efforts.

The collateral models in Figures 6-7 to 6-9 are examples of the three general types—structural, functional, and process—used in systems analysis. Figures 6-7 and 6-8 are structural models. Figure 6-9 is both a process model

and a functional model. In analyzing complex intelligence targets, all three types are likely to be used.

These models, taken together, allow an analyst to answer a wide range of customer questions. A model like Figure 6-8 can help determine the likely use and targets of the deployed biological weapons system. The model shown in Figure 6-9 can help determine what stage the program is in and can help the intelligence customer with timing political, economic, or military action to halt the program or roll it back.

In practice, these models would be used together in an iterative analysis process. As an example of how the iterative approach works, begin with the generic model of Figure 6-5. From this starting point, the analyst might create the test process submodel shown in Figure 6-6. Prompted by the recognition that a biological weapons testing program must have a test site, the analyst would ask collectors to search for test areas having associated animal pens and certain patterns of biological sensor deployment nearby. The analyst also would request that the collectors search for a carcass disposal area. Assuming the collectors are successful, the analyst can create a collateral model—a map display like that shown in Figure 6-8. Based on observation of activity at the test site and disposal area, the analyst can refine the chronological model shown in Figure 6-9.

Consider again the hunt for Pablo Escobar from chapter 3. That was an example of an iterative process. The Colombian and U.S. intelligence teams created models of Escobar's cell phone communication patterns, his network of associates, and his financial structure. From analysis of these, collectors could be aimed at specific targets—a process that will be discussed in detail in chapter 20. As new intelligence was gathered on Escobar's cartel members, cell phone numbers, bank accounts, and pattern of operations, all of these models could be updated almost daily in a continuing, iterative process.

More complex intelligence targets can require a combination of several model types. They may have system characteristics, take a network form, *and* have spatial and temporal characteristics. These three commonly encountered model types are dealt with in chapters 9–11. And we often need to do more than describe the target from either the PMESII or systems/network perspectives in space and time. We also need to estimate future states of the target—the subject of chapters 12–14. Finally, one target model of any given type may not be enough. We may need to create multiple models, as discussed next.

Alternative and Competitive Target Models

Alternative and competitive models are somewhat different things, though they are frequently confused with each other. Let's look at them in turn.

Alternative Models

Alternative models are an essential part of the synthesis process. It is important to keep more than one possible target model in mind, especially as conflicting or contradictory intelligence information is collected. The Iraqi WMD Commission noted, "The disciplined use of alternative hypotheses could have helped counter the natural cognitive tendency to force new information into existing paradigms."[11] As law professor David Schum has noted, "the generation of new ideas in fact investigation usually rests upon arranging or juxtaposing our thoughts and evidence in different ways."[12] To do that we need multiple alternative models.

And, the more inclusive you can be when defining alternative models, the better—a point we'll return to in several chapters.

In studies listing the analytic pitfalls that hampered past assessments, one of the most prevalent is failure to consider alternative scenarios, hypotheses, or models.[13] Analysts have to guard against allowing three things to interfere with their need to develop alternative models:

- *Ego.* Former director of national intelligence Mike McConnell once observed that analysts inherently dislike alternative, dissenting, or competitive views.[14] But, the opposite becomes true of analysts who operate within the target-centric approach—the focus is not on each other anymore, but instead on contributing to a shared target model.
- *Time.* Analysts are usually facing tight deadlines. They must resist the temptation to go with the model that best fits the evidence without considering alternatives. Otherwise, the result is premature closure that can cost dearly in the end result.
- *The customer.* Customers can view a change in judgment as evidence that the original judgment was wrong, not that new evidence forced the change. Furthermore, when presented with two or more target models, customers will tend to pick the one that they like best, which may or may not be the most likely model. Analysts know this.

It is the analyst's responsibility to establish a tone of setting egos aside and of conveying to all participants in the process, including the customer, that time spent up front developing alternative models is time saved at the end if it keeps them from committing to the wrong model in haste.

A number of formal alternative analysis methodologies have been defined and given names such as "analysis of competing hypotheses," "argument mapping," "signpost analysis," and "challenge analysis." These are discussed in detail in the book *Structured Analytic Techniques for Intelligence Analysis*, by Heuer and Pherson.[15]

Alternative analysis applies structured techniques that challenge underlying assumptions and broaden the range of possible outcomes considered. Its purpose is to deal with the natural human tendencies to perceive information selectively through the lens of preconceptions, to search for facts that would confirm rather than discredit existing hypotheses, and to be unduly influenced by premature consensus within a group dynamic. Formal alternative analysis involves a fairly intensive and usually time-limited effort to challenge assumptions or to identify alternative outcomes.[16]

Some organizations, in an effort to force alternative analysis, will set up separate teams to do "alternative analysis"—though, technically, this is simply competitive analysis (discussed next) done within the same organization.

Competitive Models

It is well established in intelligence that, if you can afford the resources, you should have independent groups providing competing analyses. This is because we're dealing with uncertainty. Different analysts, given the same set of facts, are likely to come to different conclusions. The U.S. intelligence community, as a result of its size and the presence of analysis groups in most of its sixteen members, has done competitive analysis for years.

Sometimes the policymakers provide a competing target model. For example, in 1982 the United States committed Marines to Lebanon in an ambitious attempt to end a civil war, force occupying Israeli and Syrian armies out of Lebanon, and establish a stable government. The U.S. administration withdrew from Lebanon eighteen months later, its policy discredited and its reputation damaged, with more than 250 Americans dead, most of them Marines killed in a terrorist bombing. The U.S. intelligence community had one assessment of the Lebanon situation; the Washington policymaking community had a strikingly different assessment that envisioned Lebanon as a potential role model for future Middle East governments.[17] Table 6-3 shows a parallel list comparing these two alternative models of the Lebanon situation.

Table 6-3 Competitive Models of the Lebanon Situation in 1982

Policymakers	Analysts
We can negotiate speedy Israeli and Syrian withdrawals from Lebanon.	President Assad won't pull Syrian troops out unless convinced that he will be attacked militarily.
Lebanon can be unified under a stable government.	Lebanon in effect has no borders, and you can't say what a citizen is.
President Gamayel can influence events in Lebanon.	Gamayel doesn't control most of Beirut, and even the Christians aren't all behind him.
We have five military factions to deal with: Christian Phalange, Muslim militia, Syrian, Palestinian Liberation Organization, and Israeli forces.	There are forty militias operating in West Beirut alone.
The Marines are peacekeepers.	The Marines are targets.

Note that this is far from a complete picture of Lebanon, which today, as in 1982, has all the elements of a complex problem. The table also is more than a target model; it contains a number of analytic judgments or hypotheses that were drawn from two competing target models.

It is important to be inclusive when defining alternative or competitive models—a point we'll return to in several chapters. The model of a situation that isn't included may be the correct model. For instance, appendix I ("A Tale of Two NIEs") contains some alternative models that were not considered in the October 2002 national intelligence estimate on Iraq's WMD. The most important one, though, was based on an assumption: that because Saddam Hussein was stonewalling on inspections and concealing evidence of WMD, he must have WMD somewhere. The opposite possibility—that he *didn't* have WMD and didn't want his opponents in the region to know that fact—simply wasn't considered.

Summary

Creating a target model starts with defining the relevant system. The system model can be a structural, functional, or process model, or any combination. The next step is to select the generic models or model templates.

Lists and curves are the simplest form of model. In intelligence, comparative models or benchmarks are often used; almost any type of model can be made comparative, typically by creating models of one's own system side by side with the target system model.

Pattern models are widely used in the intelligence business. Chronological models allow intelligence customers to examine the timing of related events and plan a way to change the course of these events. Geospatial models are popular in military intelligence for weapons targeting and to assess the location and movement of opposing forces.

Relationship models are used to analyze the relationships among elements of the target—organizations, people, places, and physical objects—over time. Four general types of relationship models are commonly used: hierarchy, matrix, link, and network models. The most powerful of these, network models, are increasingly used to describe complex intelligence targets.

Many models are combinations of these generic model types. Predictive analysis, in particular, makes use of scenarios, and we will return to those.

Process models, which describe a sequence of events or activities that produce results, are often used to assess the progress of a development project.

Profiles of leaders and key executives are used to predict decisions. Such profiles rely on the ability of the analyst to define the modal personality type.

Competitive and alternative target models are an essential part of the process. Properly used, they help the analyst deal with denial and deception and avoid being trapped by analytic biases. But they take time to create, analysts find it difficult to change or challenge existing judgments, and alternative models give policymakers the option to select the conclusion they prefer—which may or may not be the best choice.

The next chapter discusses how to populate the model templates defined in this chapter.

Notes

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